

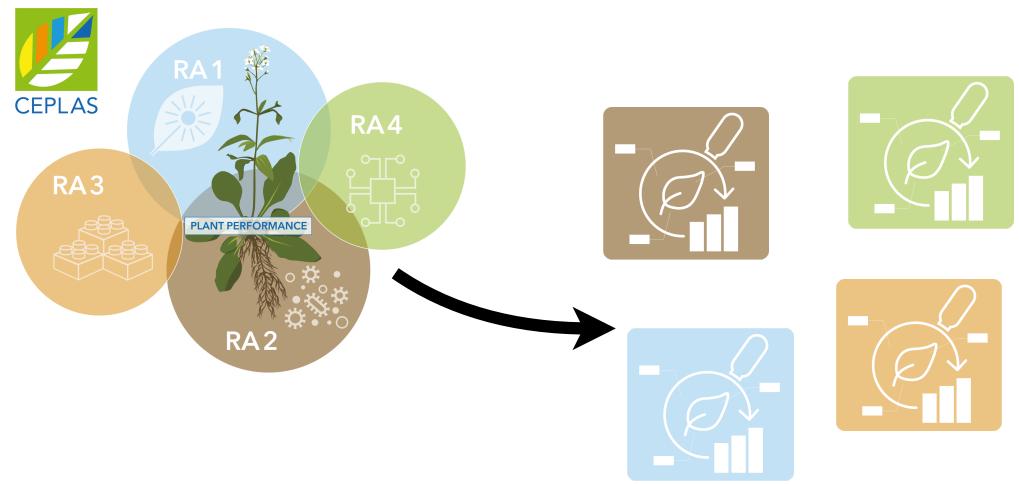
ARCify your research project

February 11th, 2025

Dominik Brilhaus (CEPLAS)
Sabrina Zander (MibiNet)

Goals

- First few steps into ARC ecosystem
- Move existing datasets into ARCs
- Share them via the DataHUB
- Annotate with metadata



House-keeping

- Use the pad to raise questions and feedback
- Copy / paste links (hands-on)



Training Materials

Slides are shared via [DataPLANT Training Material](#)

Resources – join the open source movement



DataPLANT (nfdi4plants)

DataPLANT Website: <https://nfdi4plants.org/>

Knowledge Base: <https://nfdi4plants.org/nfdi4plants.knowledgebase/>

DataHUB: <https://git.nfdi4plants.org>

GitHub: <https://github.com/nfdi4plants>

HelpDesk: <https://helpdesk.nfdi4plants.org>

You can help us by raising issues, bugs, ideas...

NEW! ARC website: <https://arc-rdm.org>

Continuous support

Data managers in Düsseldorf, Cologne, Jülich and close by (CEPLAS, MibiNet, TRR341) offer support.

- Join our [Slack](#) or [Matrix](#) for ad hoc support
- Monthly [user support meeting](#) (2nd Friday of the month)



trr_341



MibiNet

Introduce yourself

- Lab
- MibiNet / CEPLAS / TRR / ?
- Used code / programming language before
- Experience with Git / GitLab / GitHub?
- Have an ORCID
- My motivation / expectation
- My favorite lab assay

Let's draw a typical lab workflow



FAIR data stewardship

- Findable
- Accessible
- Interoperable
- Reusable

<https://doi.org/10.1038/sdata.2016.18>

[nature](#) > [scientific data](#) > [comment](#) > [article](#)

[Open Access](#) | [Published: 15 March 2016](#)

The FAIR Guiding Principles for scientific data management and stewardship

[Mark D. Wilkinson](#), [Michel Dumontier](#), [IJsbrand Jan Aalbersberg](#), [Gabrielle Appleton](#), [Myles Axton](#), [Arie Baak](#), [Niklas Blomberg](#), [Jan-Willem Boiten](#), [Luiz Bonino da Silva Santos](#), [Philip E. Bourne](#), [Jildau Bouwman](#), [Anthony J. Brookes](#), [Tim Clark](#), [Mercè Crosas](#), [Ingrid Dillo](#), [Olivier Dumon](#), [Scott Edmunds](#), [Chris T. Evelo](#), [Richard Finkers](#), [Alejandra Gonzalez-Beltran](#), [Alasdair J.G. Gray](#), [Paul Groth](#), [Carole Goble](#), [Jeffrey S. Grethe](#), [Jaap Heringa](#), [Peter A.C. 't Hoen](#), [Rob Hooft](#), [Tobias Kuhn](#), [Ruben Kok](#), [Joost Kok](#), [Scott J. Lusher](#), [Maryann E. Martone](#), [Albert Mons](#), [Abel L. Packer](#), [Bengt Persson](#), [Philippe Rocca-Serra](#), [Marco Roos](#), [Rene van Schaik](#), [Susanna-Assunta Sansone](#), [Erik Schultes](#), [Thierry Sengstag](#), [Ted Slater](#), [George Strawn](#), [Morris A. Swertz](#), [Mark Thompson](#), [Johan van der Lei](#), [Erik van Mulligen](#), [Jan Velterop](#), [Andra Waagmeester](#), [Peter Wittenburg](#), [Katherine Wolstencroft](#), [Jun Zhao](#) & [Barend Mons](#) 

— Show fewer authors

[Scientific Data](#) 3, Article number: 160018 (2016) | [Cite this article](#)

The FAIR principles

<p>Findable Accessible Interoperable Reusable</p>	<p>Easier collaboration & sharing</p> <pre>graph TD; A(()) --> B(()); A(()) --> C(()); A(()) --> D(()); B(()) --> E(()); C(()) --> E(()); D(()) --> E(());</pre>	<p>Increased findability and visibility</p>	<p>Reproducibility</p>
<p>Added-value to the research community</p> <p>nfdi NCBI EMBL-EBI</p>	<p>Compliance with funding policies</p> <pre>graph LR; A[Checkmark Document] --- B[DFG]; A --- C[EU Flag]</pre>	<p>Receive due credit</p> <pre>graph LR; A[Reuse] --- B[Citations]; A --- C[FAIR]</pre>	<p>Saves time & workload</p> <pre>graph LR; A[FAIR] --- B[Time wasted]</pre>

Is your data FAIR?

Findable | Accessible | Interoperable | Reusable

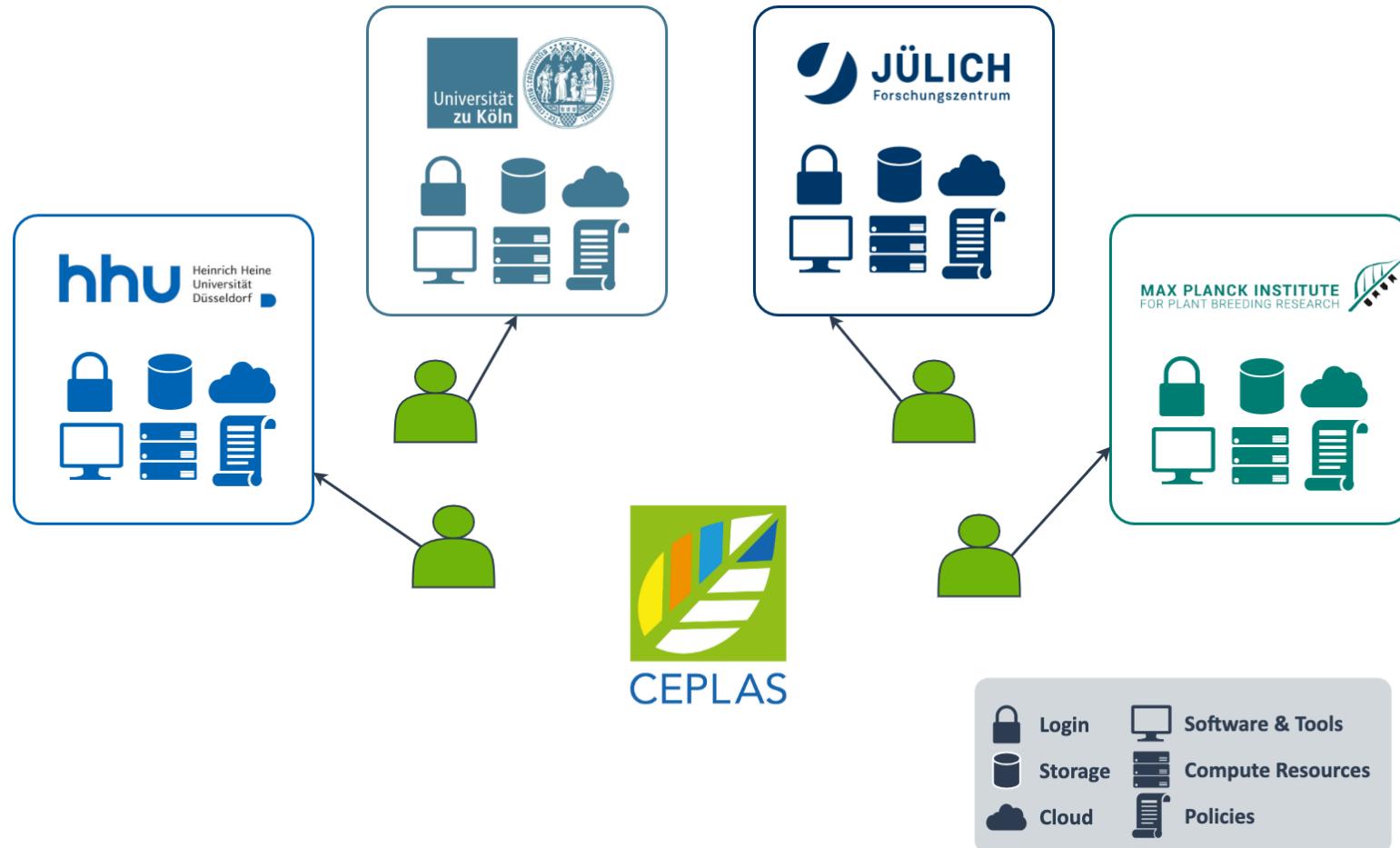
- Where do you store your data?
- How do you annotate your data?
- How do you share your data?
- What tools do you use to analyse your data?
- How do you reuse other people's data?



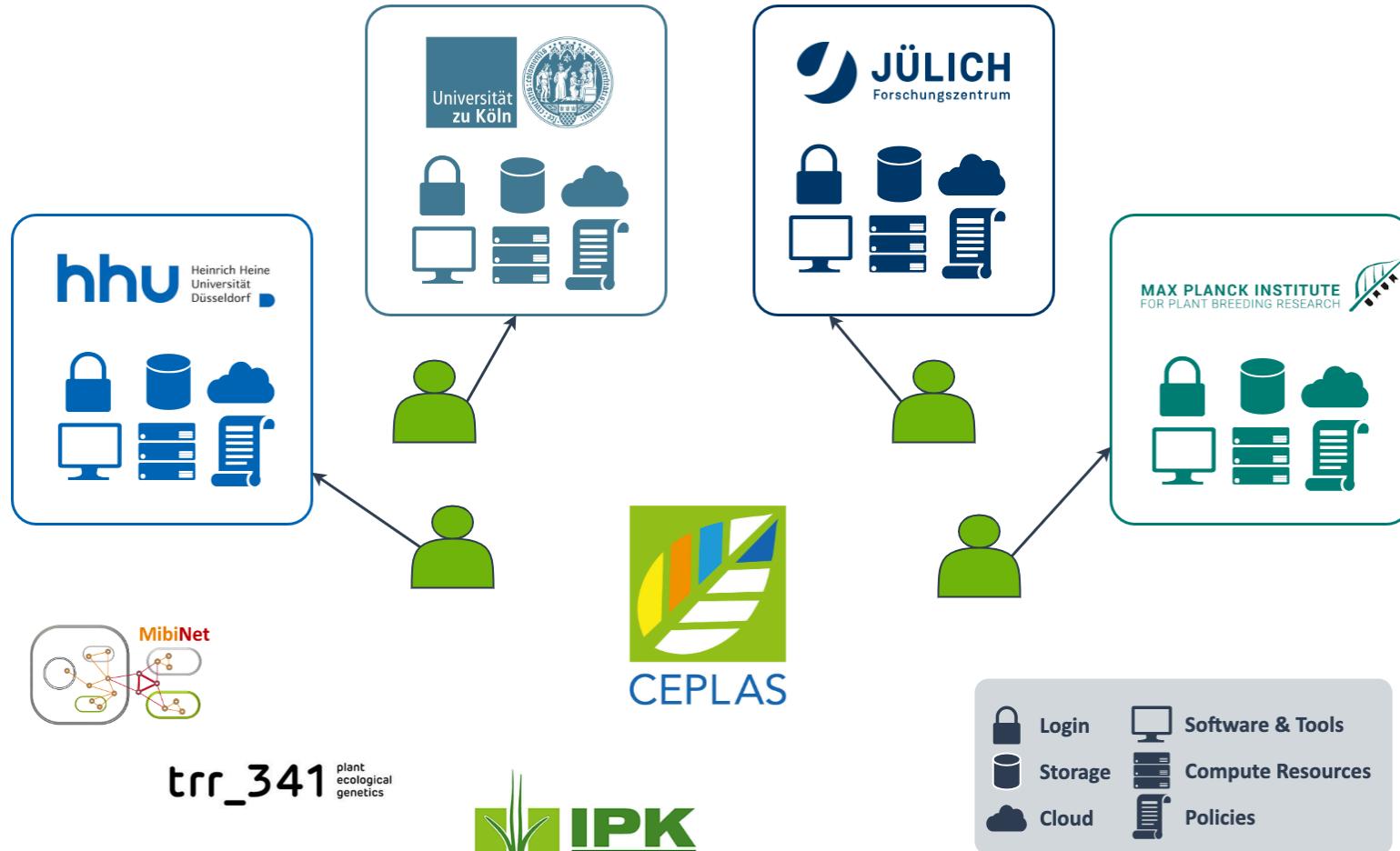
CEPLAS – One cluster, four locations



Data silos impede collaboration

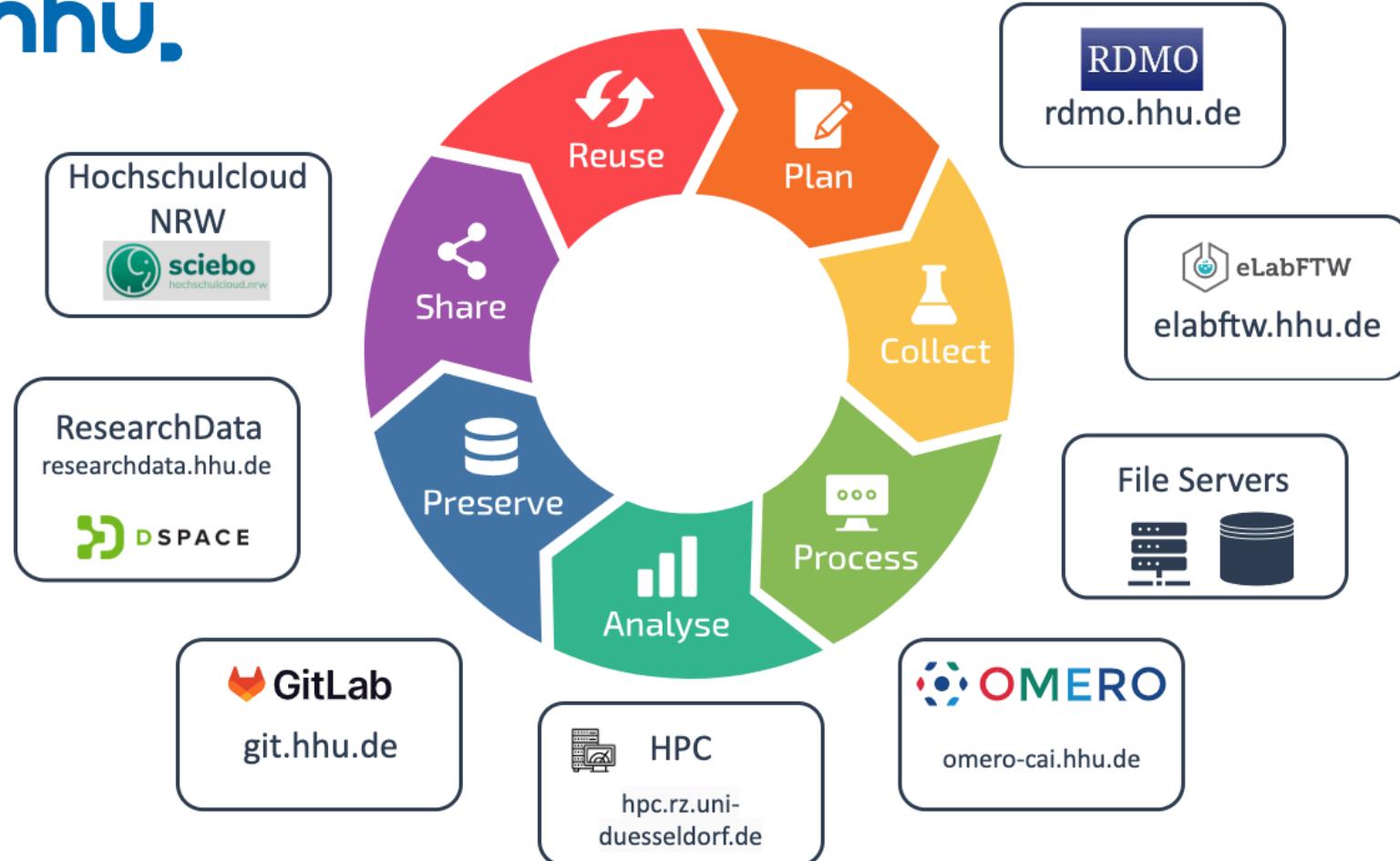


Data silos impede collaboration

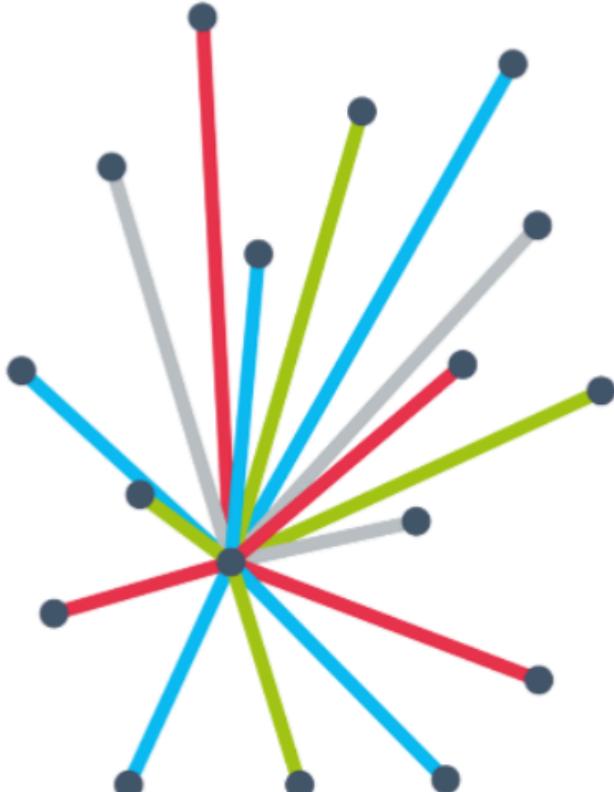


Missing interfaces impede collaboration

hhu.



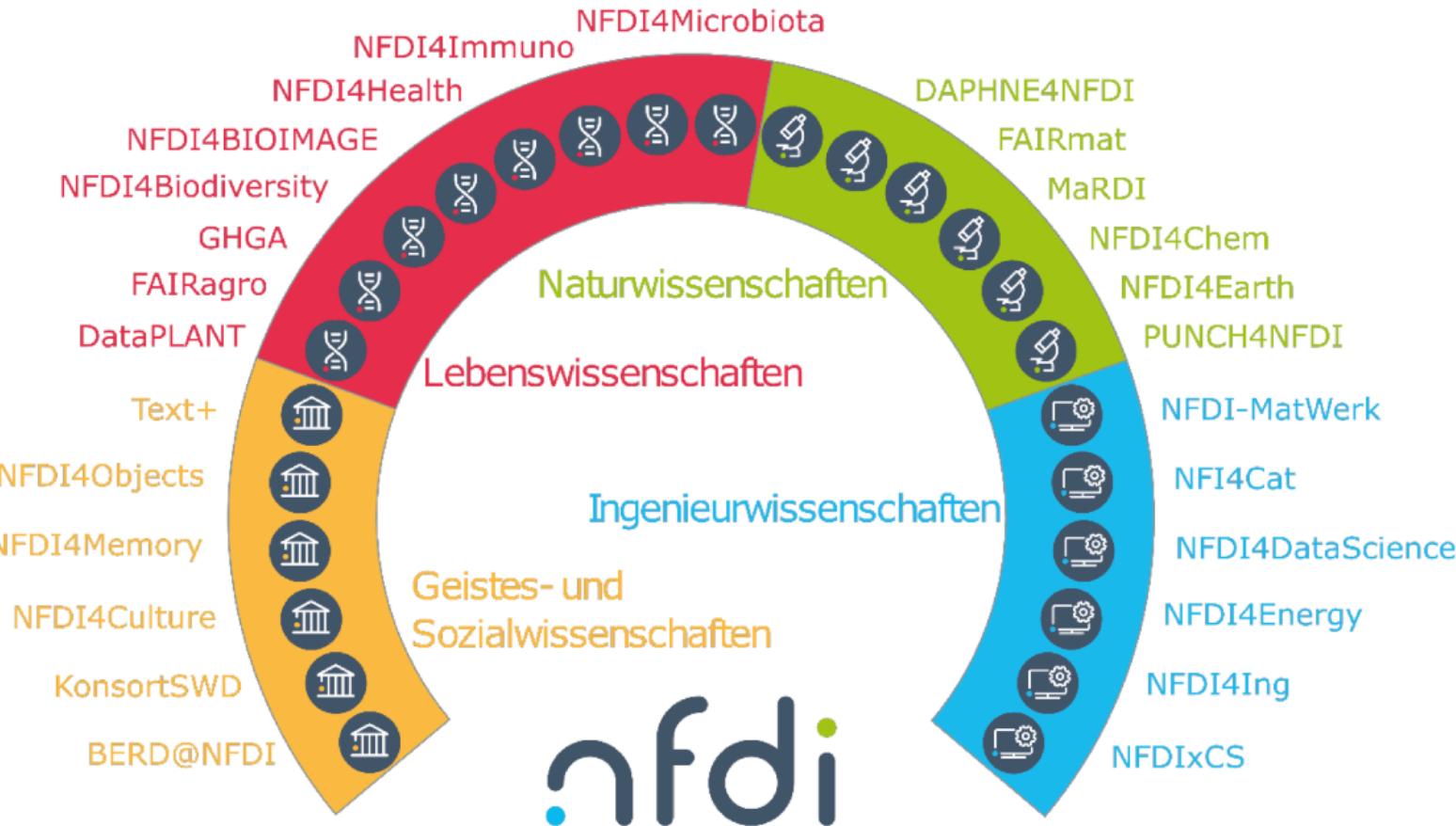
NFDI – Nationale Forschungsdaten Infrastruktur



The aim of the national research data infrastructure (NFDI) is to systematically manage scientific and research data, provide long-term data storage, backup and accessibility, and network the data both nationally and internationally.

