ETH zürich

openBIS Training

Caterina Barillari, Priyasma Bhoumik, Henry Lütcke
Scientific IT Services, ETH Zurich

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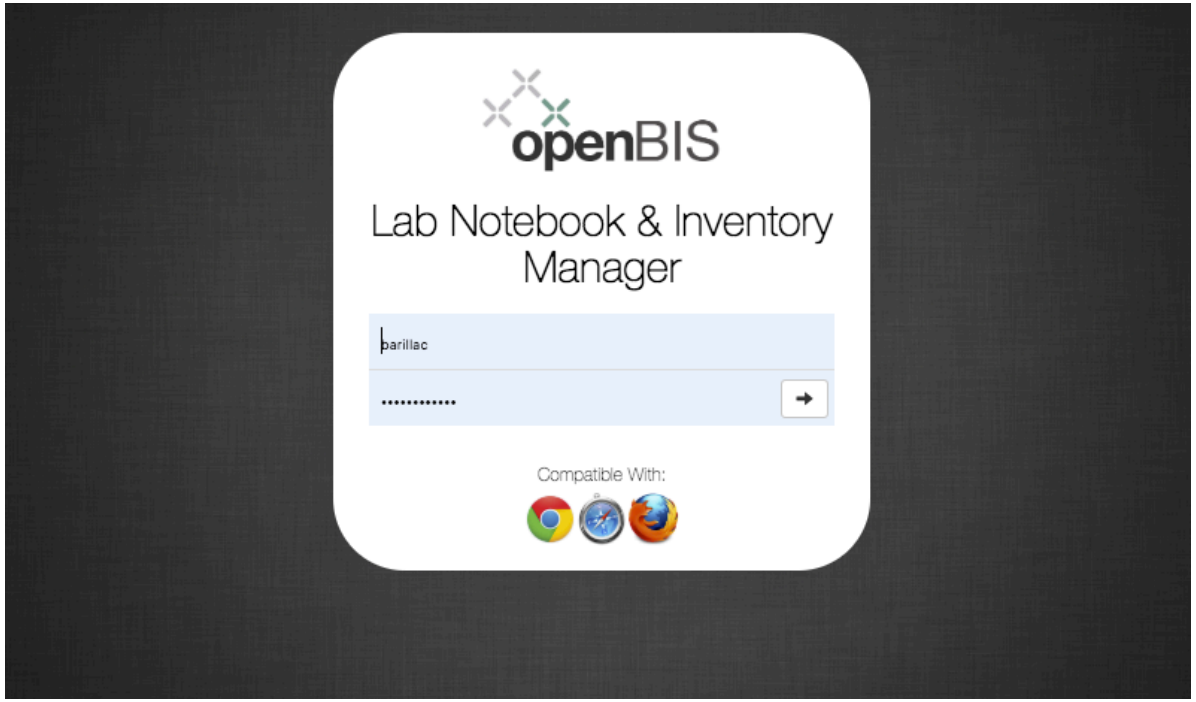
https://openbis-training.ethz.ch/openbis/webapp/eln-lims/?



Course material

https://edu.sib.swiss/course/view.php?id=452

Googledoc to use for questions/communication

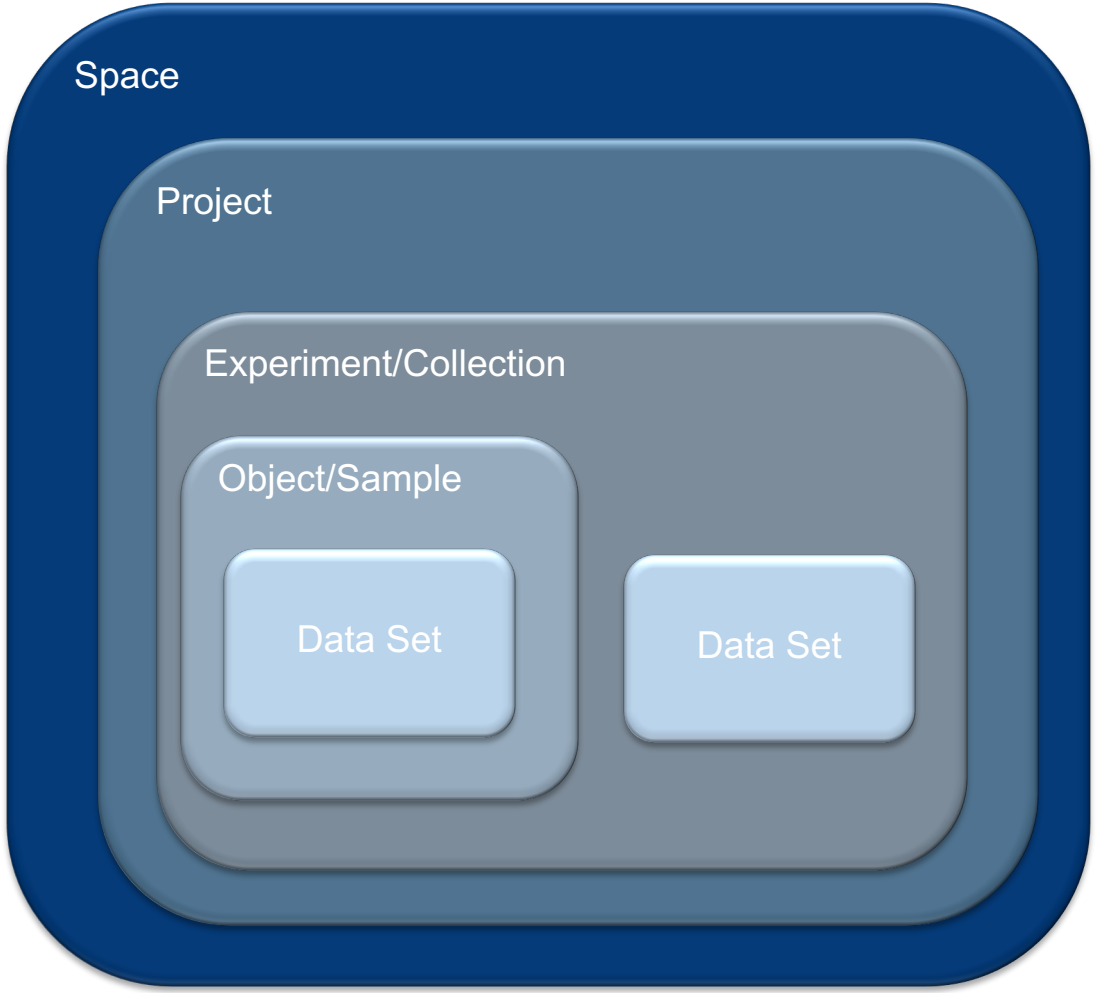
https://docs.google.com/document/d/1uNApJq3jgtYYWGxtwM15ct47LYsE0-UlT92gA6Gcddw/edit?usp=sharing

Overview of training course

1. Introduction to basic openBIS concepts
2. Hands-on tutorial:
    1. Registration of samples
    2. Registration of protocols
    3. Recording experiments and uploading data
    4. Data analysis with Jupyter notebooks
    5. Data analysis with MATLAB

Basic openBIS concepts

openBIS data structure



1. **Folder with only code**

2. **Folder with code + description**

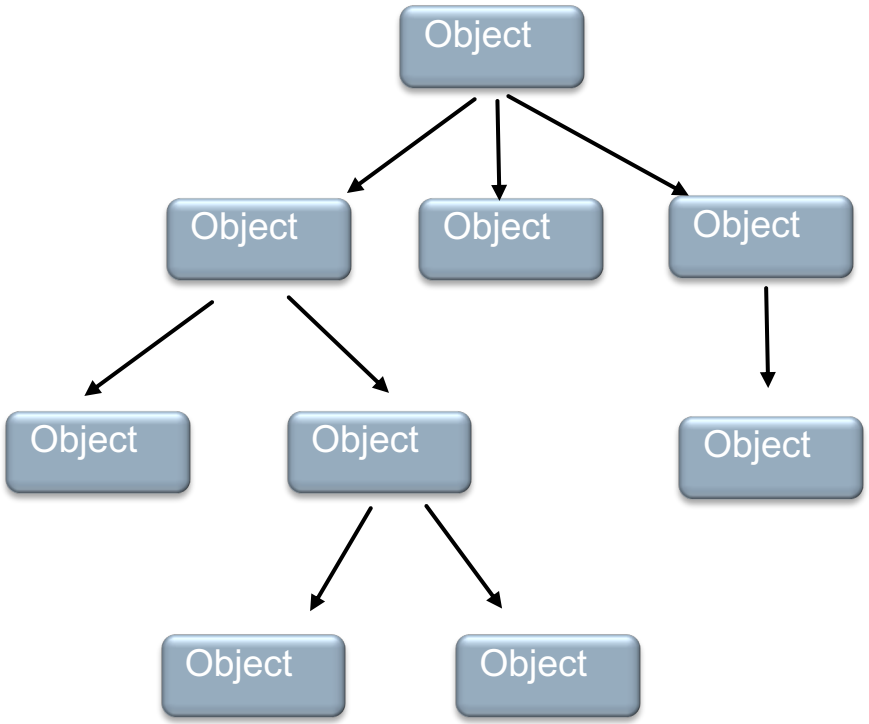
3. **Folder with code + user-defined properties**. There can be several types of Experiment/Collection, each defined by different properties. Example: *microscopy experiment, PCR experiment, etc*…