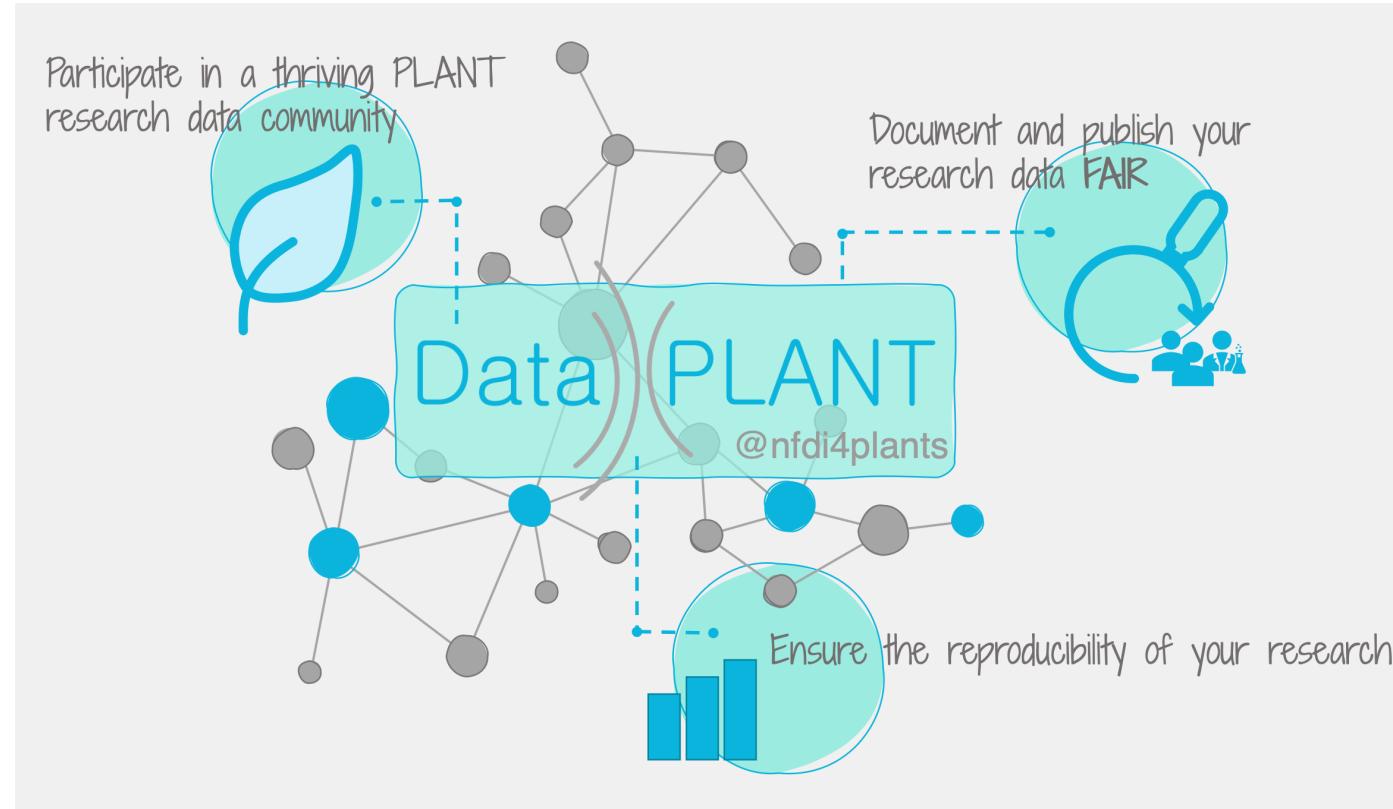
nfdi.de

NFDI – A community-targeted approach for RDM



nfdi.de

DataPLANT – NFDI4plants

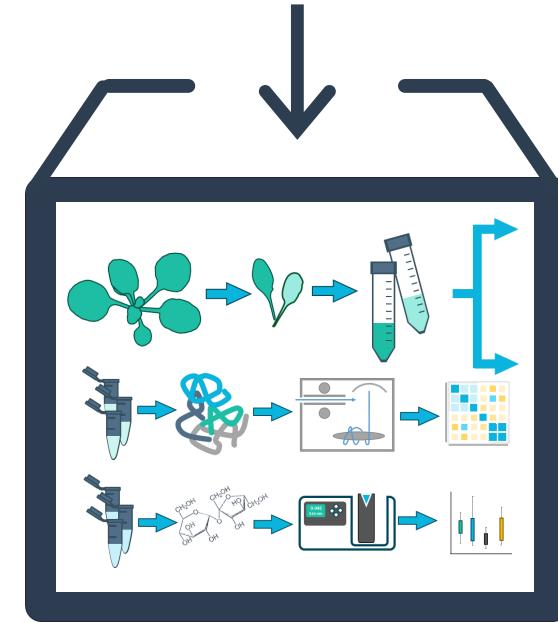
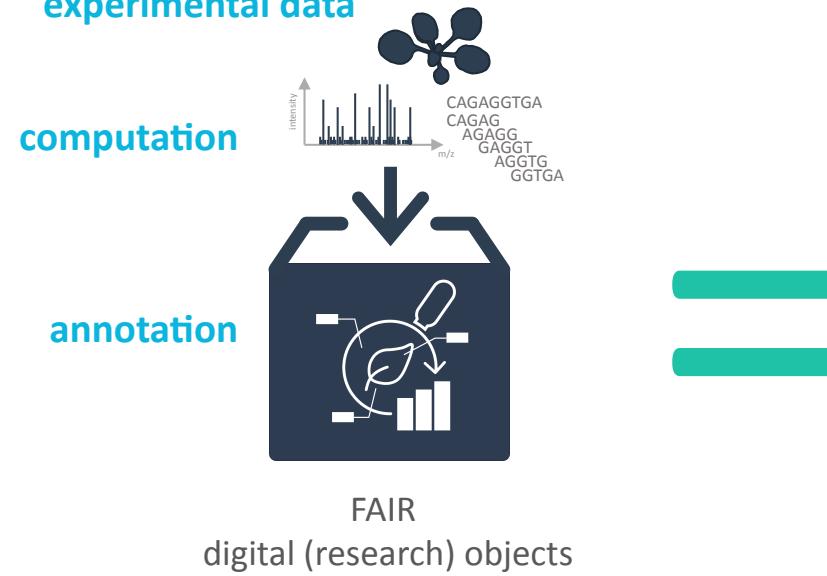


- <https://nfdi4plants.org>
- <https://arc-rdm.org>

Data Stewardship between DataPLANT and the community



Annotated Research Context (ARC)

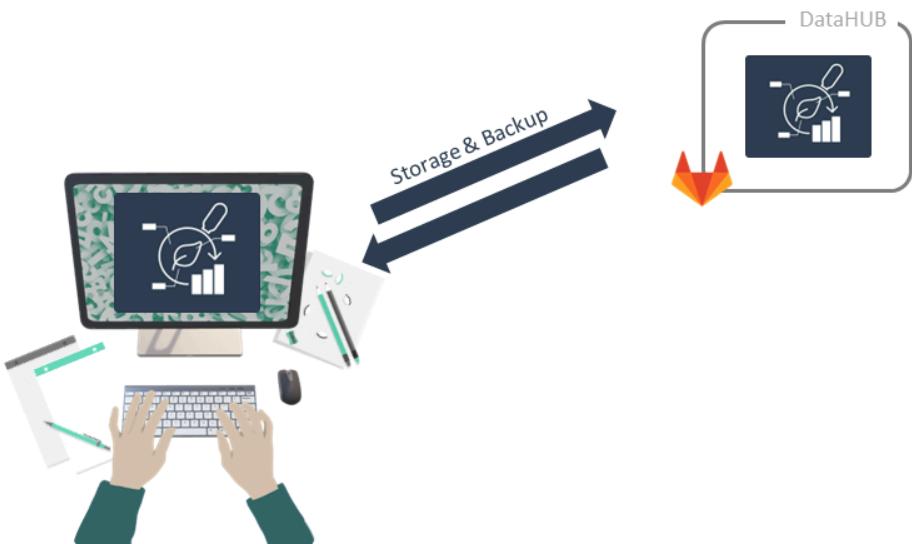


Your entire investigation in a single unified bag

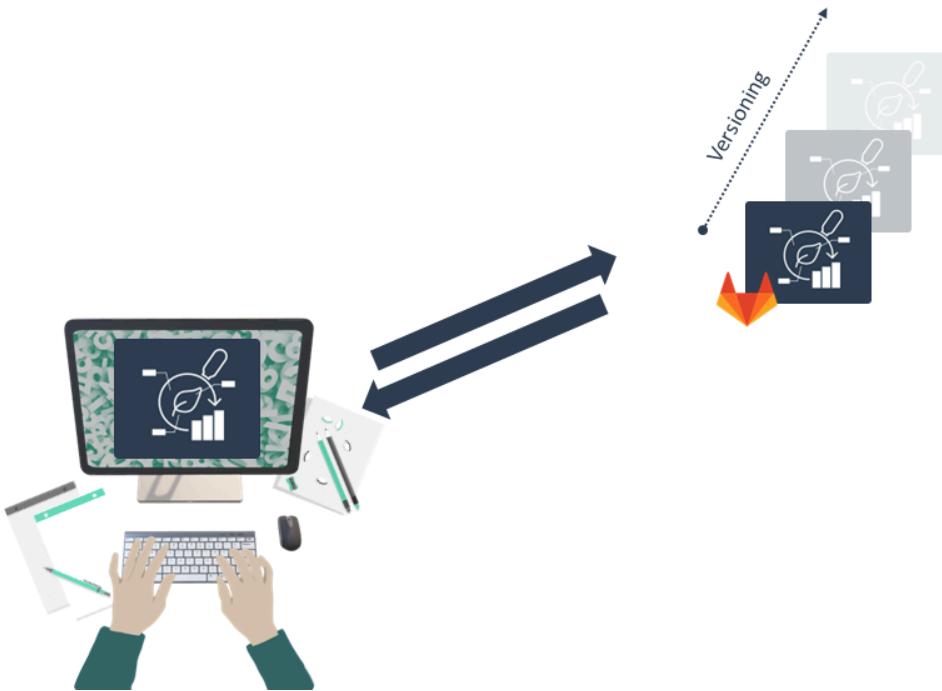
You can store your ARC in the DataHUB



You can store your ARC in the DataHUB



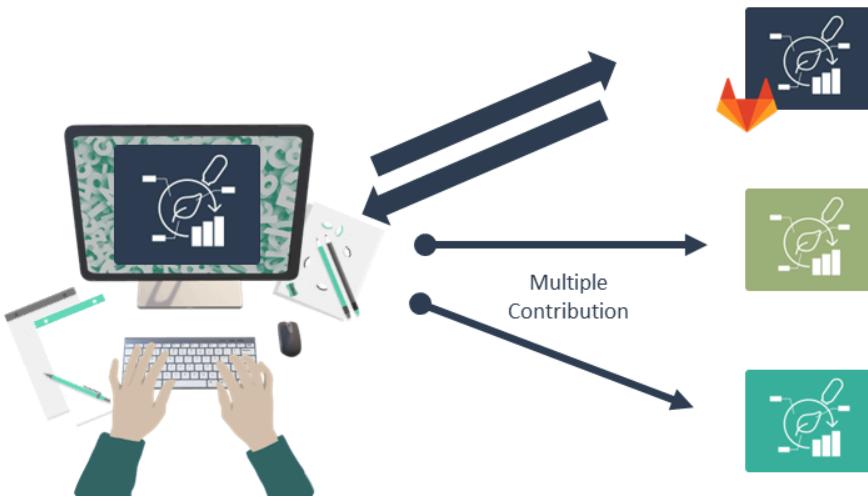
ARCs are versioned



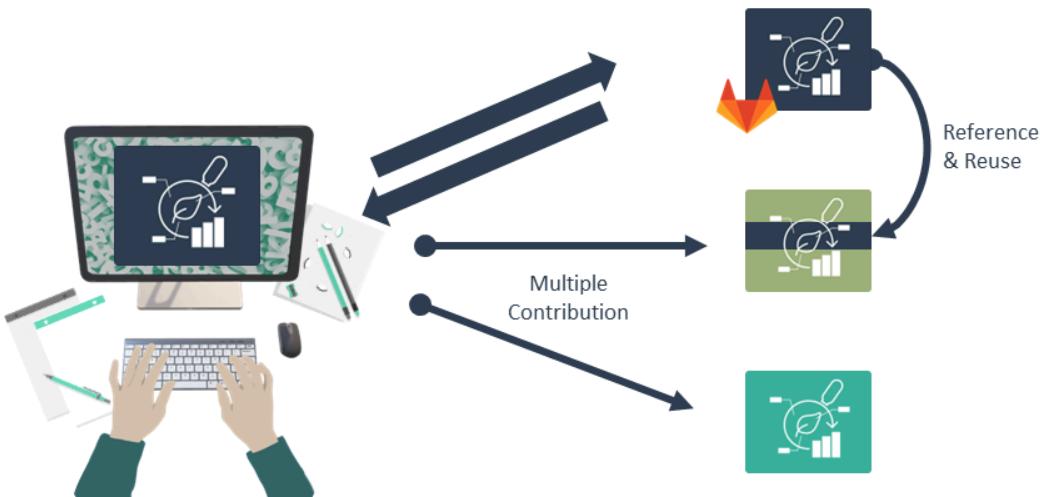
You can invite collaborators



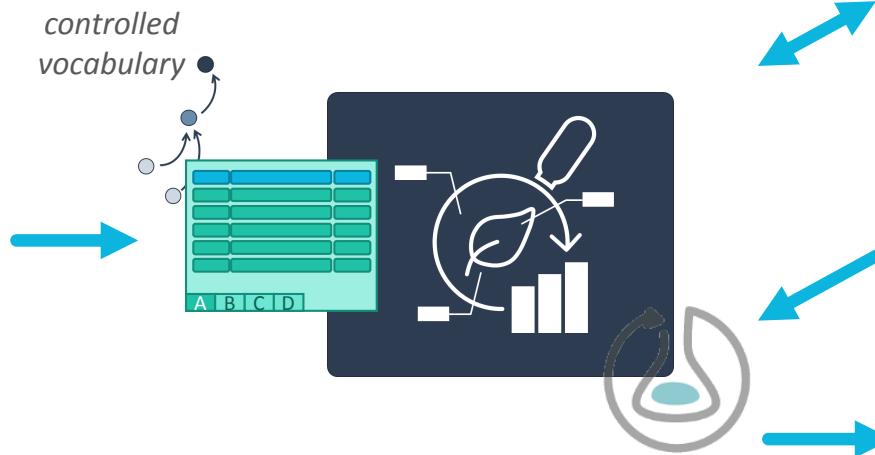
Collaborate and contribute



Reuse data in ARCs



ARC as single-entry point



specialized endpoints

ENA European Nucleotide Archive
GEO Gene Expression Omnibus
EBI: MetaboLights
PRIDE Archive Proteomics Identifications Database
BiolImage Archive

dataset search

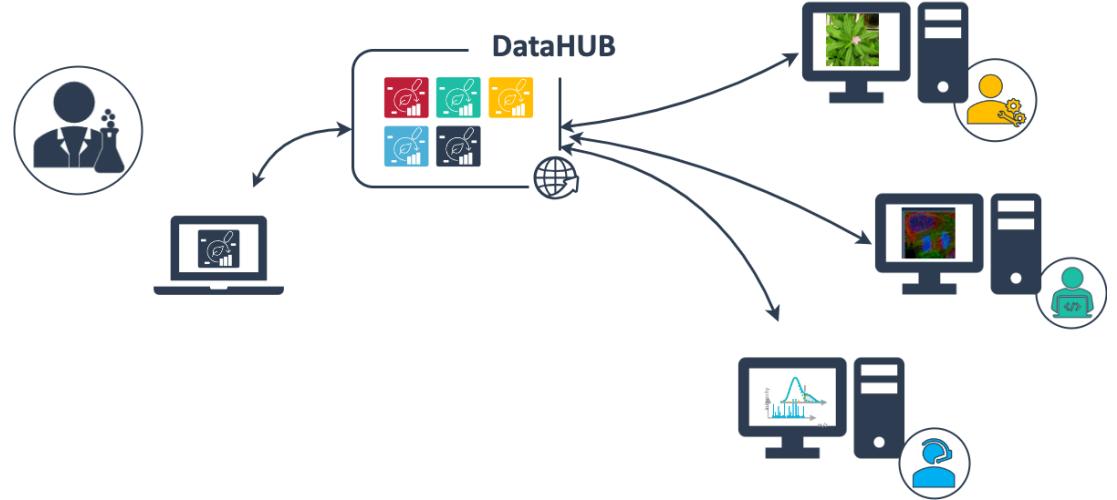
Google
OpenAIRE

data publication

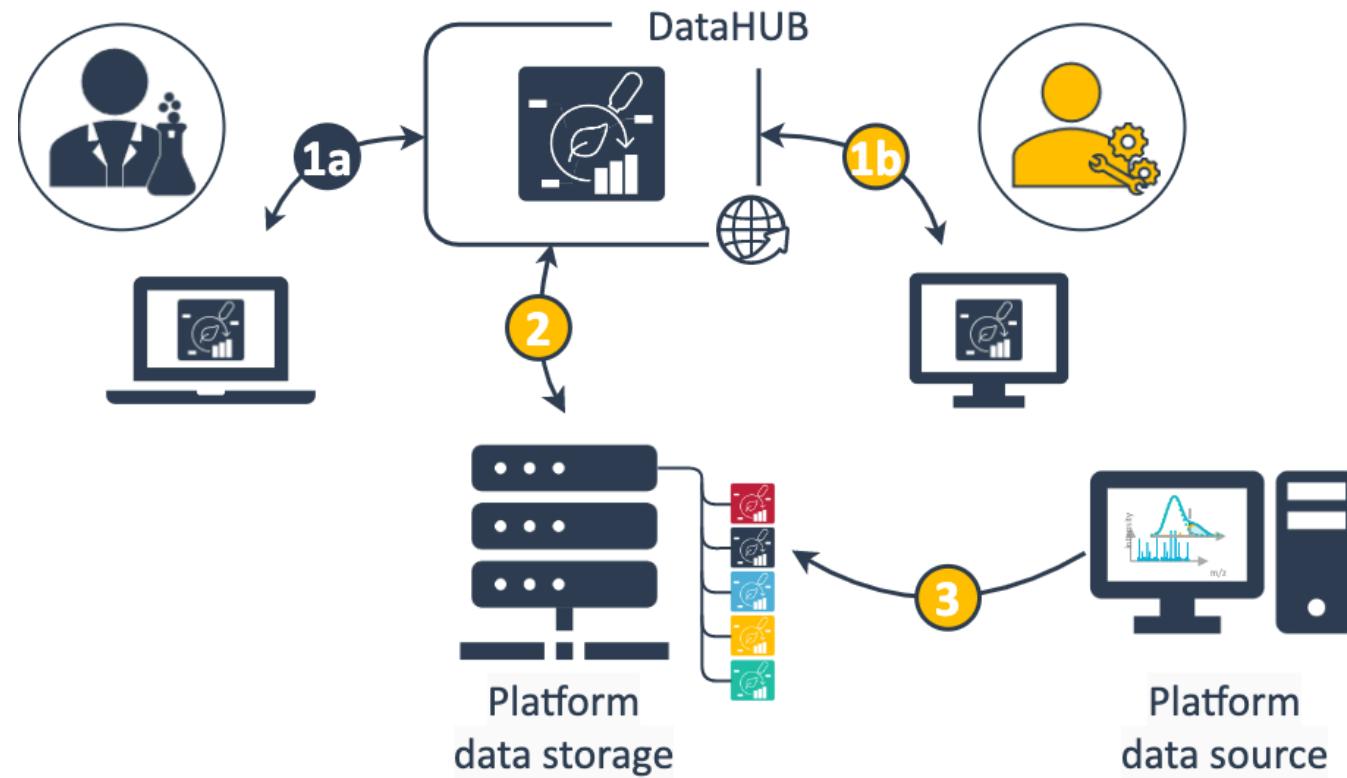
The Dataverse Project
INVENIO

Enabling platforms

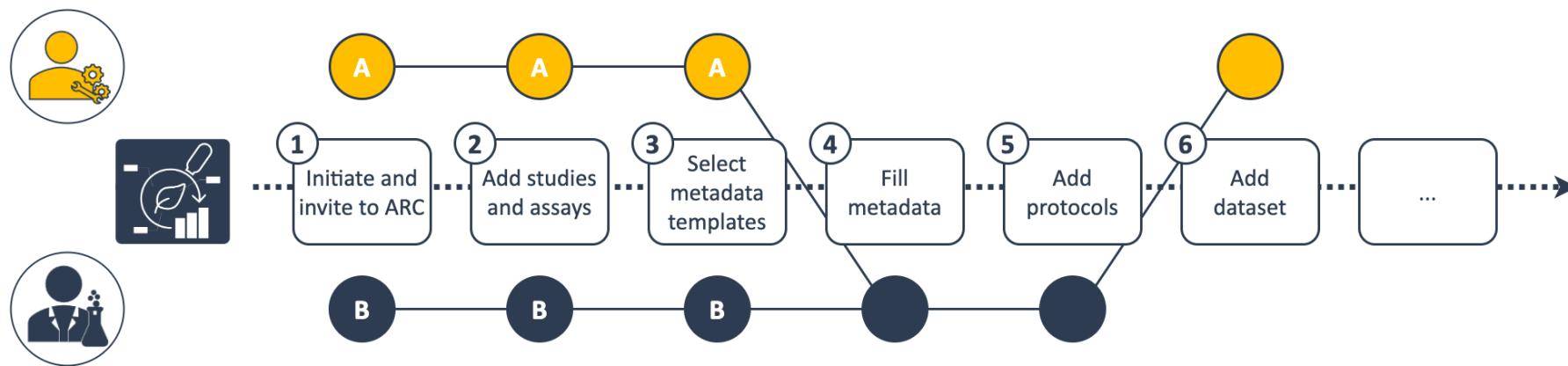
- Streamlined exchange of (meta)data
- Communication and project management



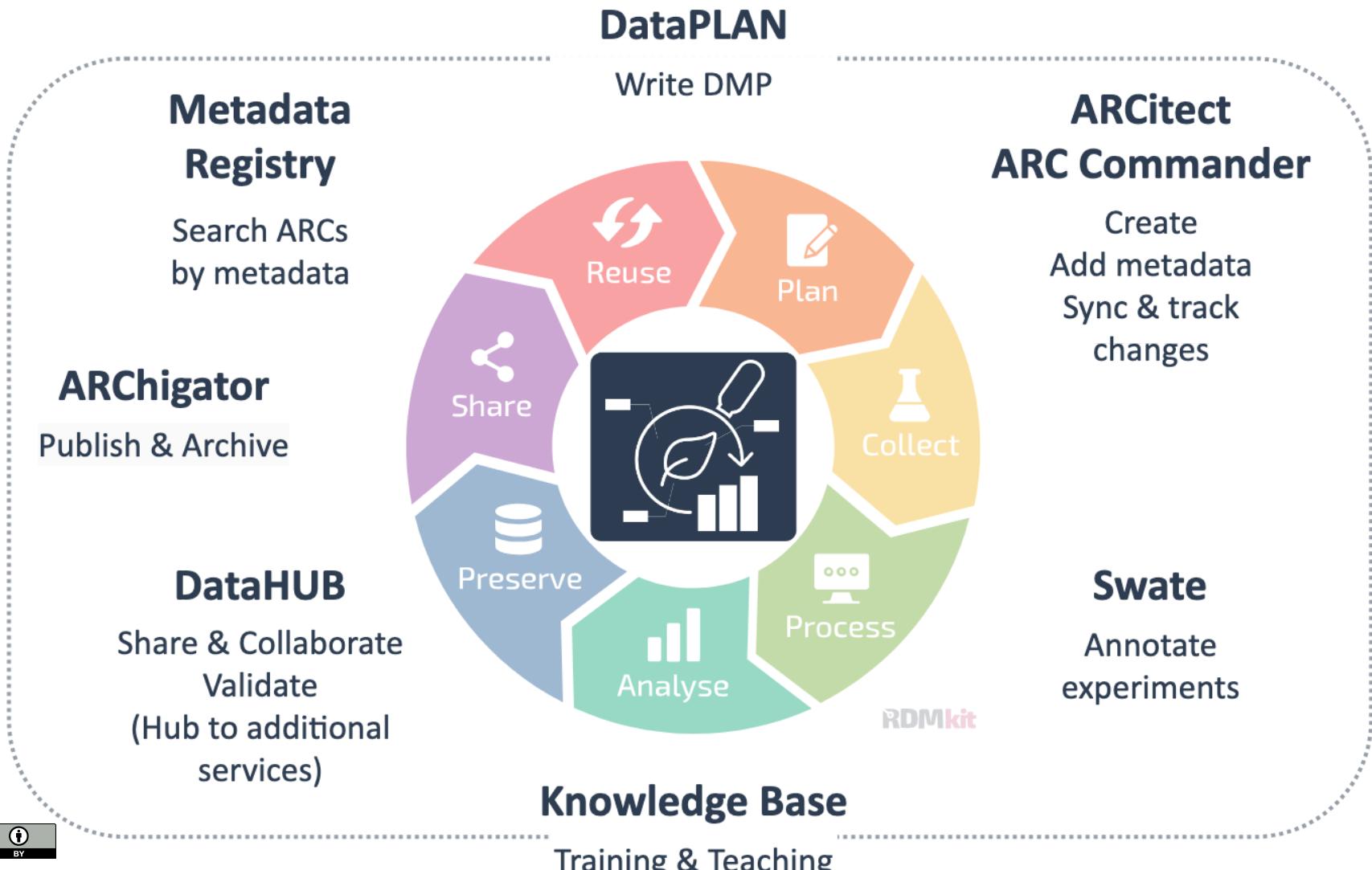
Streamlined data exchange



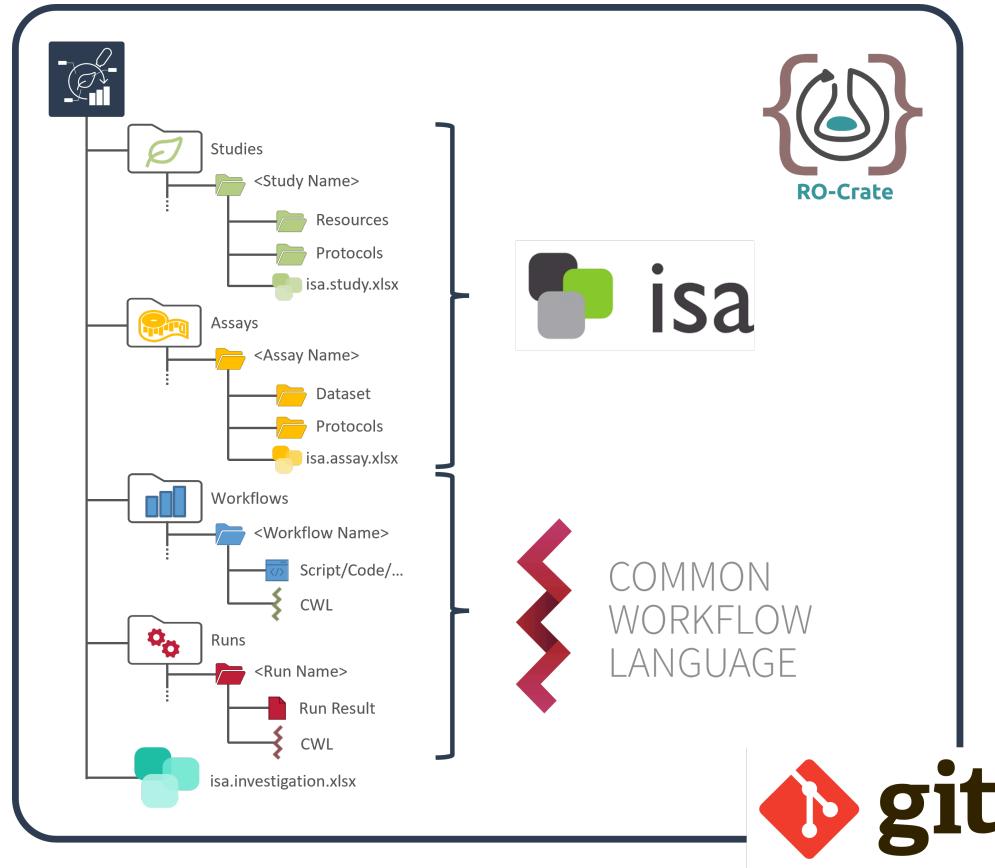
Meet your collaborators in an ARC



The ARC ecosystem



ARC builds on standards



RO-Crate

- standardized exchange
- <https://www.researchobject.org/ro-crate/>

ISA

- structured, machine-readable metadata
- <https://isa-tools.org/>

CWL

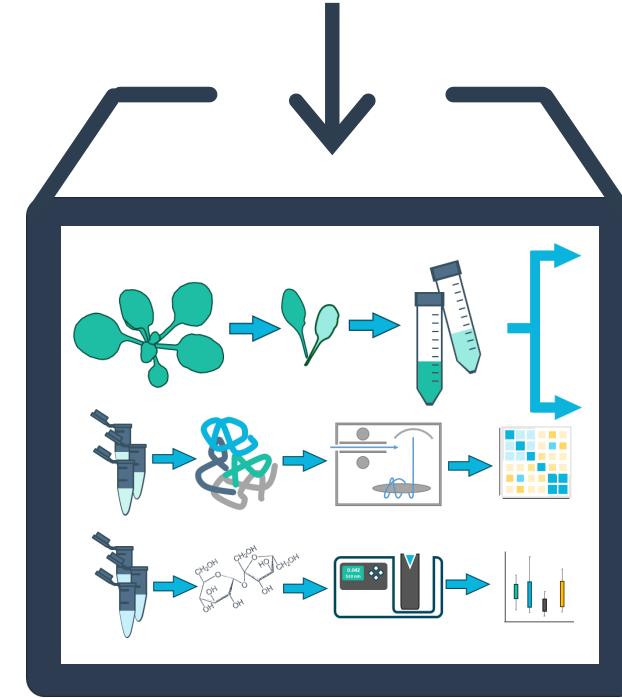
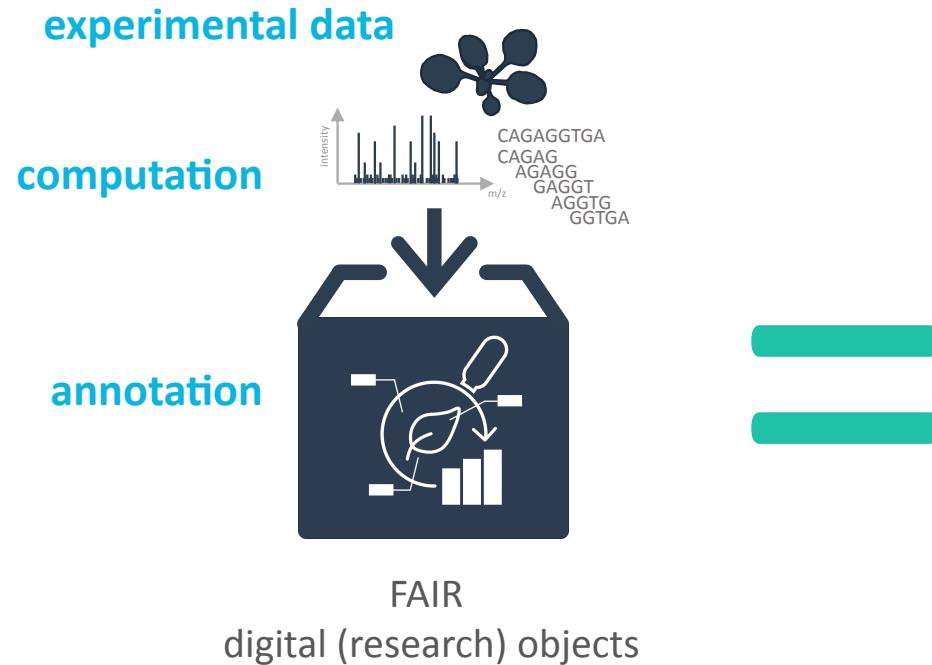
- reproducible, re-usable data analysis
- <https://www.commonwl.org/>

Git

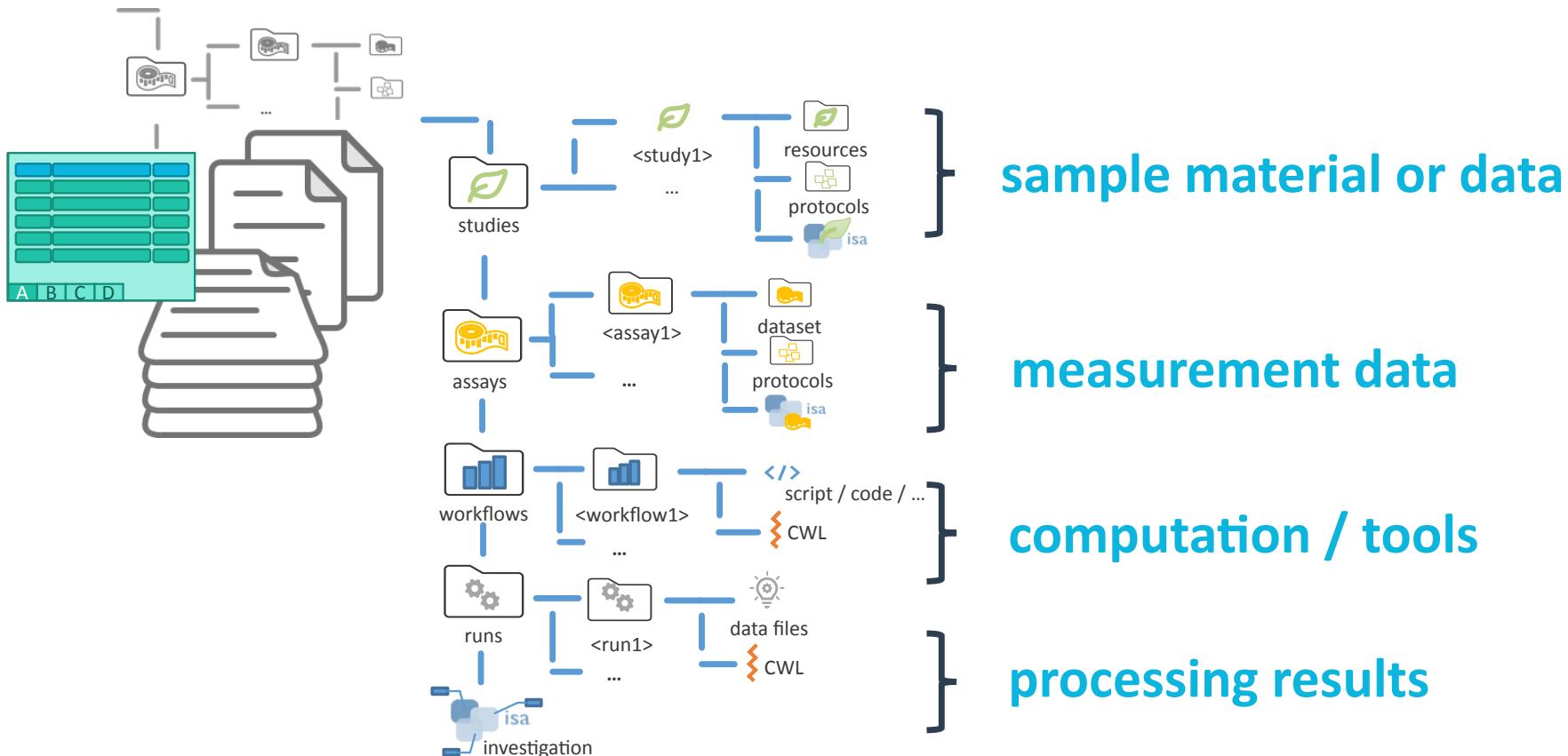
- version control
- <https://git-scm.com>

Hands-on part 1: Setup and ARCitect

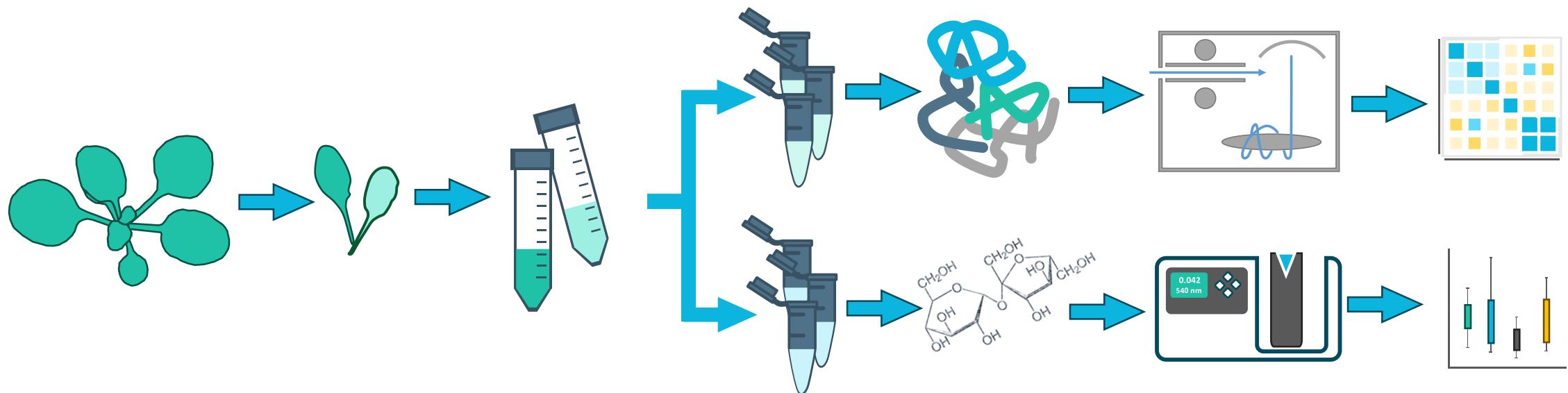
ARC: Annotated research context



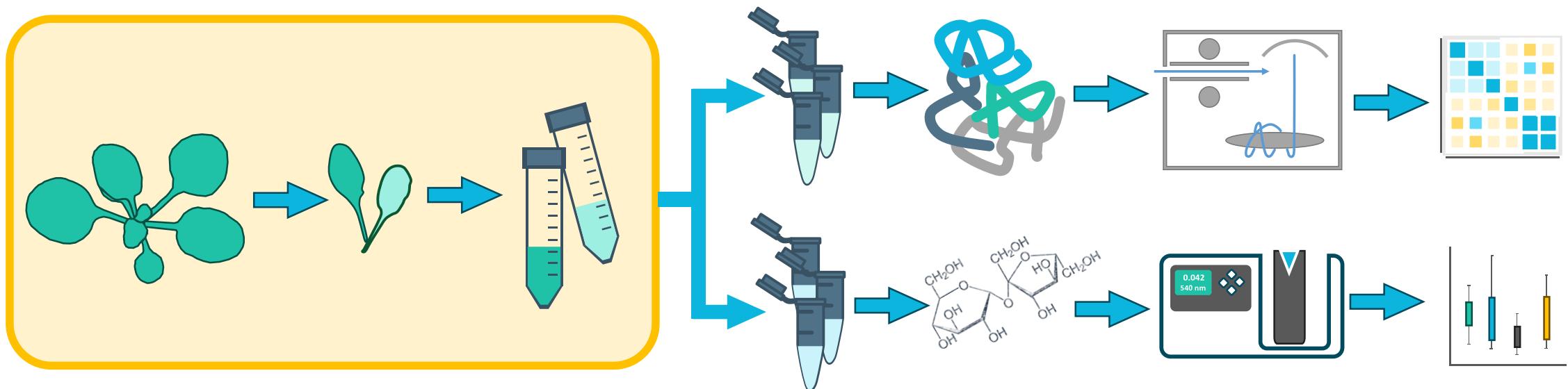
The ARC scaffold structure



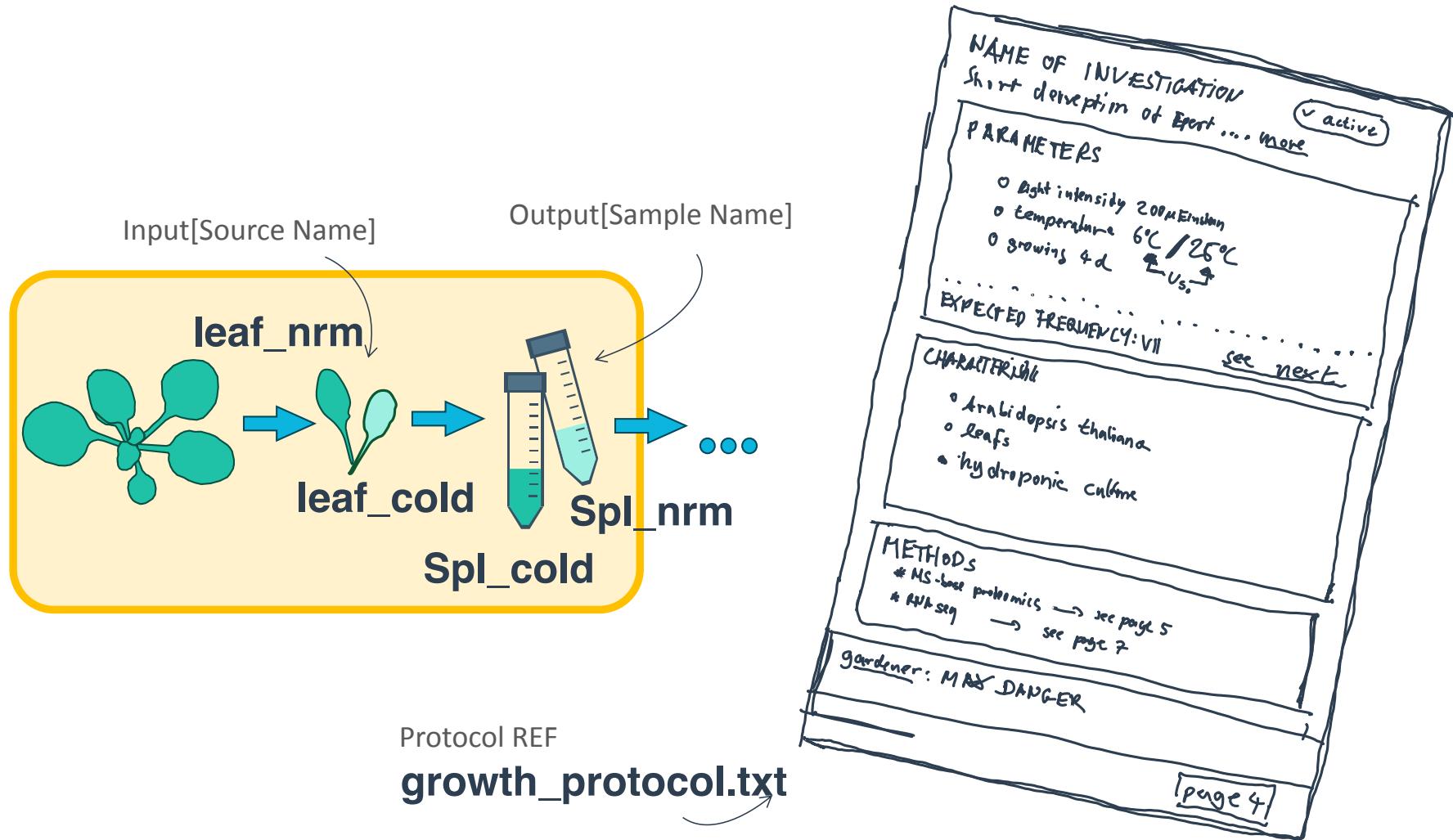
A small prototypic project



Divide and conquer for reproducibility



Identifying the 'study' part



A table-based organization schema

Input[Source Name]		Output[Sample Name]
leaf_nrm		spl_nrm
leaf_cold		spl_cold
A	B	C
D		