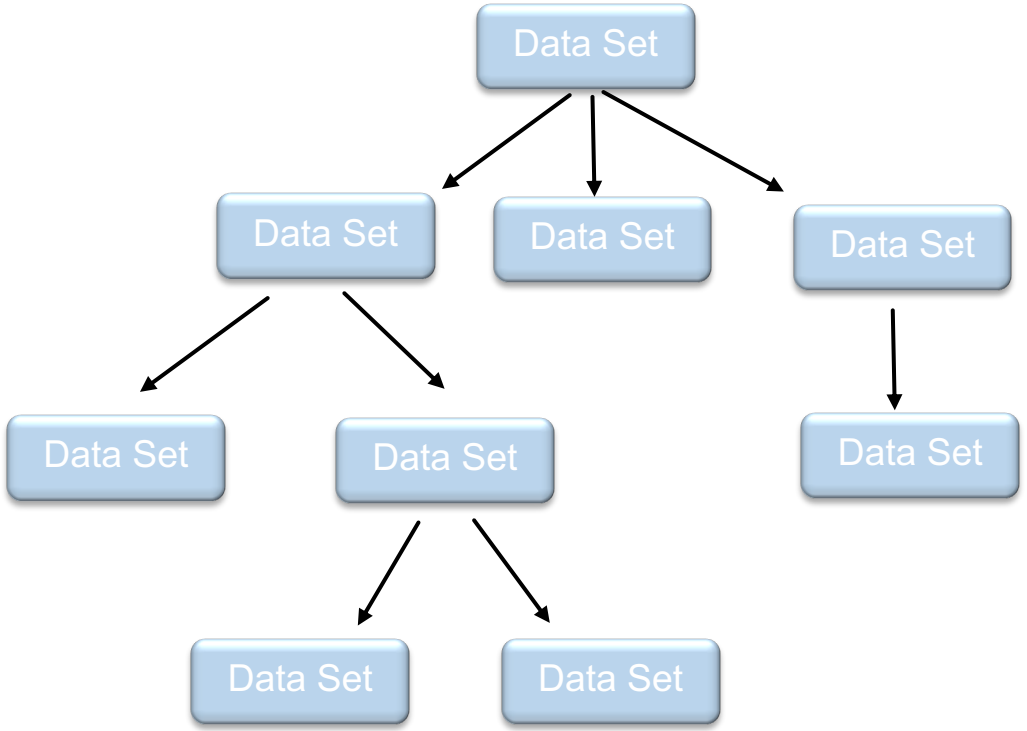
4. **Basic entity with code + user-defined properties**. There can be several types of Objects/Samples, each defined by different properties. Examples: *Antibody, Chemical, Sensor, Chip, General protocol, Experimental Step*…

5. **Folder for storing data files with code + user-defined properties**. There can be several types of Data sets, each defined by different properties.

Linking objects and datasets

- Objects can be linked to other objects, datasets to other datasets with *N:N* relationship
- In openBIS terms, these are “parent-child” relationships

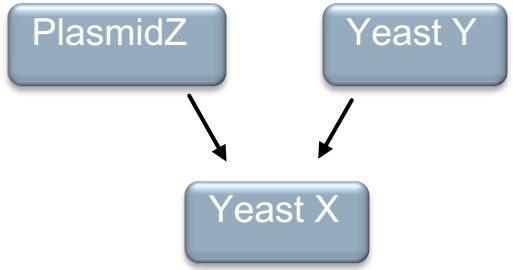




What are “parents” and “children”?

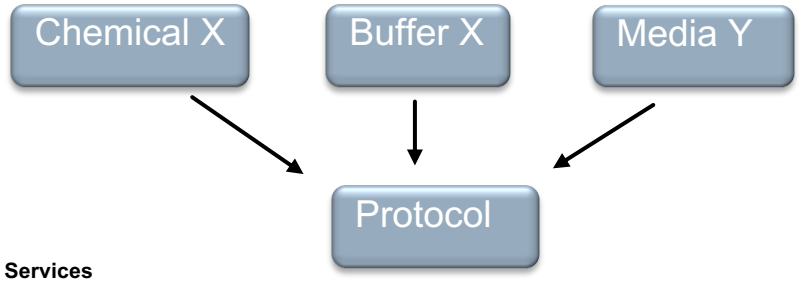
- They are a way of connecting entities together.
- Examples:

1. You make a sample from other samples.



***Yeast X** is made inserting **Plasmid Z** into **Yeast Y.** These are assigned as parents to **Yeast X**.*

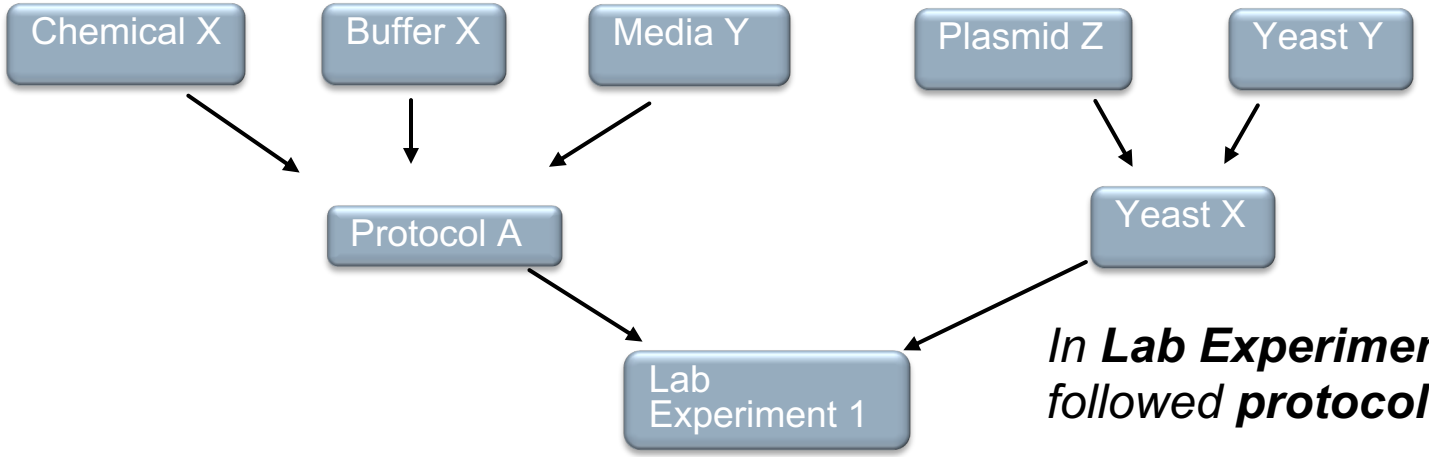
2. You write a protocol, and want to keep track of the samples used.



***Chemical X, Buffer X** and **Media Y** are needed to perform the steps described in this protocol. They are parents of this protocol.*

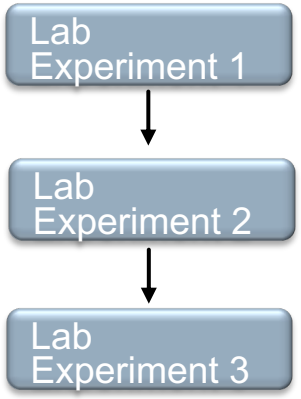
What are “parents” and “children”?