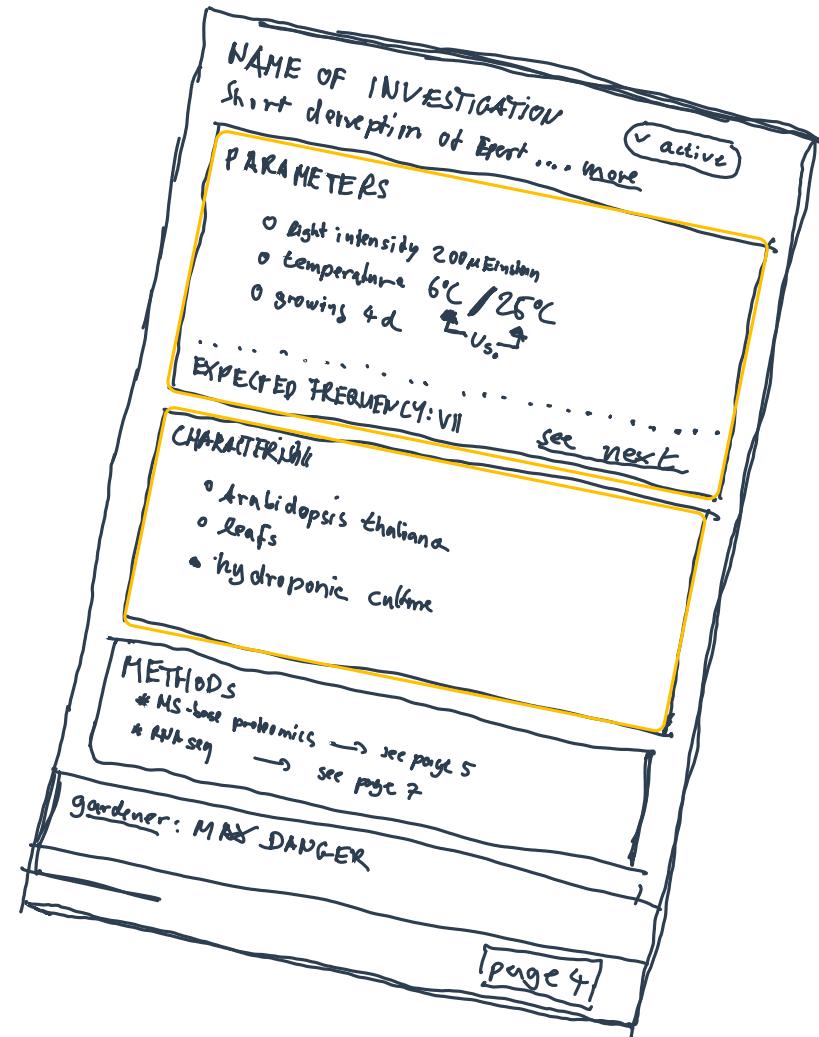
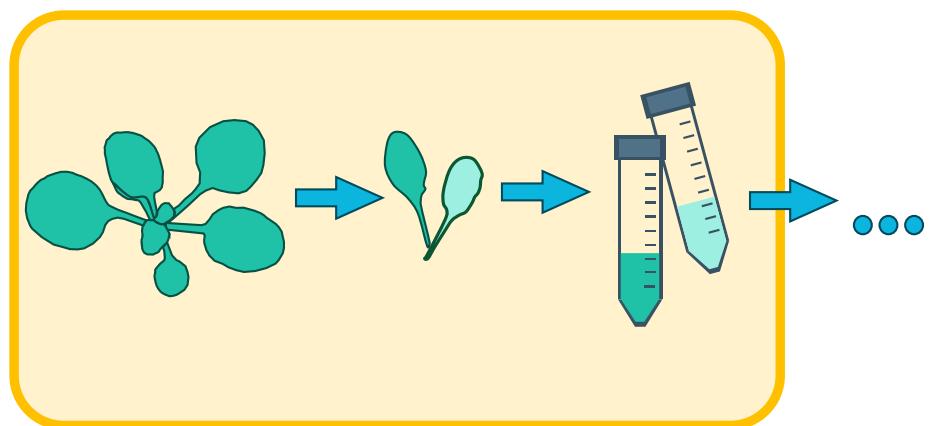
Referencing a protocol

This allows you to reference the free-text, human-readable protocol.

Input[Source Name]	Protocol REF	Output[Sample Name]
leaf_nrm	growth_protocol.txt	spl_nrm
leaf_cold	growth_protocol.txt	spl_cold
A	B	C
D		

- 💡 It is recommended that the protocol is in an open format (.md|.txt|.docx|...)
- 💡 But everything is possible also an URI to an electronic lab notebook

Parameterizing the 'study'



Finding the right metadata vocabulary

Parameters []

- Light intensity 200 µEinstein
- Temperature 6°C / 25°C
- Growing 4d

Characteristics []

- *Arabidopsis thaliana*
- Leaf
- Hydroponic culture
- Columbia

OLS: Finding the right metadata vocabulary

Temperature Dependence Temperature:Dependence_Annotation 

http://purl.uniprot.org/core/Temperature_Dependence_Annotation

Indicates the optimum temperature for enzyme activity and/or the variation of enzyme activity with temperature variation; the thermostability/thermolability of the enzyme is also mentioned when it is known.

Ontology: UNIPROT RDFS

temperature AFO:/result#AFR_0001584 

http://purl.allotrope.org/ontologies/result#AFR_0001584

A temperature (datum) is a quantity facet that quantifies some temperature. [Allotrope]

Ontology: AFO

temperature FBcv:0000466 

http://purl.obolibrary.org/obo/FBcv_0000466

Mutation caused by exposure to a temperature that is higher or lower than 25 degrees Celsius.

Ontology: FBCV

temperature PATO:0000146 

http://purl.obolibrary.org/obo/PATO_0000146

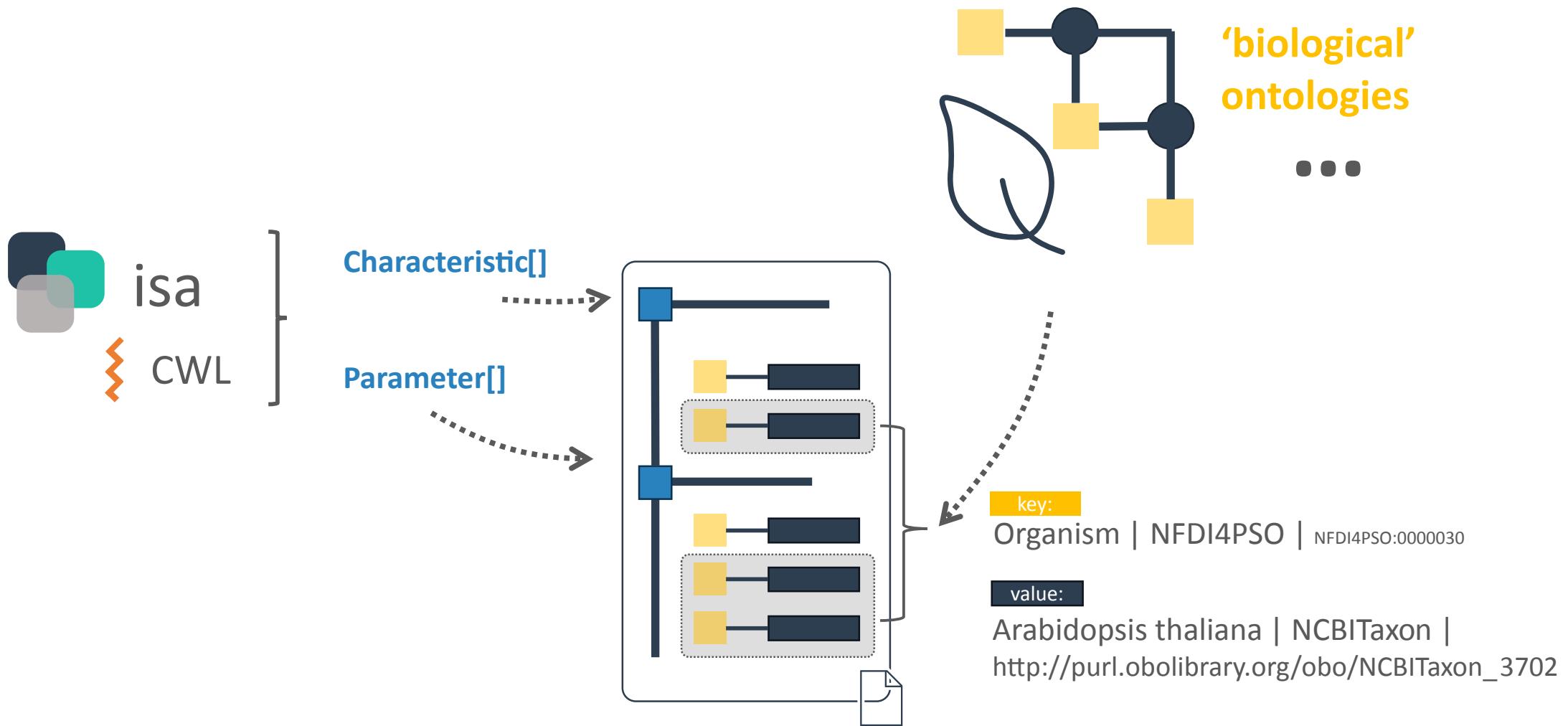
A physical quality of the thermal energy of a system.

Ontology: PATO

Also appears in: NGBO HTN CAO ZP AGRO OMIABIS OBIB MONDO TXPO MCO +

Ontology Lookup Service (OLS): <https://www.ebi.ac.uk/ols4/>

Finding the metadata vocabulary and descriptors



Finding the metadata vocabulary and descriptors

Parameters []

- 
- 
- 
-  Light intensity 200 µEinstein
-  Temperature 6°C / 25°C
-  Growing 4d

Characteristics []

- 
- 
- 
-  *Arabidopsis thaliana*
-  Leaf
-  Hydroponic culture
-  Columbia

Finding the metadata vocabulary and descriptors

Parameters []

- ■ Light intensity
 - ■ 200 µEinstein
- ■ Temperature
 - ■ 6°C / 25°C
- ■ Growth time
 - ■ 4d

Characteristics []

- ■ Organism
 - ■ *Arabidopsis thaliana*
- ■ Tissue
 - ■ Leaf
- ■ Growth medium
 - ■ Hydroponic culture
- ■ Ecotype
 - ■ Columbia

Hands-on part 1: Setup and ARCitect

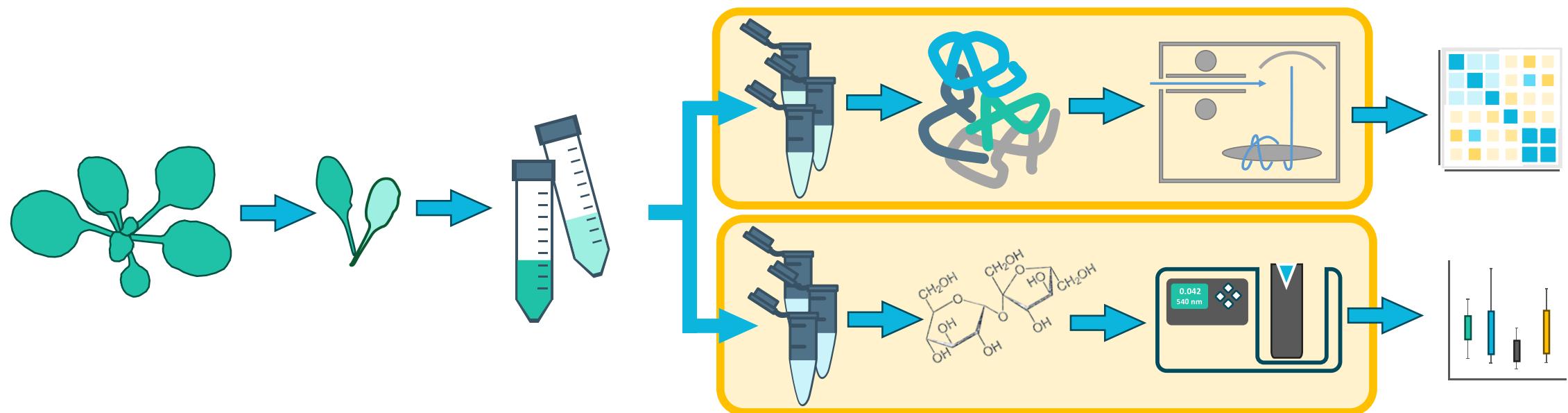
Follow the [Start Here guide](#) in the DataPLANT knowledge base.



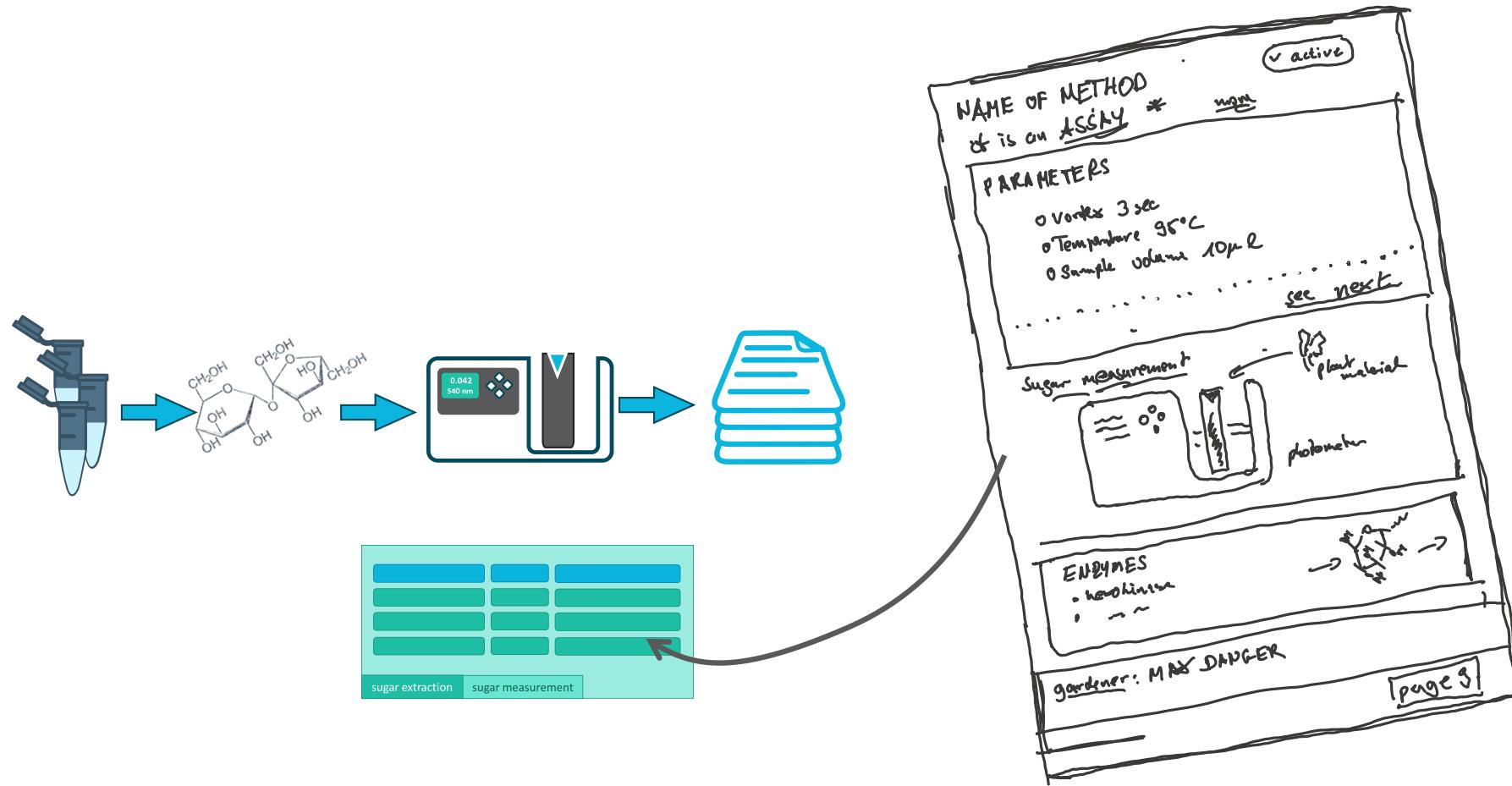
Until step **Add a study**

Hands-on part 2: ARCitect (and Swate)