3. You describe an experiment and you want to keep track of the protocol(s) and samples used



*In **Lab Experiment 1** we used **Yeast X** and followed **protocol A**.*

4. You make one experiment in several steps and you want to link each step to the previous one

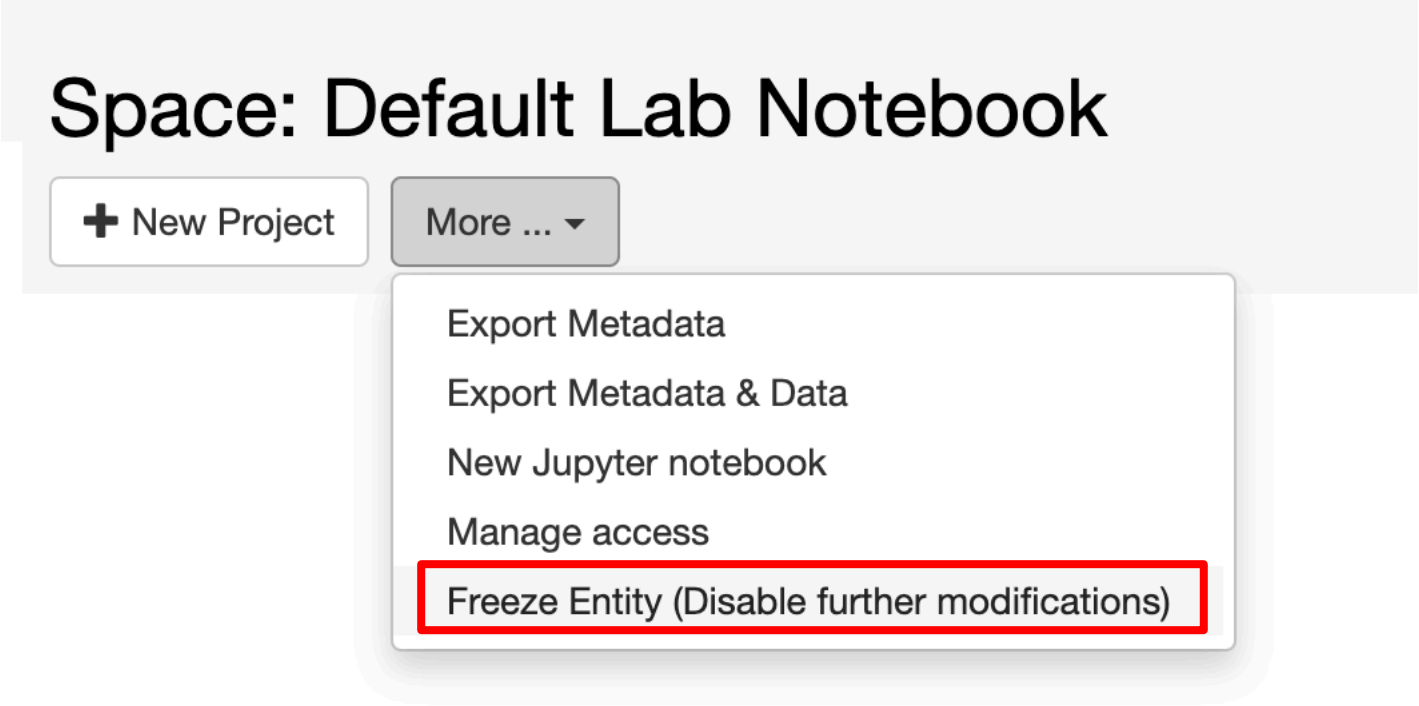


Roles

Role	Capabilities
Observer (Space or Instance)	Read-only access to given spaces or to the whole instance.
Space/Project user	Create + edit Object, Experiment. Edit Project .
Space/Project power user	User rights +create Projects . Delete object, experiment, project, datasets. Add, update vocabulary terms.
Space/Project admin	Power user rights+ list roles; create and delete space roles; edit datasets.
Instance admin	Space admin rights + create types. Has access to everything.

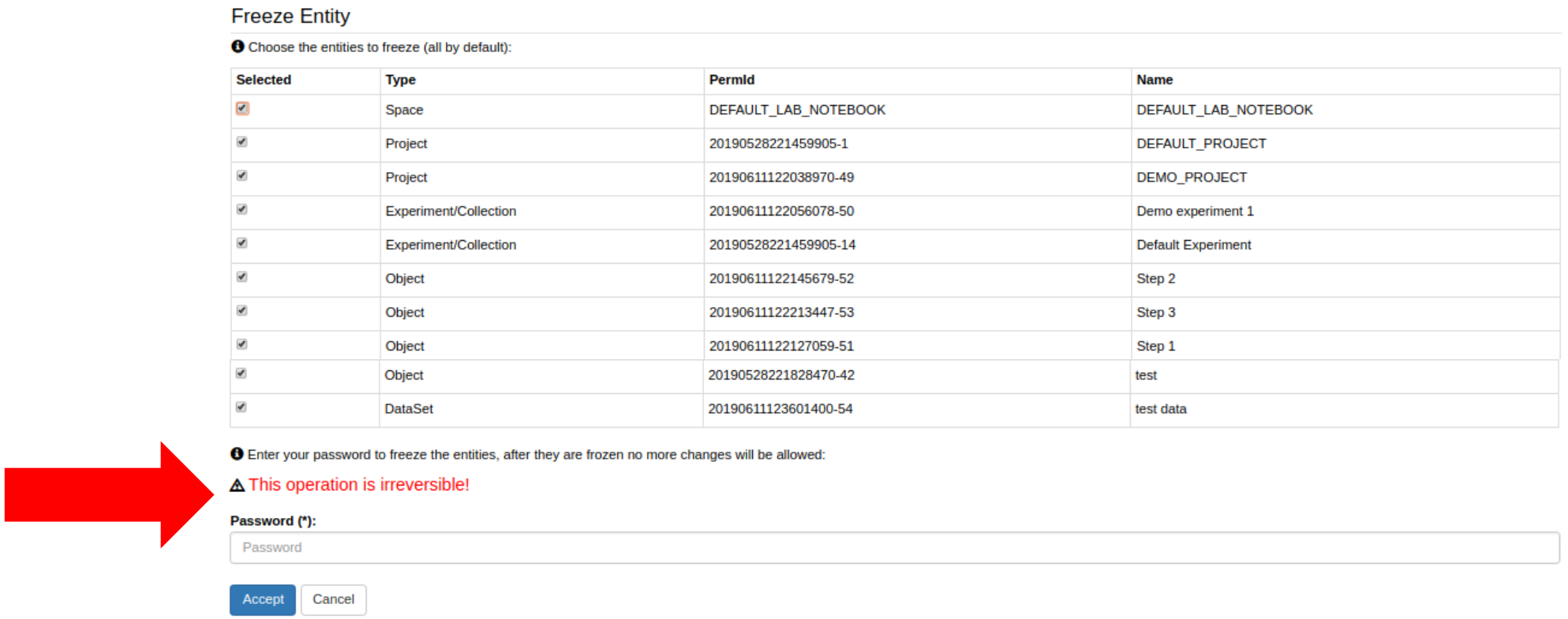
Freezing entities

It is possible to “freeze” every level of the openBIS hierarchy.



Freezing entities

At every level, everything below is always selected to be frozen. Selection can be modified.