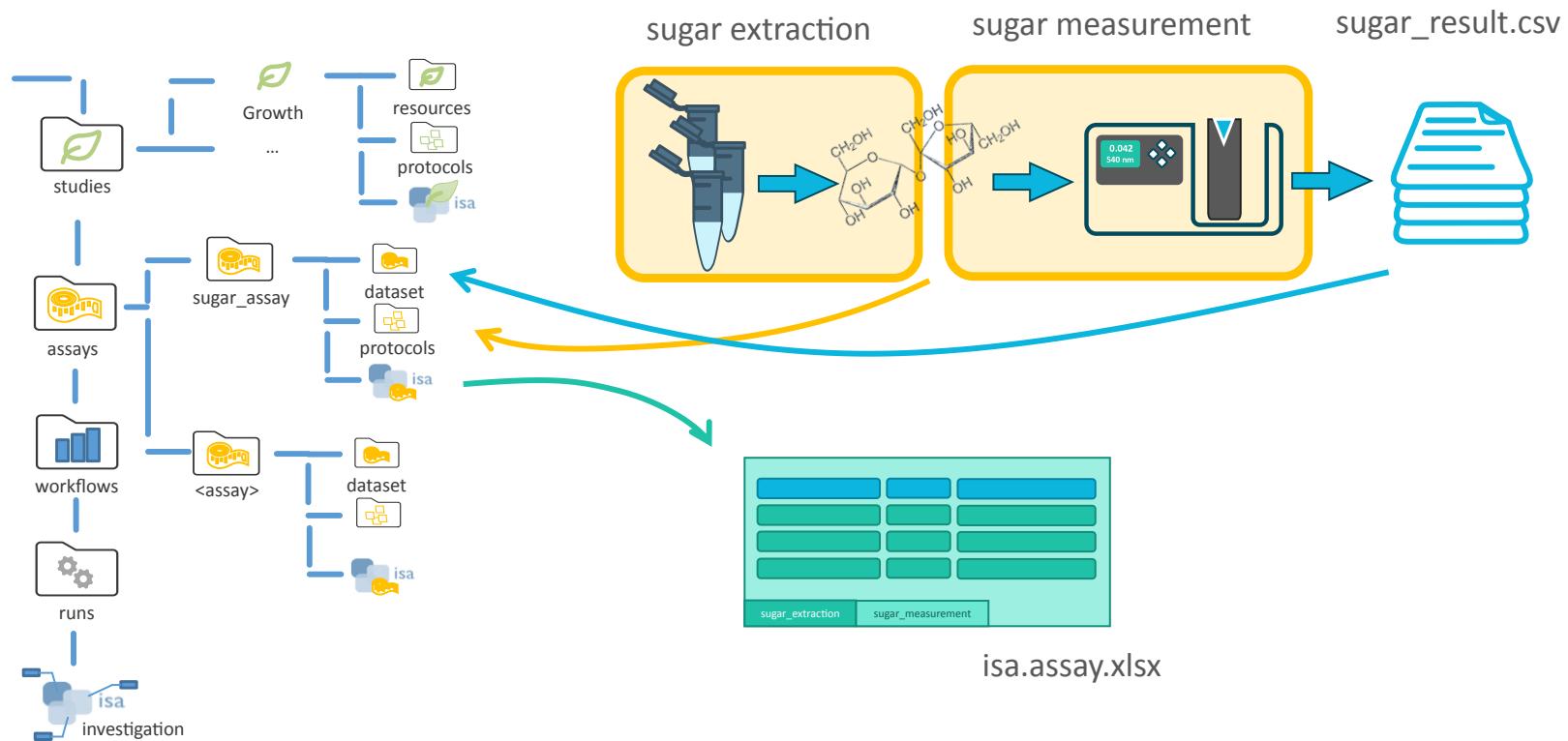
Identifying assays



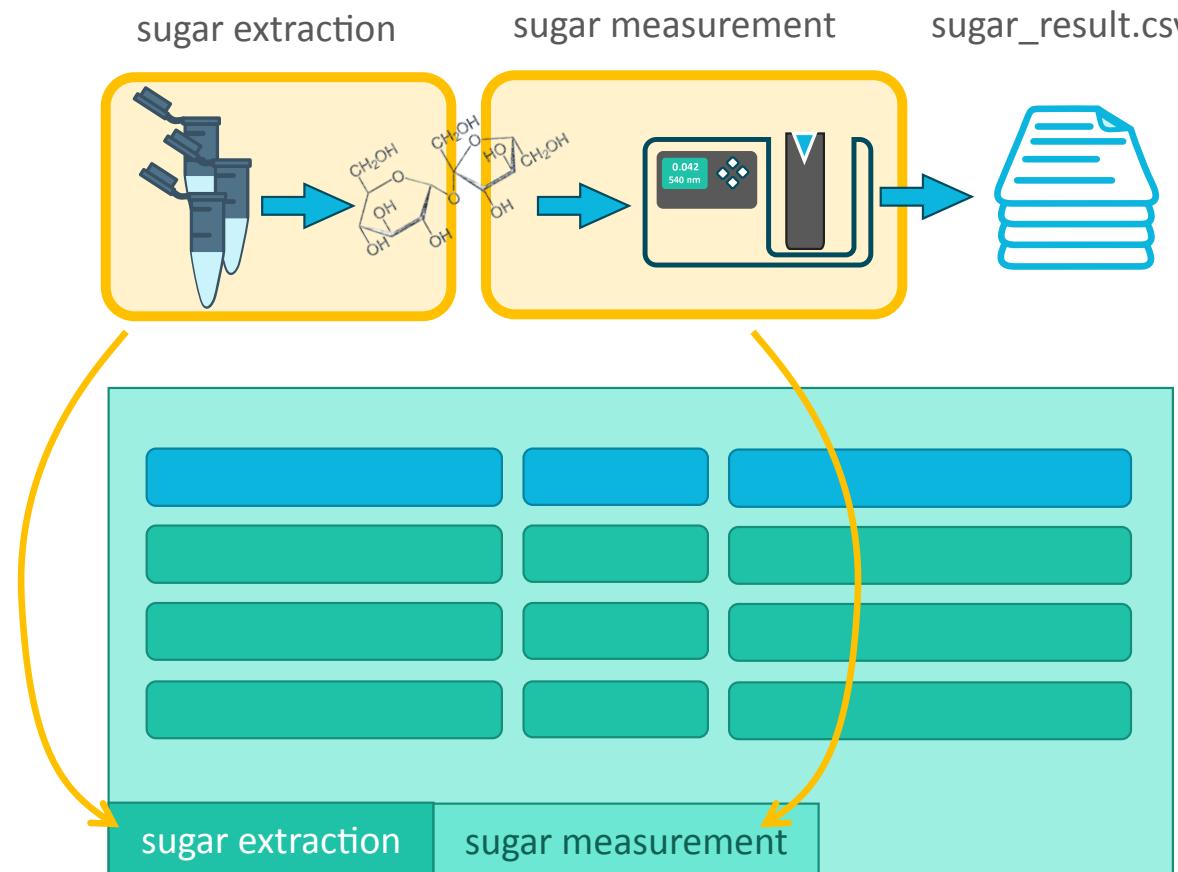
Assay for sugar measurement



Separating different assay elements

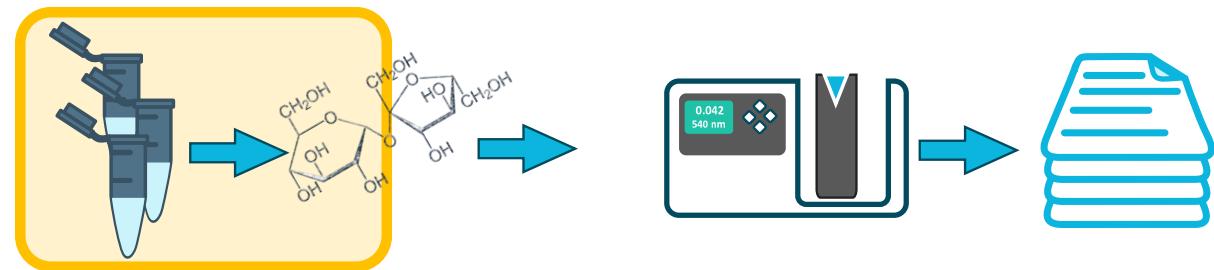


Isolating the lab processes in an assay



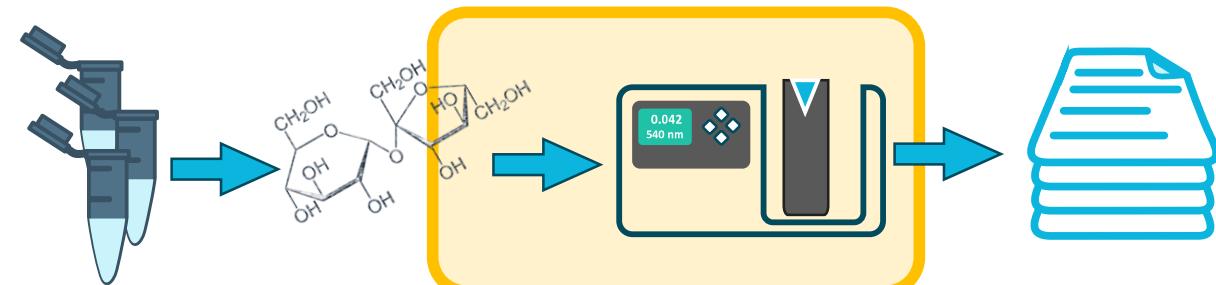
Parameteterization: sugar extraction

- Vortex Mixer
 - 3 seconds
- Temperature
 - 95 degree celsius



Parameteterization: sugar measurement

- technical replicate
 - 1,2,3,...
- sample volume
 - 10 microliter
- buffer volume
 - 190 microliter
- cycle count
 - 5



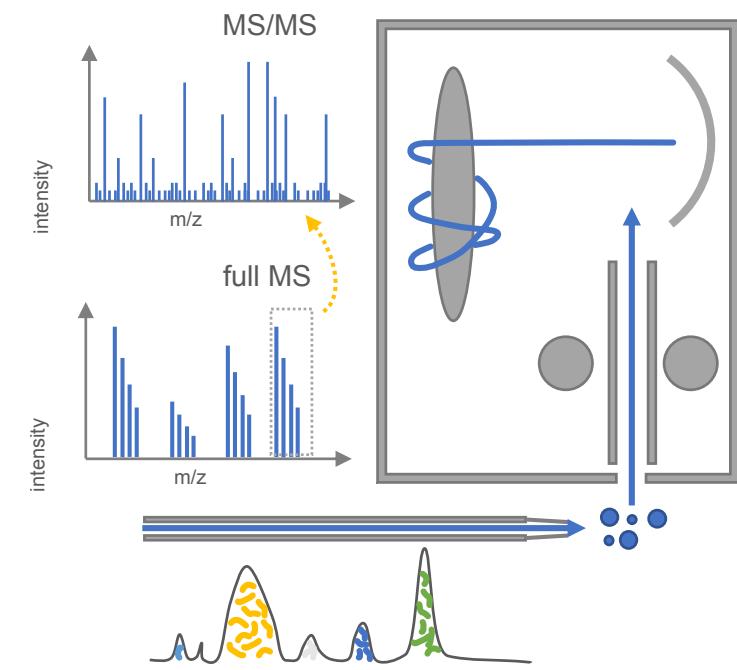
Save time using standard methods and SOPs

Parameter []

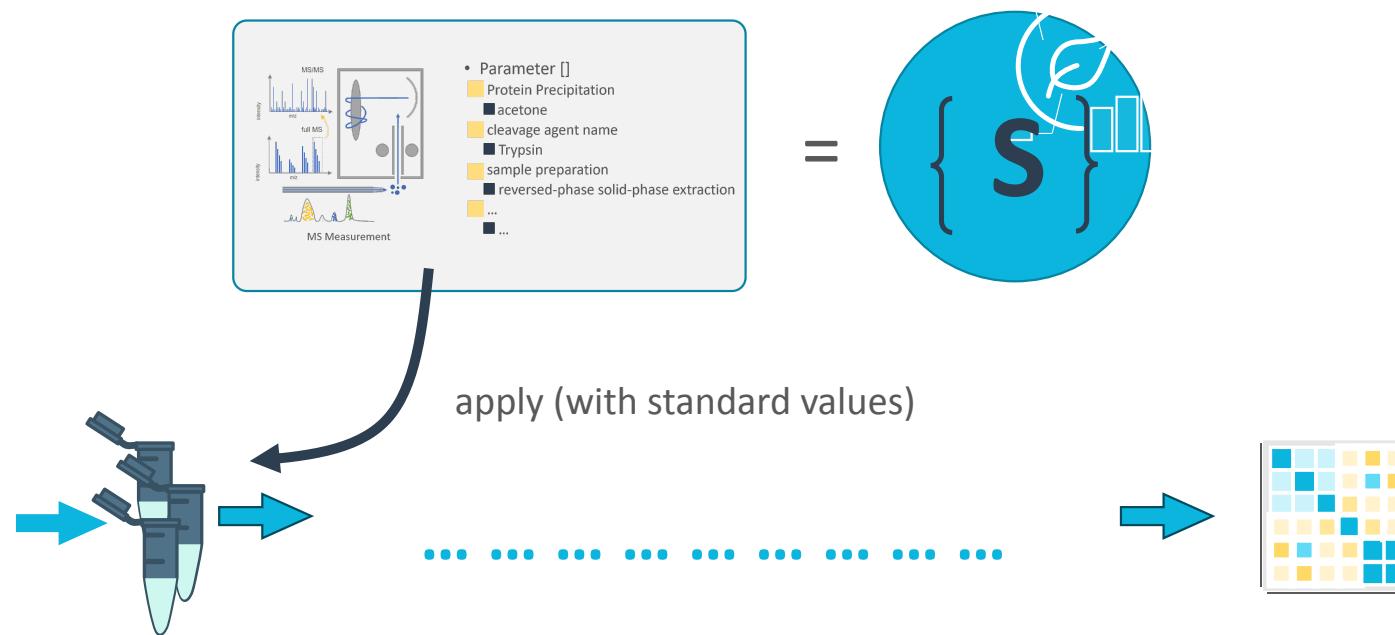
- █ Protein Precipitation
 - █ acetone
- █ cleavage agent name
 - █ Trypsin
- █ sample preparation
 - █ reversed-phase solid-phase extraction
- ...

Component []

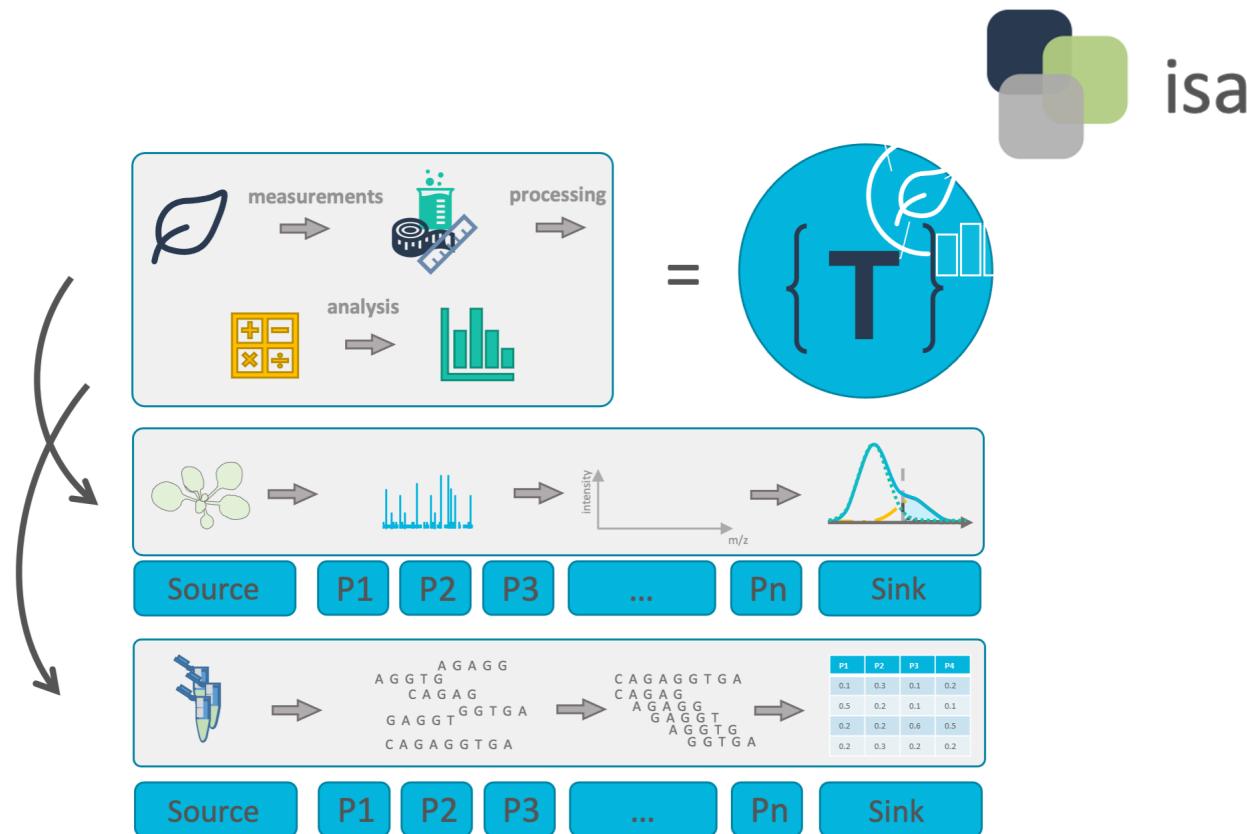
- █ chromatography instrument model
 - █ nanoElute2
- █ chromatography column model
 - █ PepSep C18 1.9 μ , 25cm x 75 μ m
- ...
...



Applying standard procedures to sample record



Realization of lab-specific metadata with templates



Facilities can define their most common workflows as templates

Hands-on part 2: ARCitect (and Swate)

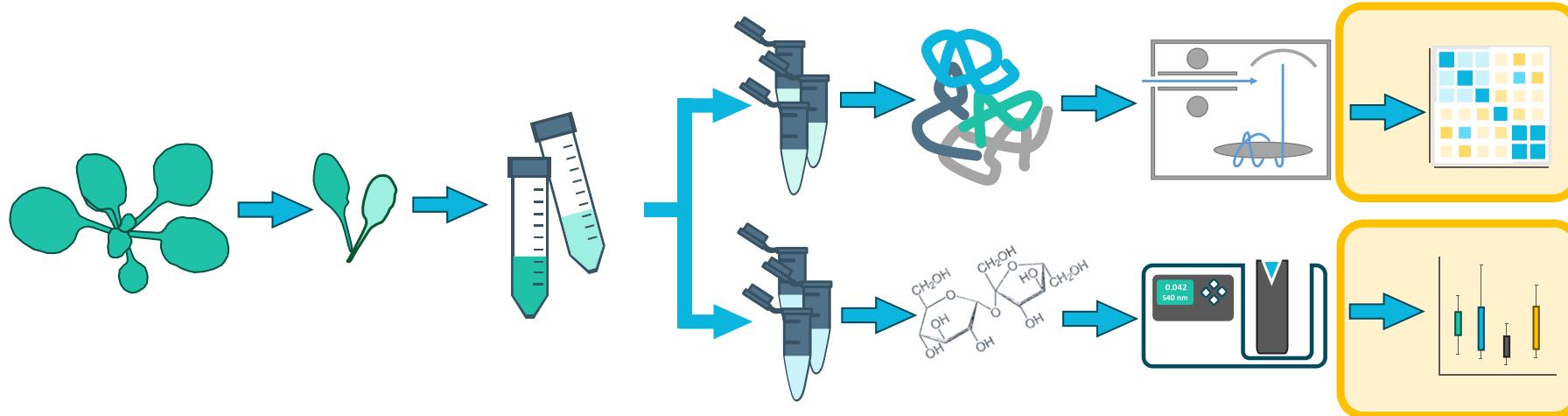
Continue the [Start Here](#) guide in the DataPLANT knowledge base.