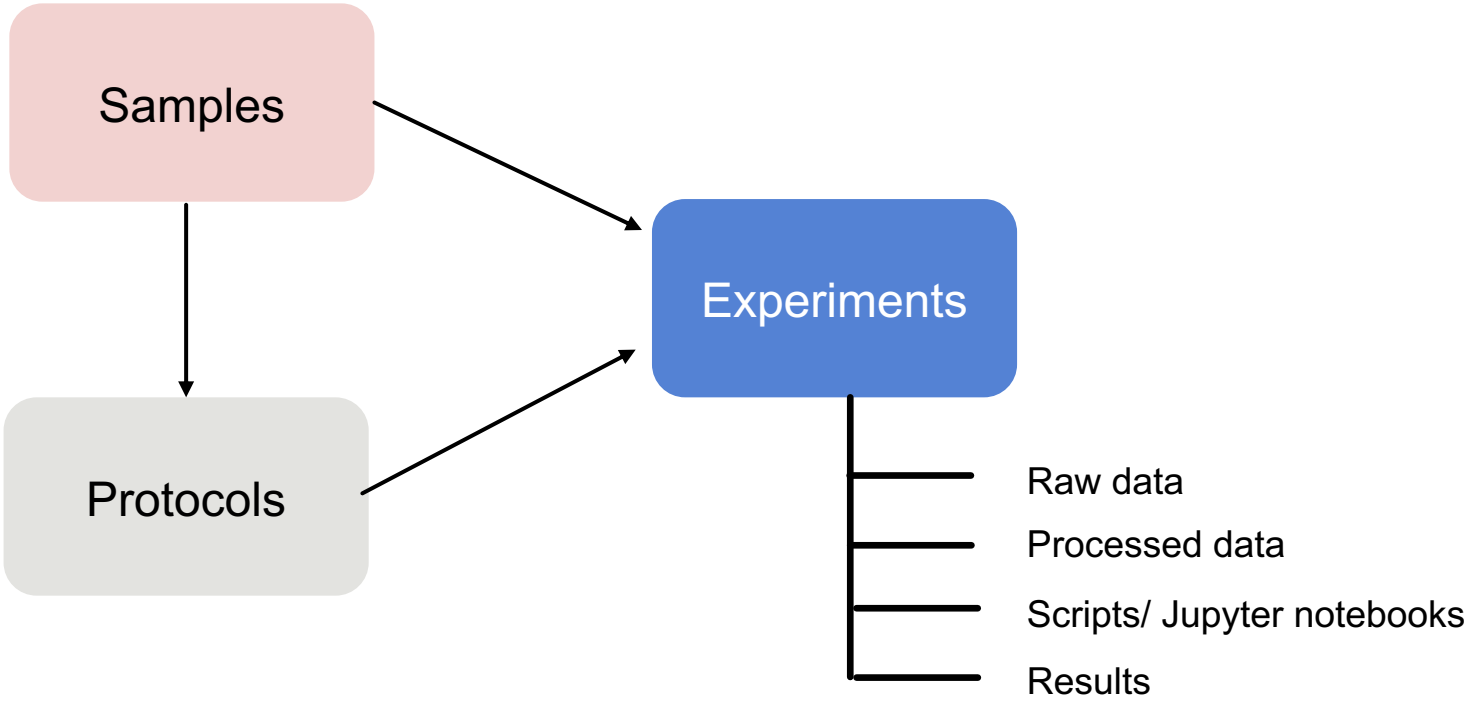
How to use the openBIS Inventory & Lab Notebook

Inventory

Shared by all lab members.

Lab Notebook

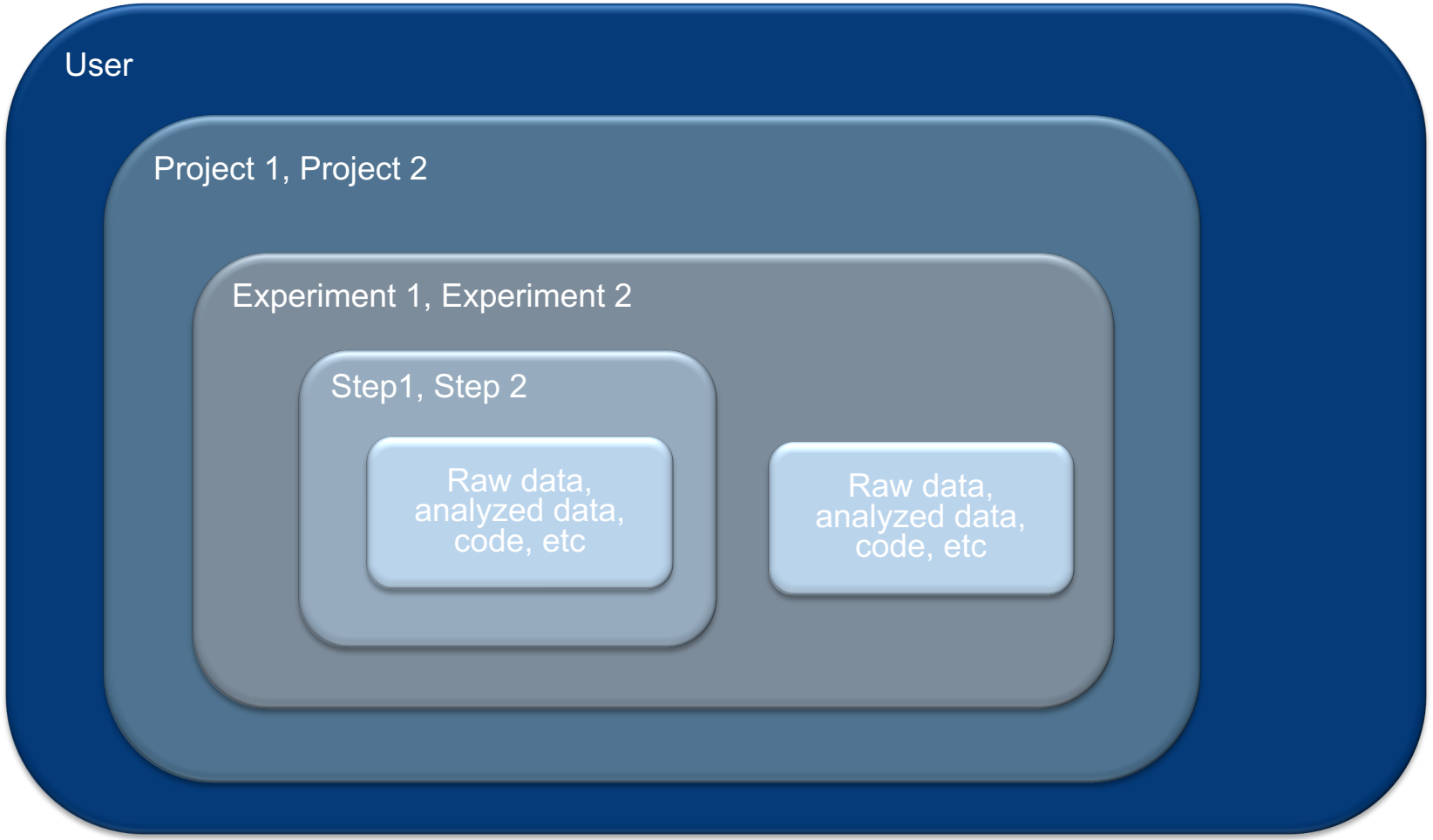
Personal space. Can be shared.



Organization of openBIS Lab Notebook

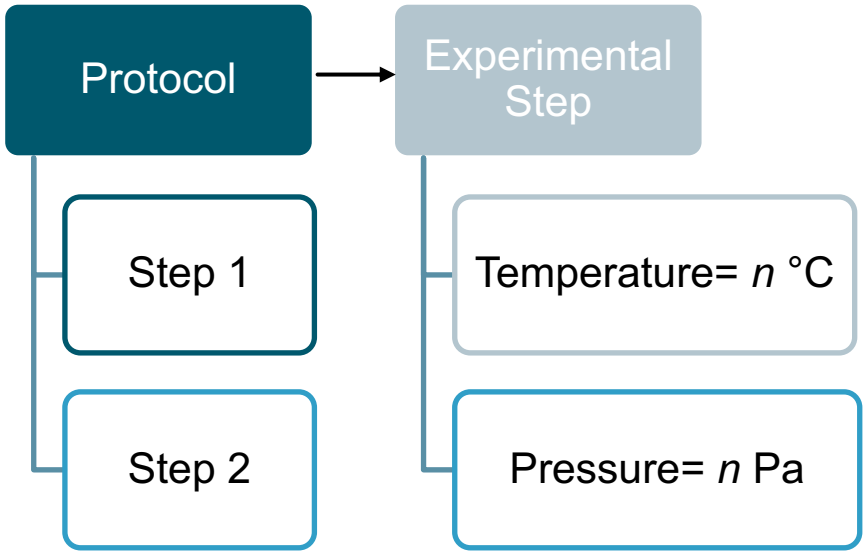
- In the Lab Notebook part of openBIS, usually each user has a **personal Space** where to organize P**rojects** and E**xperiments**
- An openBIS **Experiment** is a specific scientific question. The single attempts to answer this question can be modelled as **Experimental Steps**.
- **Experimental Steps** can be linked to samples, protocols, other Experimental Steps
- Data (raw, processed, analysed, final results) can be attached to Experiments or Experimental steps in **Datasets**