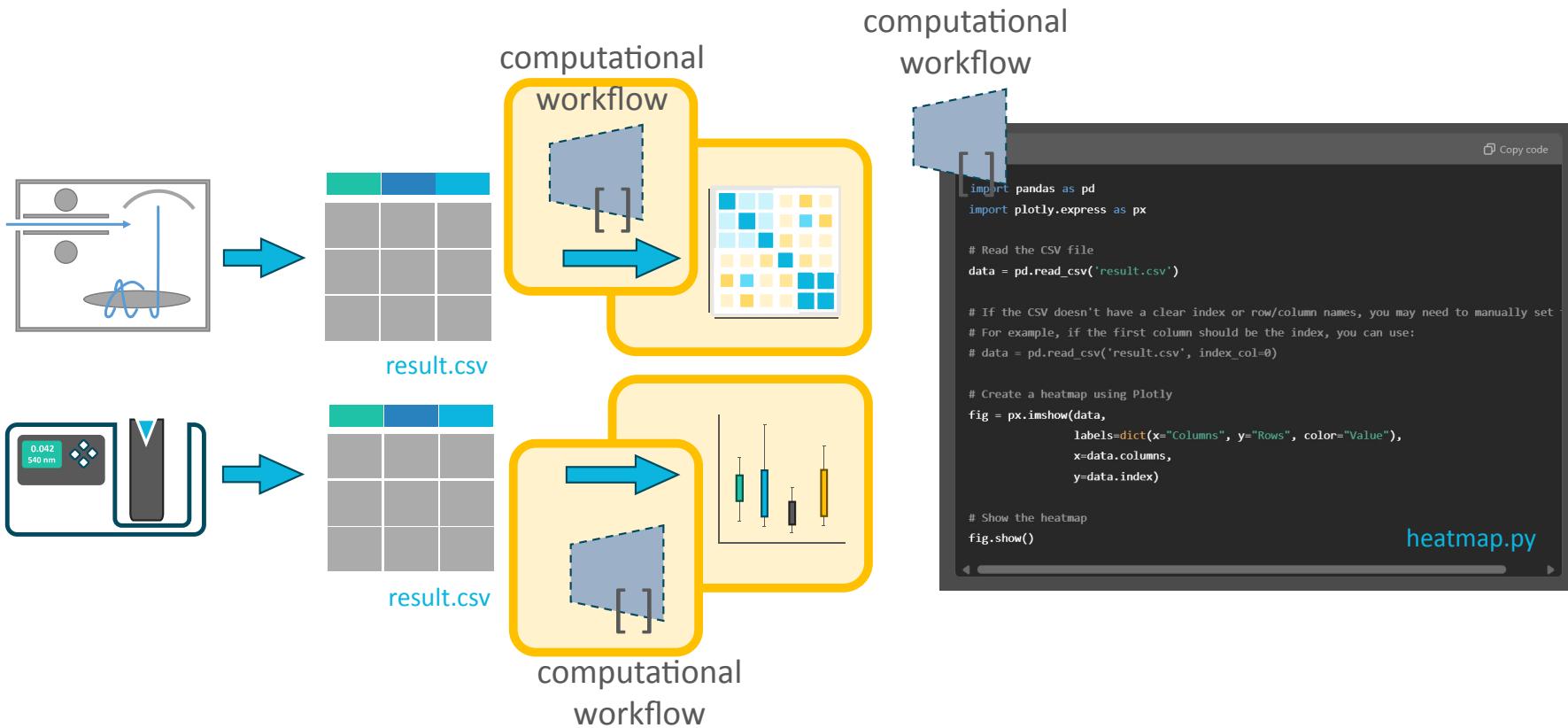
Until step **Add assay data**

Hands-on part 3: Data

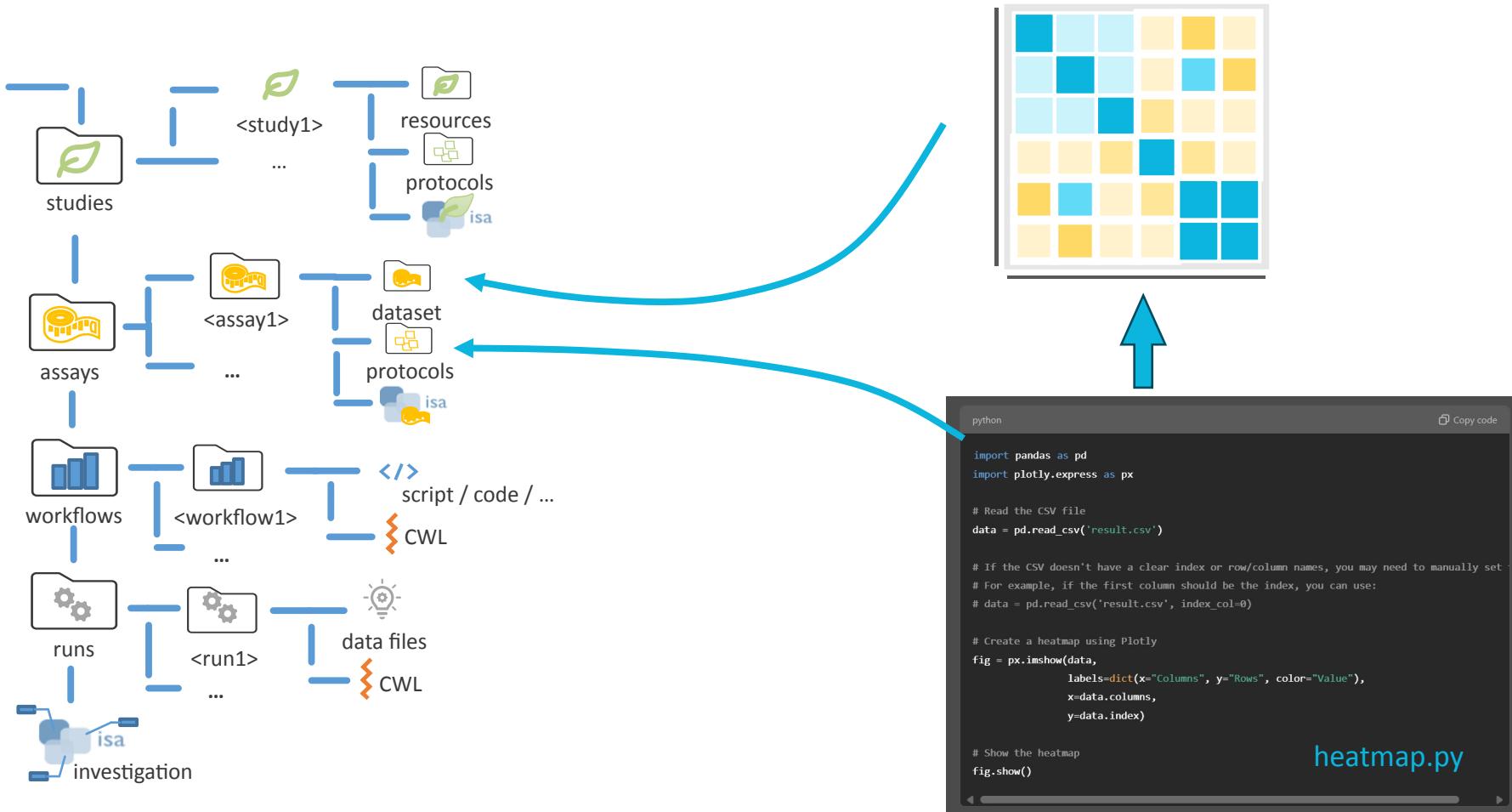
Options to annotate the data analysis



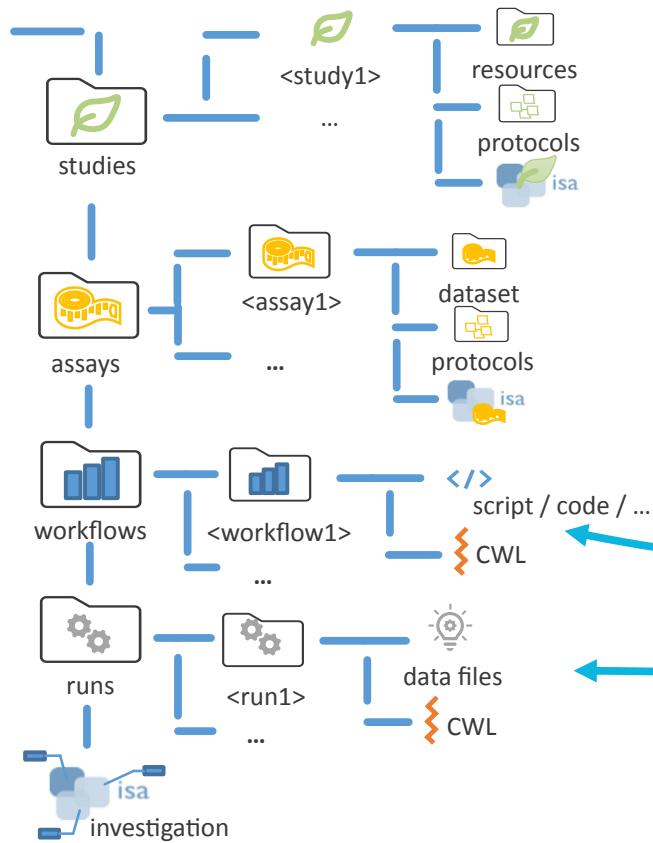
A computational workflow is like a protocol



Option I: Create a virtual assay



Option II: Create a workflow and run



A screenshot of a code editor window titled "heatmap.py" containing the following Python script:

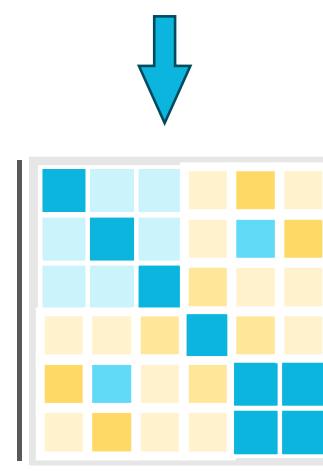
```
python
import pandas as pd
import plotly.express as px

# Read the CSV file
data = pd.read_csv('result.csv')

# If the CSV doesn't have a clear index or row/column names, you may need to manually set -
# For example, if the first column should be the index, you can use:
# data = pd.read_csv('result.csv', index_col=0)

# Create a heatmap using Plotly
fig = px.imshow(data,
                 labels=dict(x="Columns", y="Rows", color="Value"),
                 x=data.columns,
                 y=data.index)

# Show the heatmap
fig.show()
```



Use CWL to wrap your workflow

CWL workflow document (*.cwl)

```
graph LR; A[Workflow Document] --> B[Job Parameter]; B --> C[CWL runner]; C --> D[Output Folder]
```

```
graph TD; subgraph CWL_tool_descriptors ["CWL tool descriptors (*.cwl)"]; direction TB; 1[1] --> 2[2]; 2 --> 3[3]; 3 --> 4["#!/usr/bin/env cwl-runner"]; 4 --> 5[cwlVersion: v1.0]; 5 --> 6[class: Workflow]; 6 --> 7[inputs:]; 7 --> 8[tarball: File]; 8 --> 9[name_of_file_to_extract: string]; 9 --> 10[outputs:]; 10 --> 11[compiled_class:]; 11 --> 12[type: File]; 12 --> 13[outputSource: compile/classfile]; 13 --> 14[steps:]; 14 --> 15[untar:]; 15 --> 16[run: tar-param.cwl]; 16 --> 17[in:]; 17 --> 18[tarfile: tarball]; 18 --> 19[extractfile: name_of_file_to_extract]; 19 --> 20[out: [extracted_file]]; 20 --> 21[compile:]; 21 --> 22[run: arguments.cwl]; 22 --> 23[in:]; 23 --> 24[src: untar/extracted_file]; 24 --> 25[out: [classfile]];
```

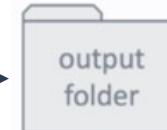
CWL job parameter (*.yaml)

```
graph LR; A[Job yaml] --> B[CWL runner]; B --> C[Output folder]
```

```
graph TD; subgraph CWL_job_parameter ["CWL job parameter (*.yaml)"]; file: fastq; param: 5; workflow: wf.cwl; output_folder: /temp;
```

CWL
tool descriptors (*.cwl)

CWL runner



Hands-on part 3: Data

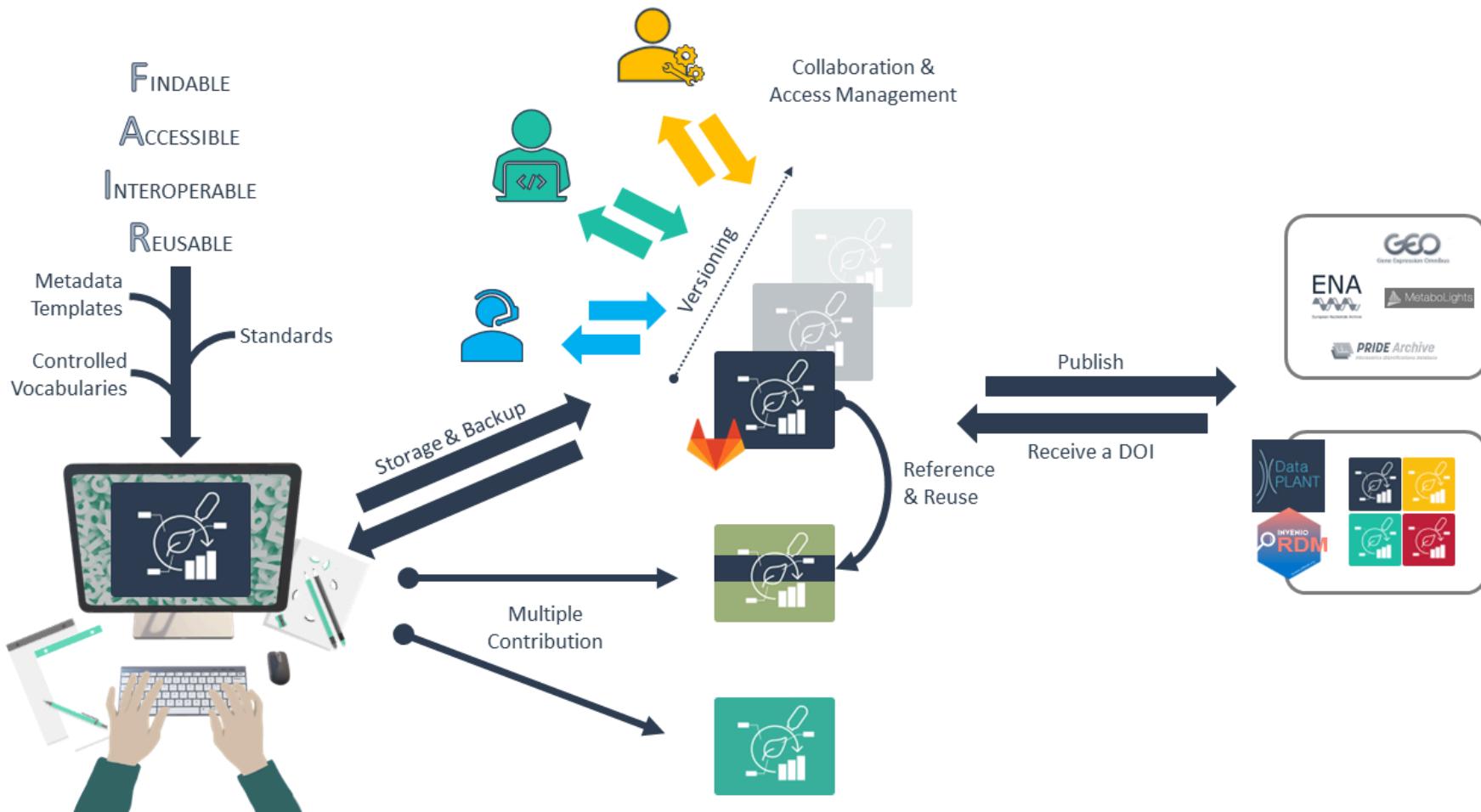
Continue the [Start Here](#) guide in the DataPLANT knowledge base.



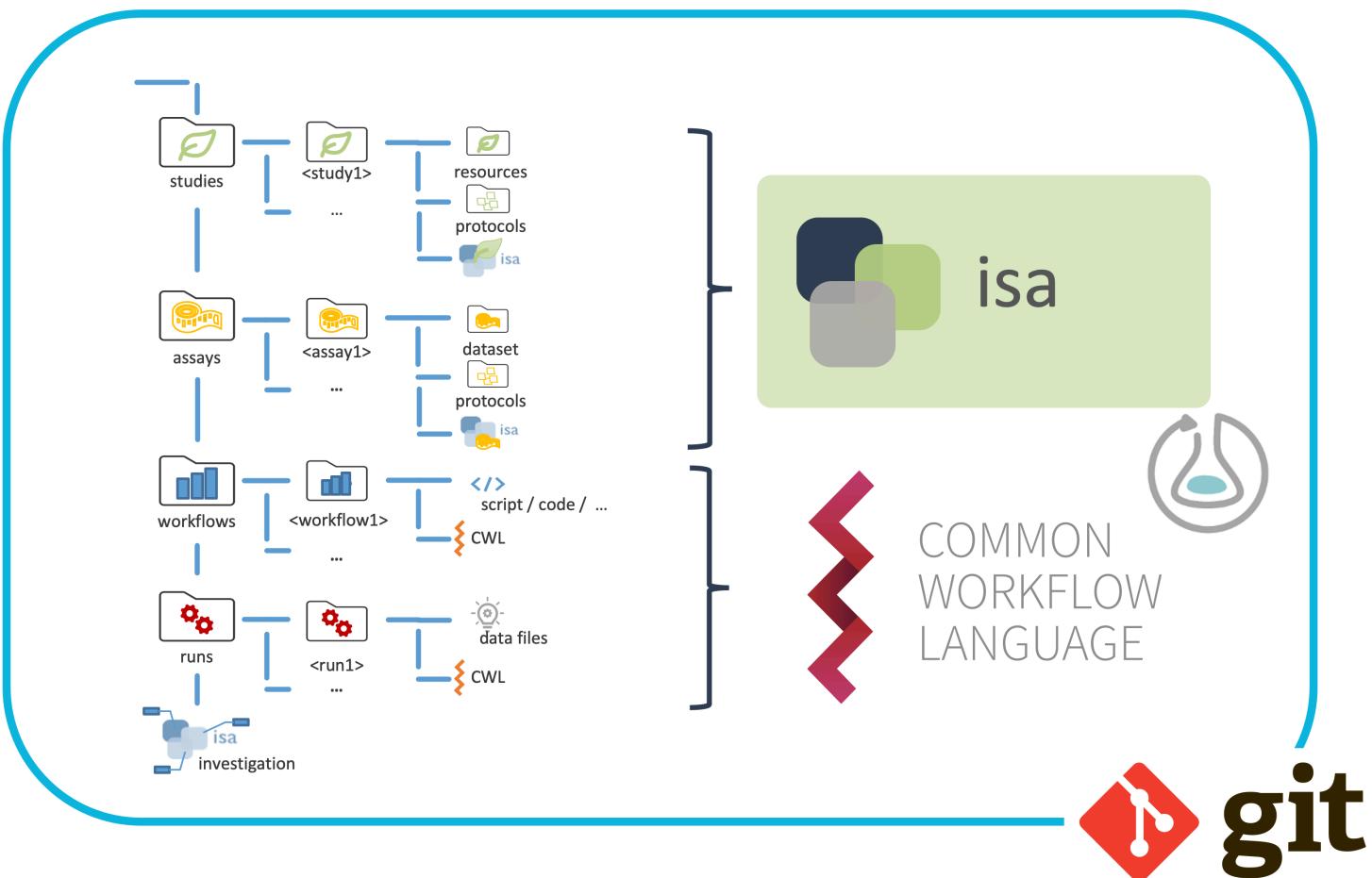
Until step **Data analysis**

Hands-on part 4: DataHUB

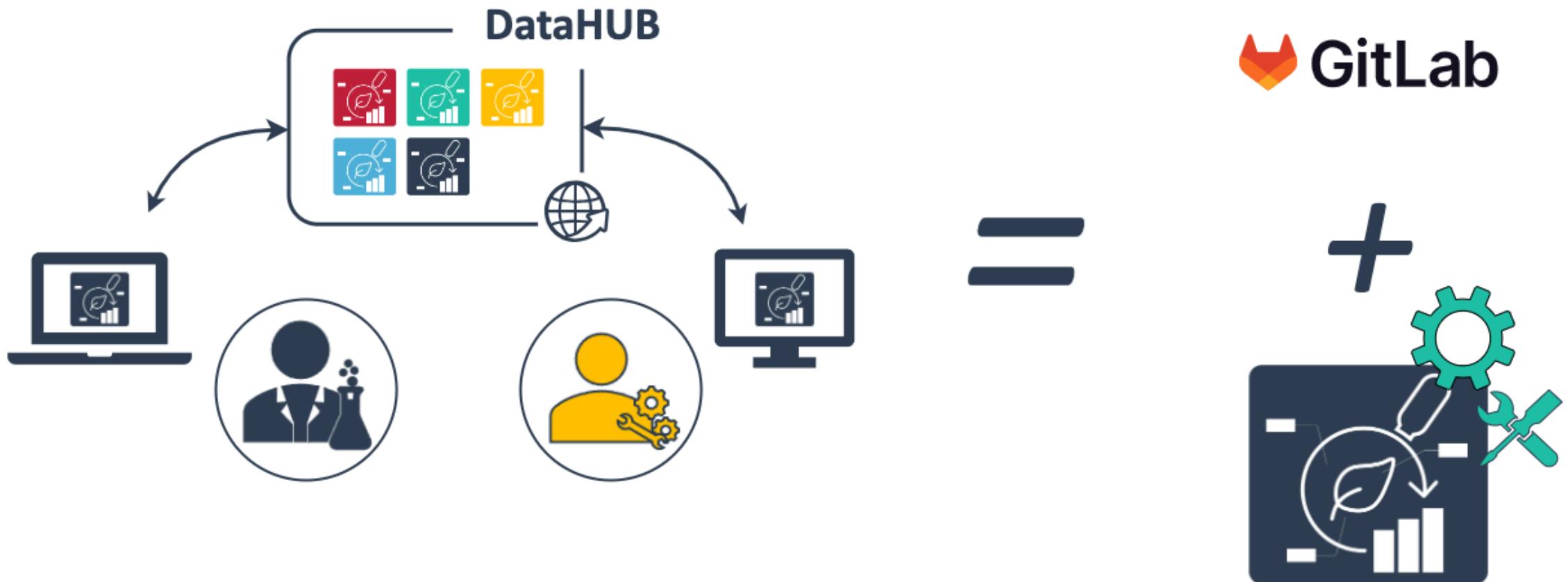
DataHUB overview



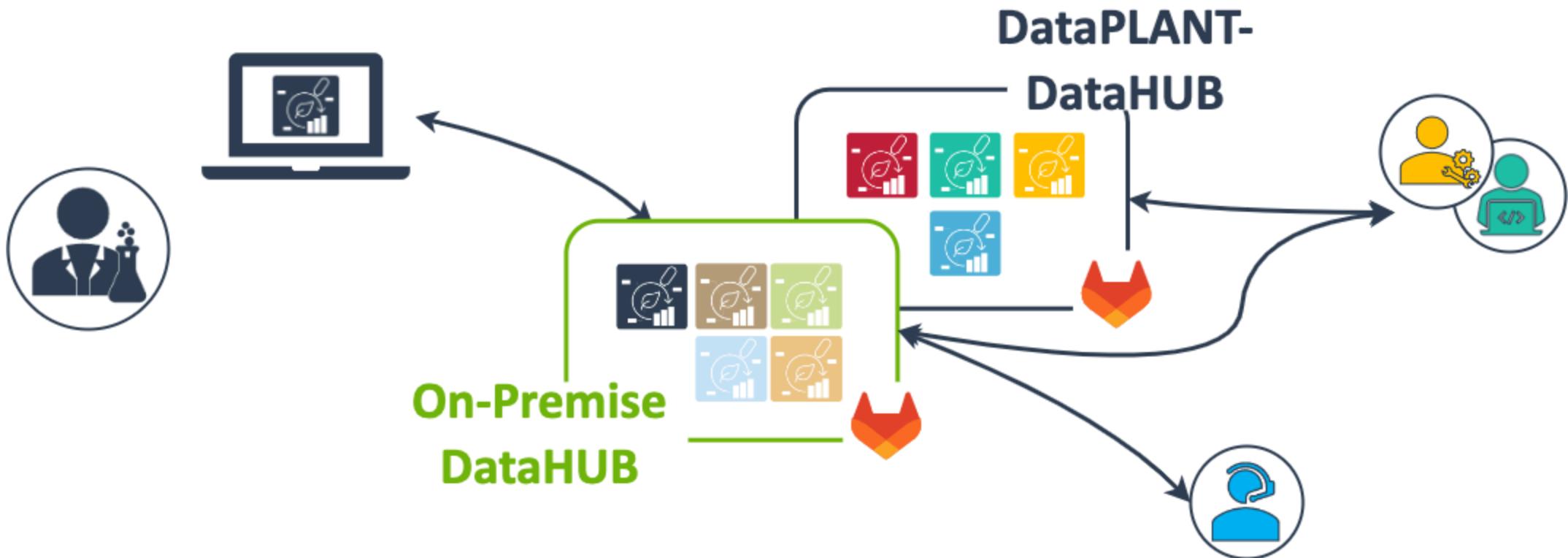
ARC builds on standards + Git



The DataPLANT DataHUB – a GitLab *Plus*

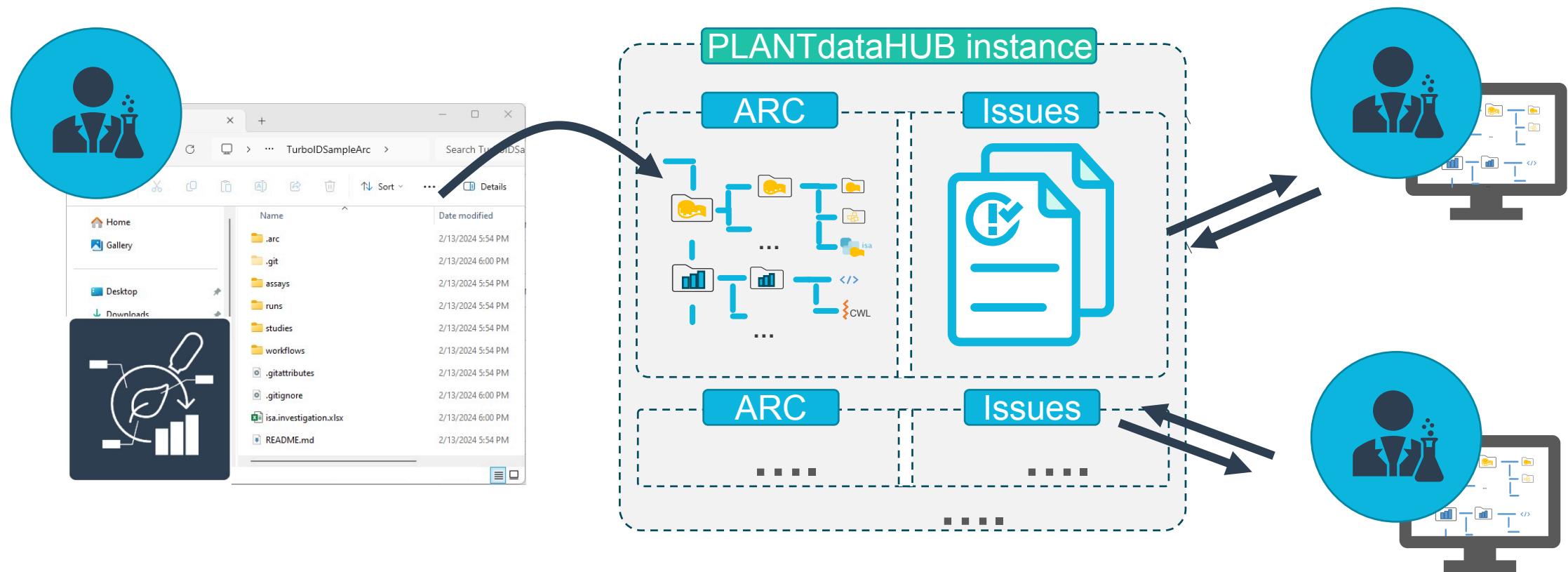


On-premise DataHUBs

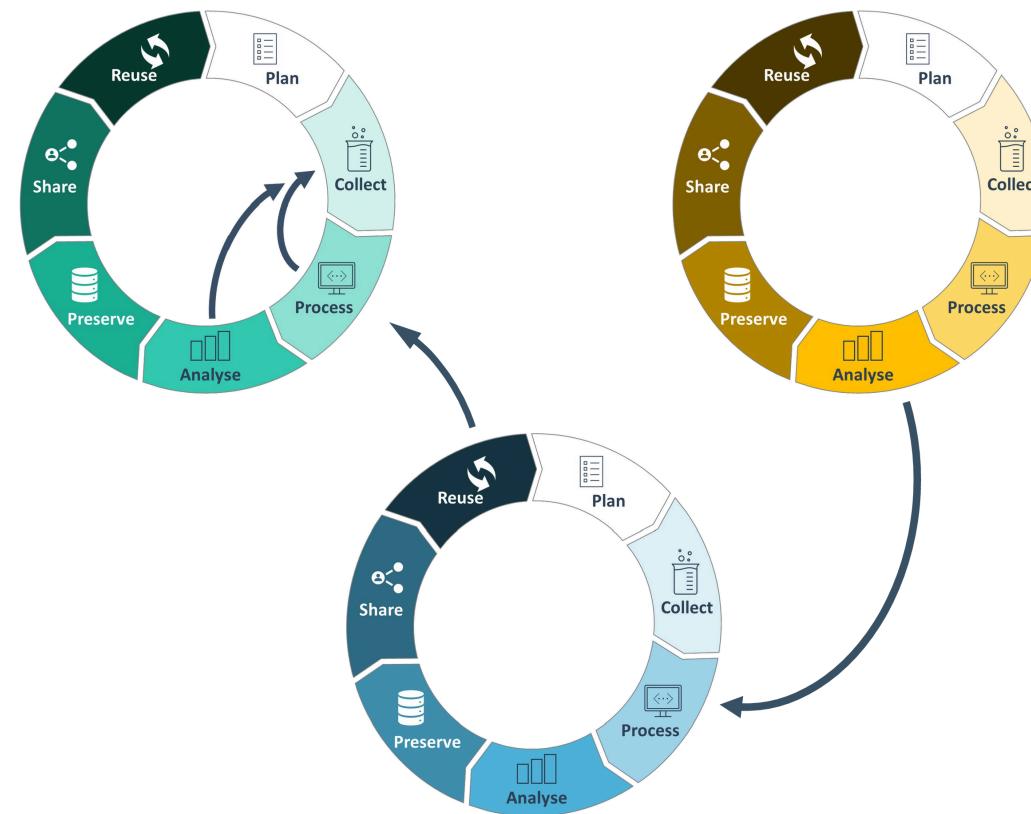


ARC services are available as on-premise option

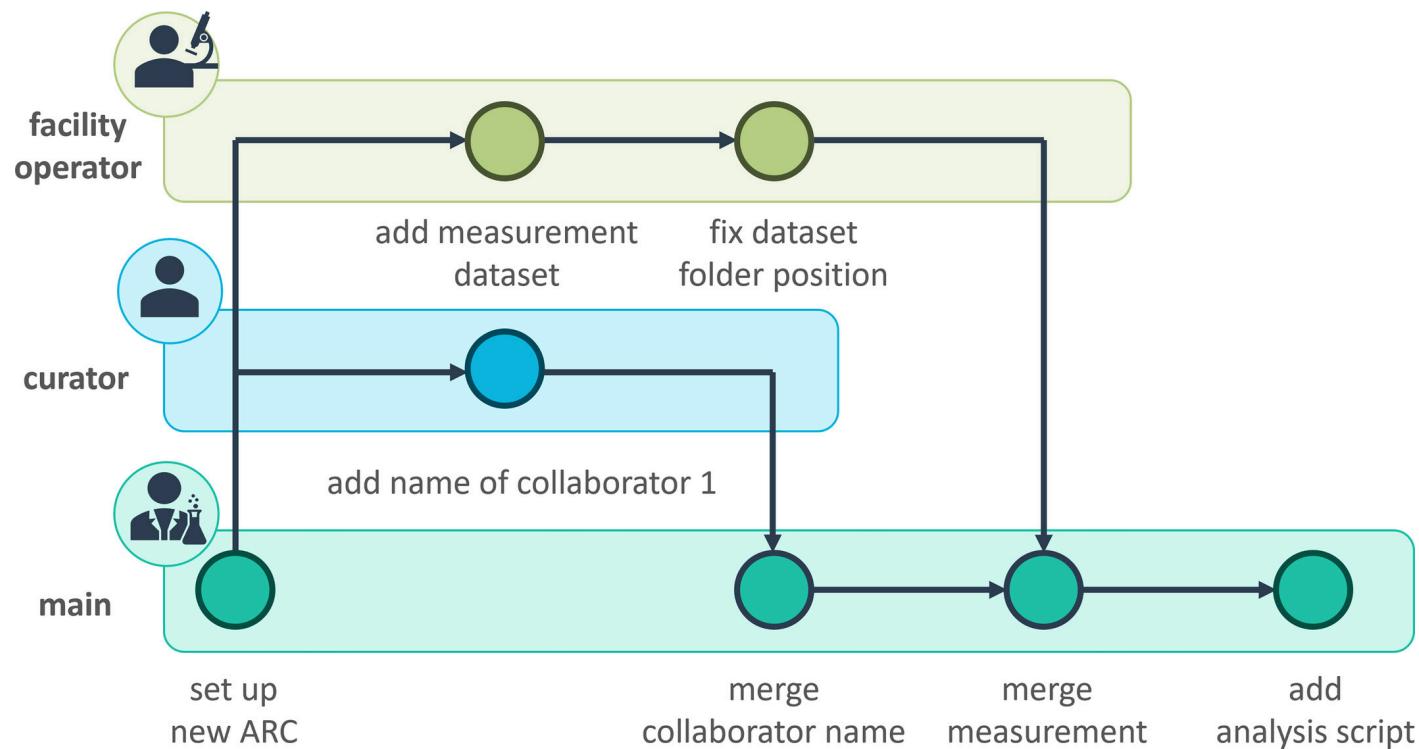
Using the DataHUB to collaborate



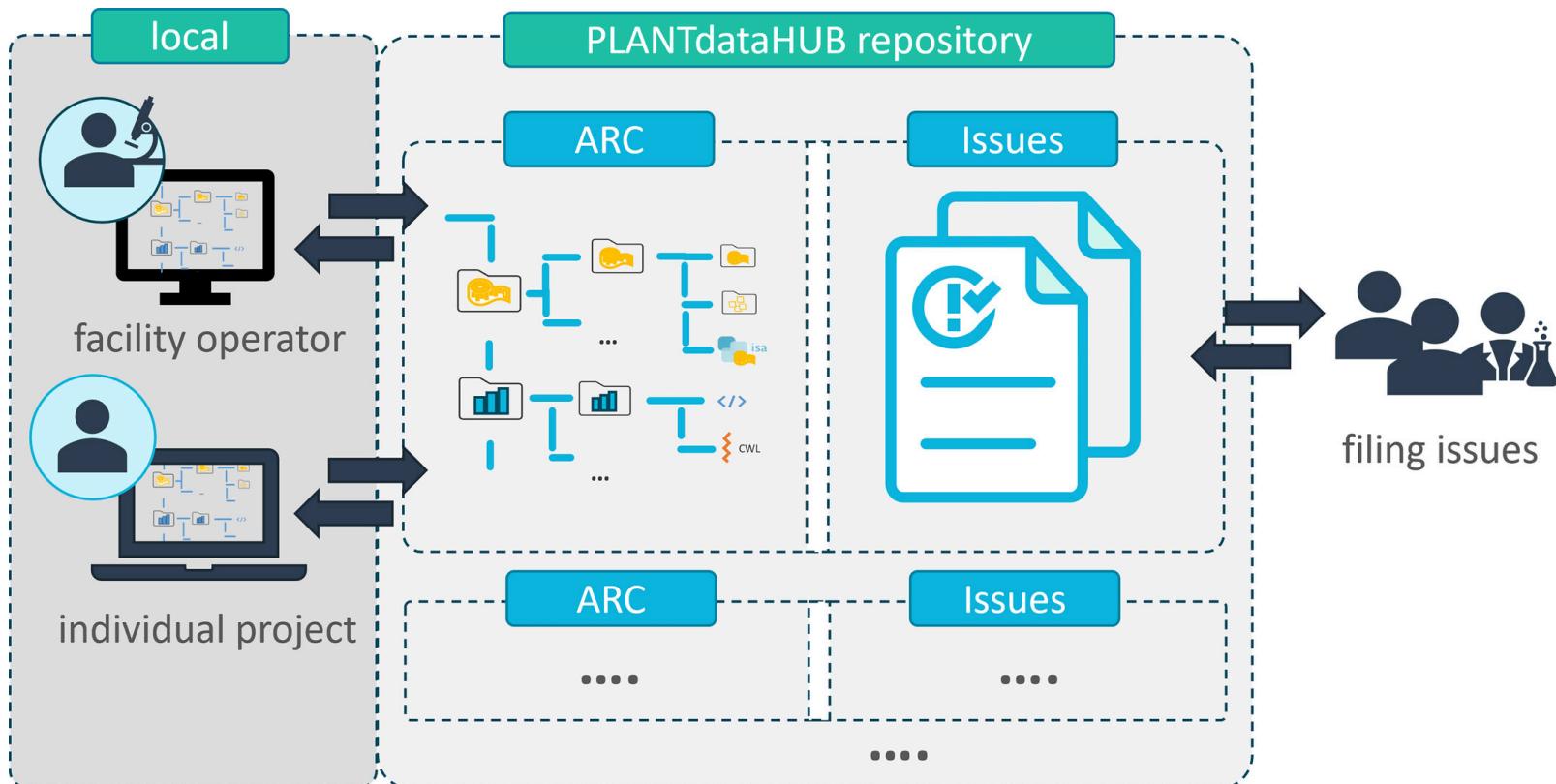
The Research Data Lifecycle *is mutable*



Mutable data life cycle



Project management



ARCs come with their own wiki space

- directly associated to your ARC
- same access rights as your ARC
- share meeting minutes or ideas with collaboration partners
- keep ARC clean of files that are not considered "research data"

The screenshot shows a DataHub interface for an ARC named 'Demo_ARC'. The sidebar on the left contains links for Project (Demo_ARC), Pinned, Manage, Plan, Issues (0), Issue boards, Milestones, Wiki (which is currently selected), Code, Build, Secure, and Help. The main content area has a header 'Home' and a message about CQC pipelines. It includes sections for 'Home' (last edited by Demo User just now), 'Meeting Schedule' (with a list of dates: 2024-06-12 Kick-off, 2024-06-27 Proposal discussion, 2024-07-04 Discuss RNA-seq pipeline), and 'Ideas and drafts' (Golden Gate protocol).

Hands-on part 4: DataHUB

Continue the [Start Here](#) guide in the DataPLANT knowledge base.



Until the final **complete** step

DataHUB terminology and data sharing

Choosing the proper role

When inviting new members to an ARC or group, you can choose between different levels.

Permissions & Roles

Roles are assigned when adding a user to an ARC or to a group. This is a very simplified summary.

Guest – Can only see the ARC's wiki

Reporter – Can read, but not add or edit data

Developer – Reporter permissions + can read, add, and edit data

Maintainer – Developer permissions + can add new members

Owner – Maintainer + can delete ARC, manage memberships and permissions



By default you are **Owner** of an ARC you create or upload to the DataHUB.

Projects and Groups are not the same

- "Project" = ARC
- "Groups" = Group of users

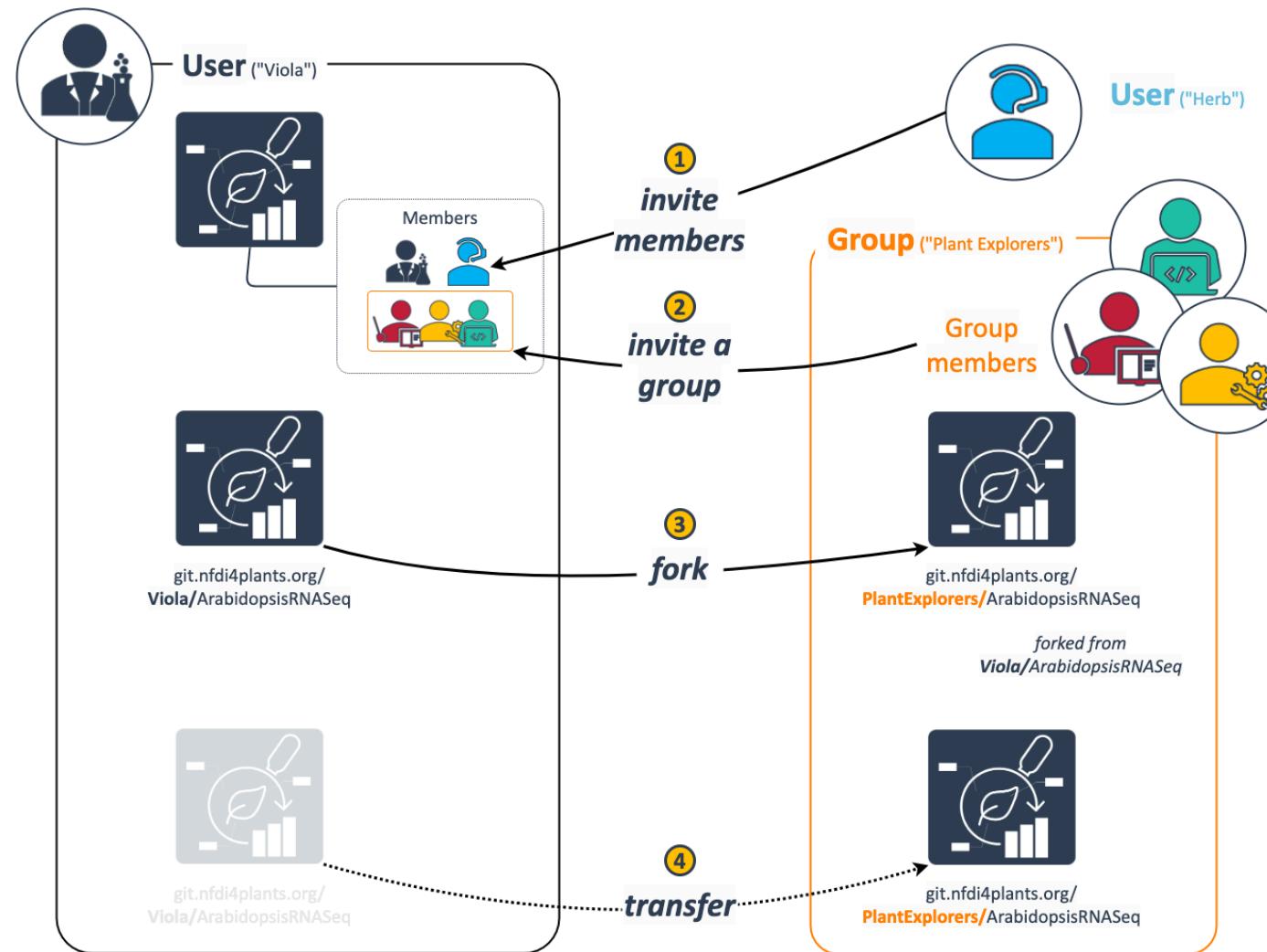
Project = ARC

- In the DataHUB, ARCs are called "projects"; they are the same.
- An ARC can be shared with individual users (invited as "members") or a group.

DataHUB Groups = Group of members (e.g. lab)

- A "Group" is a group of users with specific permissions
- A group can share ARCs
- A group can be invited to an ARC
- Groups can have subgroups

Options to share an ARC via the DataHUB



Namespaces

- Every user has a personal namespace, where they can upload or create new ARCs
- Every group and subgroup has its own namespace

Type	URL	Namespace	Name
A personal ARC	https://git.nfdi4plants.org/brilator/Facultative-CAM-in-Talinum	brilator	Dominik Brilhaus
An group-shared ARC	https://git.nfdi4plants.org/hhu-plant-biochemistry/Samuilov-2018-BOU-PSP	hhu-plant-biochemistry	HHU Plant Biochemistry

 **Personal** is not the same as **private**

Visibility

The visibility of ARCs and groups can be managed individually for each ARC or group

Visibility

The visibility of each ARC can be managed in the settings of the ARC



Private – ARC access must be granted explicitly to each user or group.



Internal – ARC can be accessed by any logged in user.



Public – ARC can be accessed without authentication.



By default every ARC and every group is set to **private**.

ARC DataHUB members // ARC Investigation contacts

The screenshot shows the 'Project members' section of the DataHUB interface. It lists four members:

Account	Source	Max role	Expiration	Activity
Adriano Nunes-Nesi @nunesnesi	HHU Plant Biochemistry by Sebastian Triesch	Maintainer	Expiration date	User created: Jul 05, 2023 Access granted: Jul 10, 2023 Last activity: Aug 09, 2023
Andreas Weber @andreas.weber	HHU Plant Biochemistry by Sebastian Triesch	Maintainer	Expiration date	User created: Mar 10, 2023 Access granted: Jul 31, 2023 Last activity: Sep 11, 2023
Dominik Brilhaus It's you @brilator	Direct member by Dominik Brilhaus	Owner	Expiration date	User created: Feb 21, 2022 Access granted: Dec 06, 2023 Last activity: Mar 26, 2024
Franziska Fichtner @franziska.fichtner	HHU Plant Biochemistry by Sebastian Triesch	Maintainer	Expiration date	User created: Aug 11, 2023 Access granted: Aug 11, 2023 Last activity: Aug 11, 2023

DataHUB: ARC members

https://git.nfdi4plants.org/hhu-plant-biochemistry/Samuilov-2018-BOU-PSP/-/project_members

The screenshot shows the 'Investigation Contacts' section of the ARCIctect interface. It displays a list of contacts with their ORCID IDs and scores:

Contact	Score
Sladjana Samuilov <orcid>	4/10
Nadine Rademacher <orcid>	3/10
Samantha Flachbart <orcid>	3/10
Leila Arab <orcid>	3/10
Saleh Alfarraj <orcid>	3/10
Franziska Kuhnert <orcid>	3/10
Stanislav Kopriva <orcid>	3/10
Andreas P. M. Weber <orcid>	4/10
Tabea Mettler-Altmann <orcid>	3/10

ARCIctect: Investigation Contacts

Investigation contacts are not automatically invited as members to the ARC.

Version control

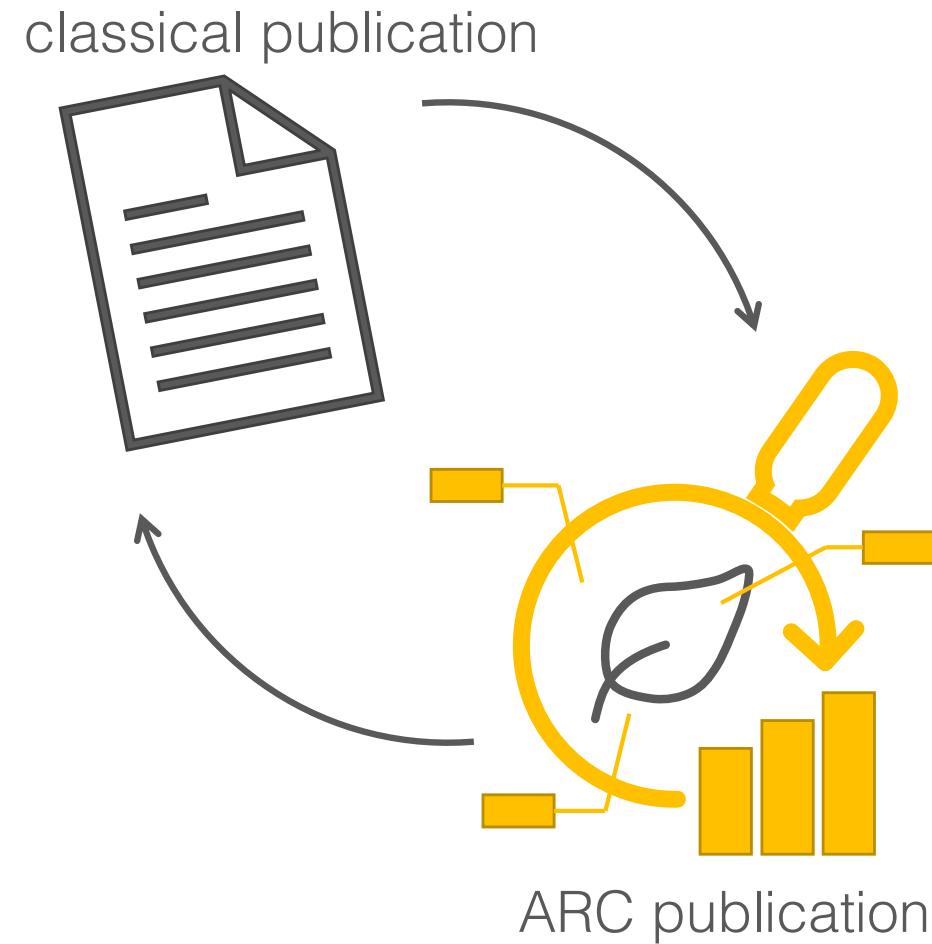
Check out the **commit history** of your ARC via Repository (2) or directly via commits (7)

The screenshot shows the interface of a project named "Demo_ARC". The left sidebar contains navigation links: Manage (1), Plan (2), Code (3), Build (4), Secure (5), Deploy (6), Operate (7), Monitor (8), Analyze (9), Settings (10), and Help (11). The main area displays a commit history for the "main" branch (7). A single commit is shown: "arc init" by Demo User, authored 4 minutes ago, with a green checkmark and the ID 7a8c9714. Below the commit history is a table of files and their last commit and update times:

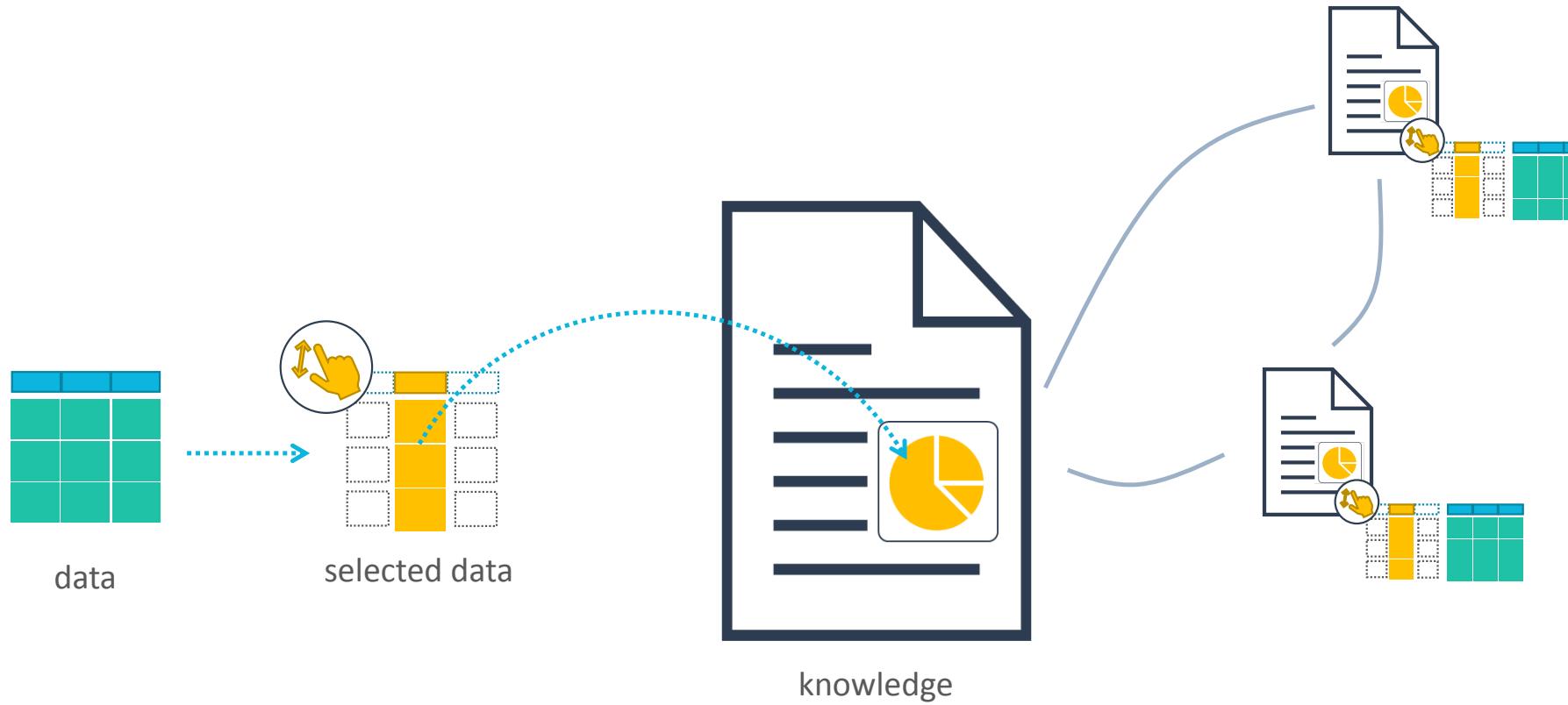
Name	Last commit	Last update
assays	arc init	4 minutes ago
runs	arc init	4 minutes ago
studies	arc init	4 minutes ago
workflows	arc init	4 minutes ago
.gitignore	arc init	4 minutes ago
isa.investigation.xlsx	arc init	4 minutes ago

The right side of the screen shows "Project information" with a pipeline status of "passed" and a "Publish ARC" button. It also lists 1 Commit, 2 Branches, 0 Tags, and 7 KiB Project Storage. Below this are links for Auto DevOps, README, LICENSE, CHANGELOG, CONTRIBUTING, Kubernetes cluster, Wiki, and Integrations. At the bottom, it shows the project was created on July 13, 2024.

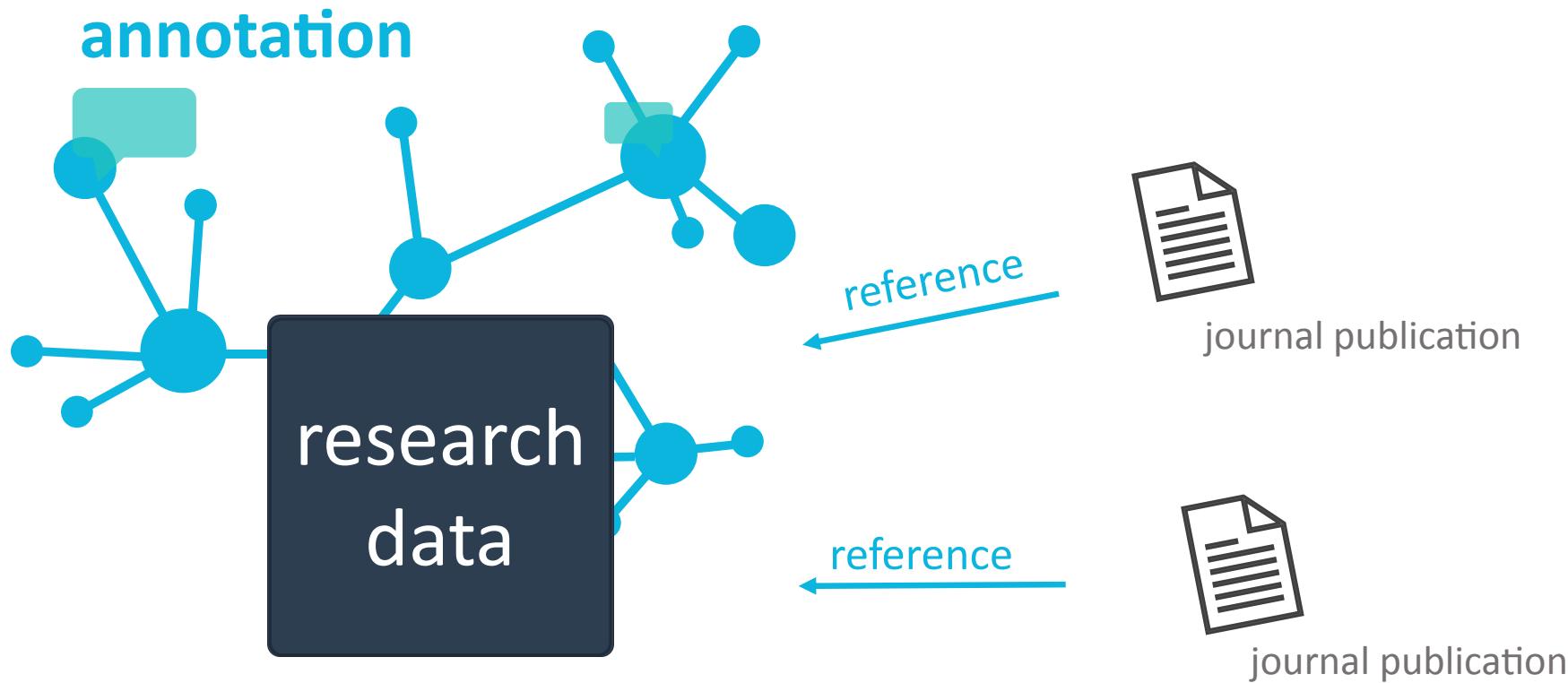
Hands-on part 5: ARC data publication



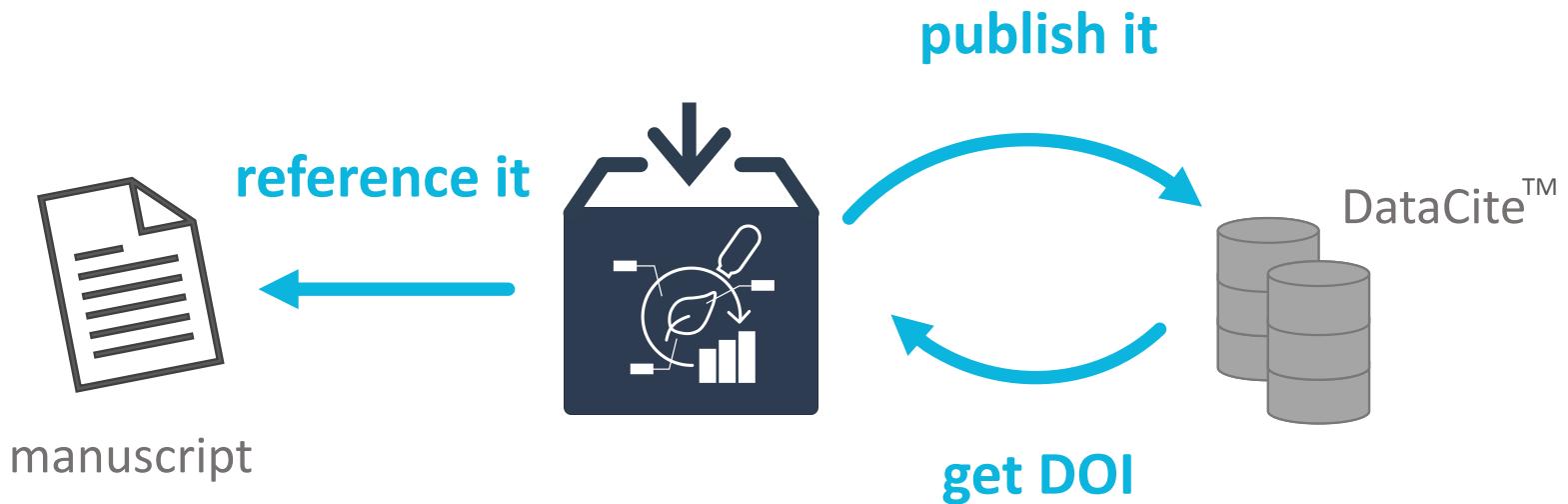
Moving from paper to FAIR data publication



Moving from paper to data publications



Publish your ARC, get a DOI



Publish your ARC with a few clicks

The screenshot shows a bioRxiv project page for 'Ru_ChlamyHeatstress'. The project icon features a green cell with a鞭毛 (flagella) and a red thermometer icon. The project ID is 122. The page displays 53 commits, 1 branch, 0 tags, and 293.9 GB of project storage. Topics listed include Chlamydomonas, abiotic stress, proteomics, and more. A note states: "Algae cultures were grown mixotrophically (TAP). After 24h of 35°C/40°C the cells were shifted back to room temperature for 48h. 'omics samples were taken." At the bottom, there are three numbered buttons: 1. pipeline (passed), 2. Publish ARC (blue button with a heart icon), and 3. arc quality (yellow button showing 301/301).

Ru_ChlamyHeatstress

Project ID: 122

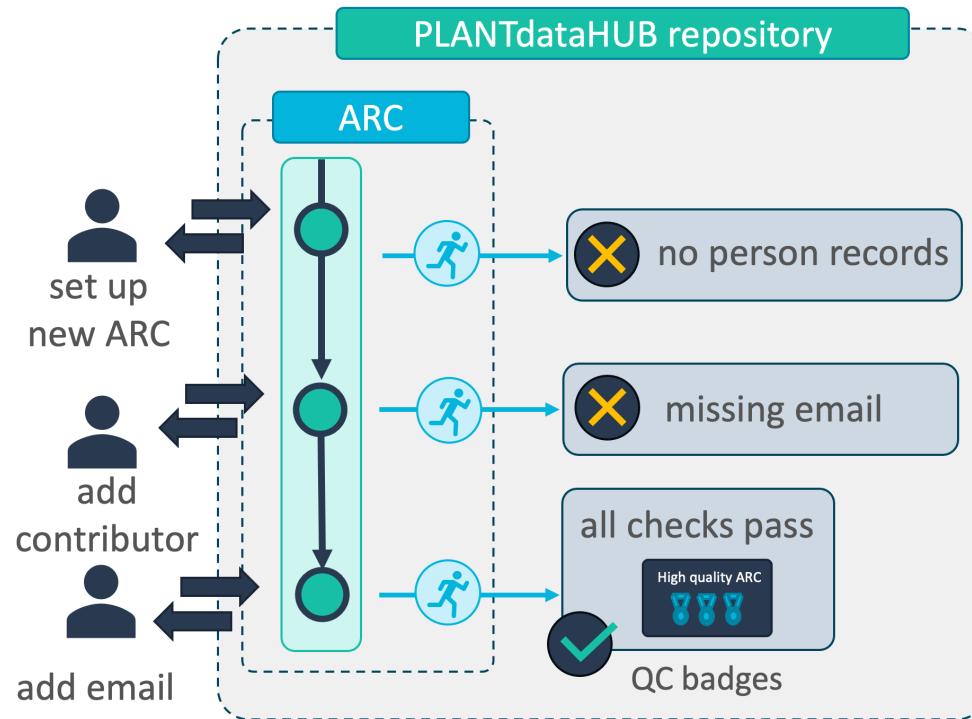
53 Commits 1 Branch 0 Tags 293.9 GB Project Storage

Topics: Chlamydomonas, abiotic stress, proteomics, + 1 more

Algae cultures were grown mixotrophically (TAP). After 24h of 35°C/40°C the cells were shifted back to room temperature for 48h. 'omics samples were taken.

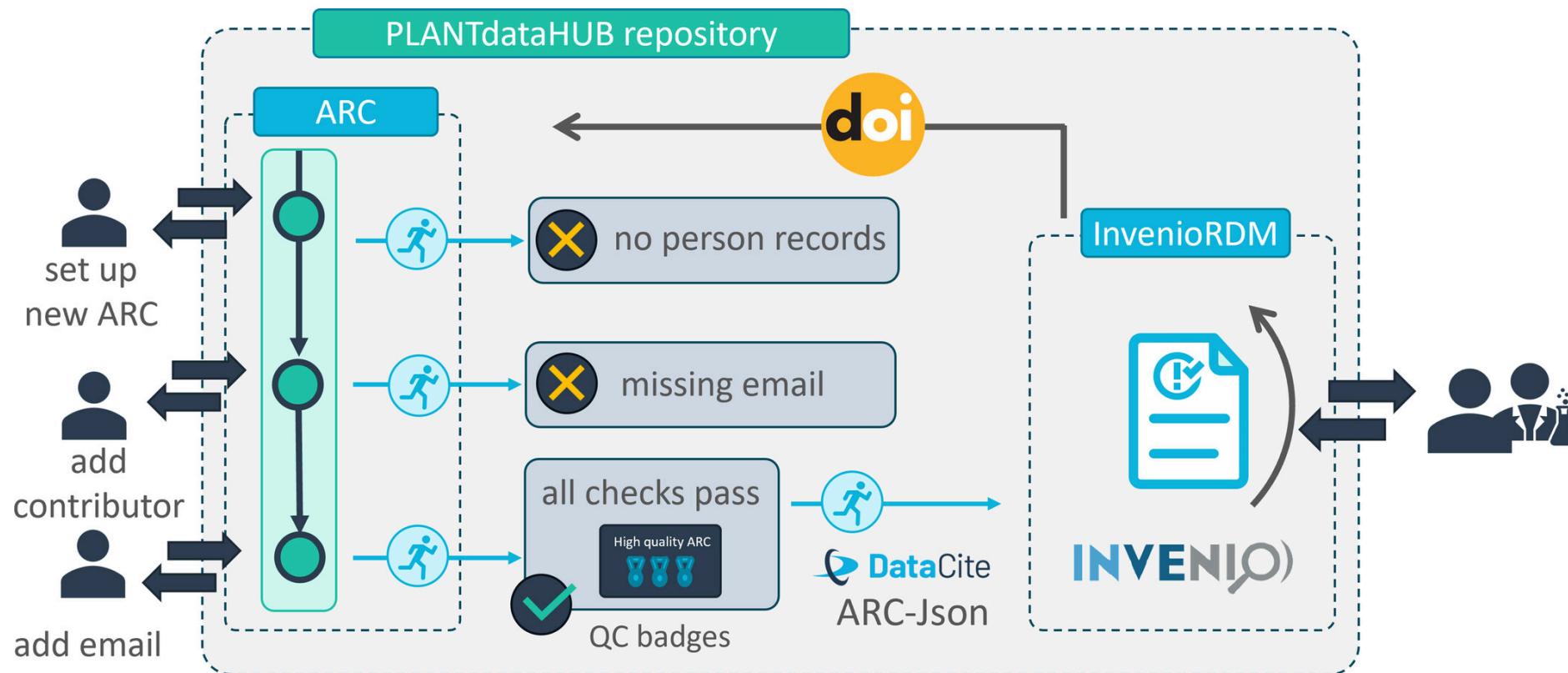
1 pipeline passed 2 Publish ARC 3 arc quality 301/301

Validation



adapted from Weil, H.L., Schneider, K., et al. (2023), PLANTdataHUB: a collaborative platform for continuous FAIR data sharing in plant research. Plant J. <https://doi.org/10.1111/tpj.16474>

Validate & publish



Validation towards publication

Receive a DOI

Published September 7, 2023 | Version v1

Dataset  Open

Systems-wide investigation of responses to moderate and acute high temperatures in the green alga *Chlamydomonas reinhardtii*.

Zhang, Ningning¹; Mattoon, Erin¹; McHargue, Will¹ ; Venn, Benedict² ; Zimmer, David² ; Pecani, Kresti³; Jeong, Jooyeon¹; Anderson, Cheyenne¹; Chen, Chen⁴; Berry, Jeffrey¹; Xia, Ming¹; Tzeng, Shin-Cheng¹ ; Becker, Eric¹; Pazouki, Leila¹; Evans, Bradley¹; Cross, Fred³; Cheng, Jianlin⁴; Czymmek, Kirk¹ ; Schröda, Michael⁵ ; Mühlhaus, Timo² ; Zhang, Ru¹ 

Show affiliations

Style APA

1
Citation

Zhang, N., Mattoon, E., McHargue, W., Venn, B., Zimmer, D., Pecani, K., Jeong, J., Anderson, C., Chen, C., Berry, J., Xia, M., Tzeng, S.-C., Becker, E., Pazouki, L., Evans, B., Cross, F., Cheng, J., Czymmek, K., Schröda, M., ... Zhang, R. (2023). Systems-wide investigation of responses to moderate and acute high temperatures in the green alga *Chlamydomonas reinhardtii*. [Data set]. DataPLANT. <https://doi.org/10.60534/9e5jx-75d83>

Description

hosted on: <https://git.nfd4plants.org/projects/122>

Files

arc-summary.md

[Data set] Systems-wide investigation of responses to moderate and acute high temperatures in the green alga *Chlamydomonas reinhardtii*.

File contents:

- root
 - isa.investigation.xlsx
 - README.md
 - runs

2

 Edit

 New version

 Share

Versions

Version v1	Sep 7, 2023
10.60534/9e5jx-75d83	

Details

DOI
[DOI 10.60534/9e5jx-75d83](https://doi.org/10.60534/9e5jx-75d83)

Resource type
Dataset

Publisher
DataPLANT

Export

JSON 

Hands-on part 5: Data publication

1. ARC validation
2. (Towards) ARC publication

Q&A and Wrap-up

DataPLANT Resources – join the open source movement

DataPLANT Website: <https://nfdi4plants.org/>

Knowledge Base: <https://nfdi4plants.org/nfdi4plants.knowledgebase/>

DataHUB: <https://git.nfdi4plants.org>

GitHub: <https://github.com/nfdi4plants>

HelpDesk: <https://helpdesk.nfdi4plants.org>

 You can help us by raising issues, bugs, ideas...

 NEW! ARC website: <https://arc-rdm.org>

Continuous support

Data managers in Düsseldorf, Cologne, Jülich and close by (CEPLAS, MibiNet, TRR341) offer support.

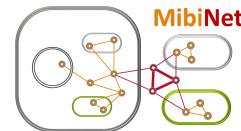
1. Slack Workspace for ad hoc support
2. Monthly user meeting (2nd Friday of the month)

→ [Details](#).



trr_341

plant
ecological
genetics



Five-Finger-Feedback



Contributors

If not referenced otherwise, figures and slides presented here were created by members of DataPLANT (<https://nfdi4plants.org>).

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