openBIS Lab notebook



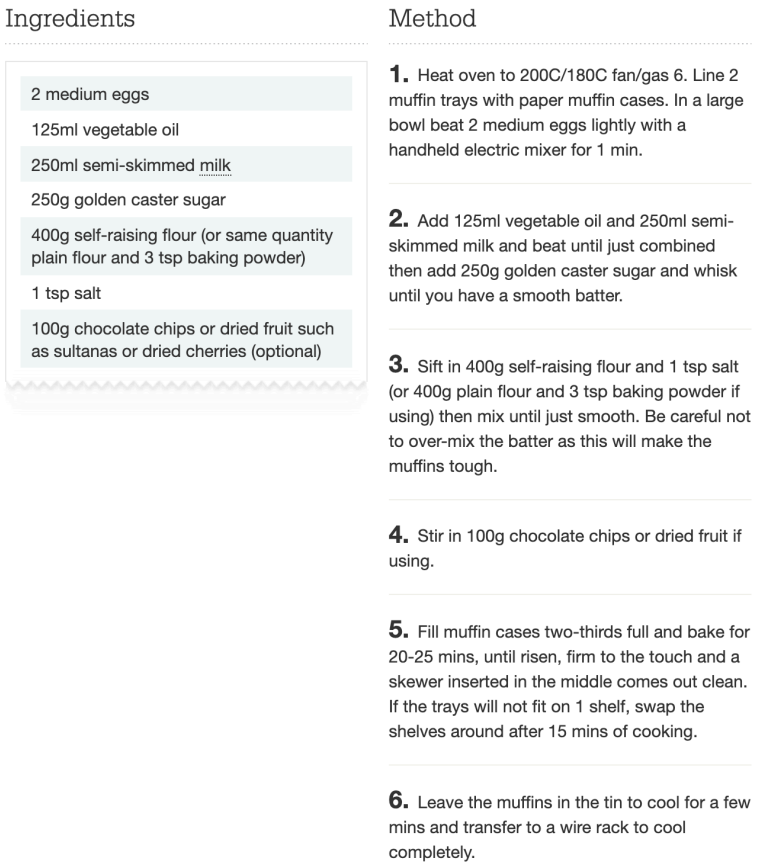
Protocols or Experimental Steps?

- Protocols are standard procedures used in the lab that need to be shared with all lab members
- Every time a given protocol is followed when performing one Experimental Step, the protocol can be linked as parent and the experimental details should be recorded in the Experimental Step itself.



Example

Protocol: muffins recipe



Ingredients

- 2 medium eggs
- 125ml vegetable oil
- 250ml semi-skimmed milk
- 250g golden caster sugar
- 400g self-raising flour (or same quantity plain flour and 3 tsp baking powder)
- 1 tsp salt
- 100g chocolate chips or dried fruit such as sultanas or dried cherries (optional)

Method

1. Heat oven to 200C/180C fan/gas 6. Line 2 muffin trays with paper muffin cases. In a large bowl beat 2 medium eggs lightly with a handheld electric mixer for 1 min.
2. Add 125ml vegetable oil and 250ml semi-skimmed milk and beat until just combined then add 250g golden caster sugar and whisk until you have a smooth batter.
3. Sift in 400g self-raising flour and 1 tsp salt (or 400g plain flour and 3 tsp baking powder if using) then mix until just smooth. Be careful not to over-mix the batter as this will make the muffins tough.
4. Stir in 100g chocolate chips or dried fruit if using.
5. Fill muffin cases two-thirds full and bake for 20-25 mins, until risen, firm to the touch and a skewer inserted in the middle comes out clean. If the trays will not fit on 1 shelf, swap the shelves around after 15 mins of cooking.
6. Leave the muffins in the tin to cool for a few mins and transfer to a wire rack to cool completely.

Experimental Step: making muffins

- I use 240 ml of whole milk, instead of 250 ml semi-skimmed
- I add a teaspoon of sodium bicarbonate
- I cook the muffins for 30 mins at 180°C

The protocol gives me directions and defines the steps; When I perform my experiment I can change some parameters and this needs to be recorded.

Overview of today's openBIS tutorial

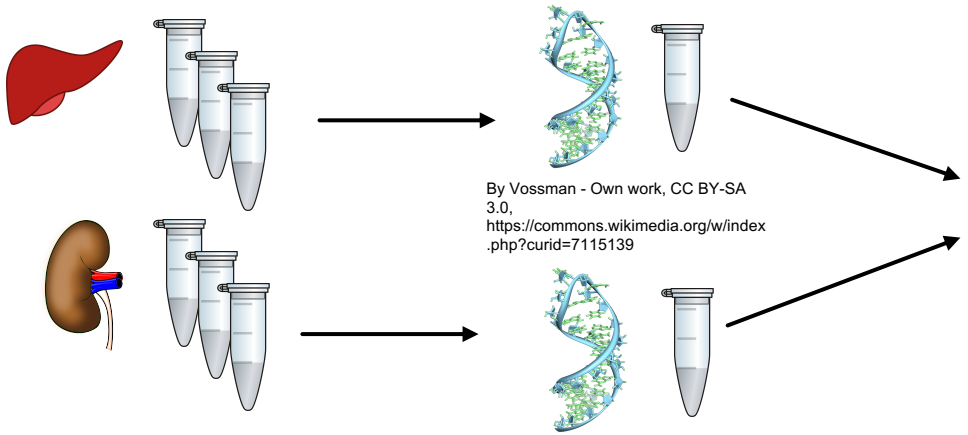
Example: RNA sequencing study of 8 different dog breeds

Goal of the study: *understand intra breed genetic variability of dogs with special reference to Beagle dog, since Beagles are used as an animal model for compound testing in the pharma industry.*

The eight different dog breeds are as follows:

1. Beagle
2. GSD
3. Golden Retriver
4. Terrier
5. King Charles
6. Poodle
7. Rottweiler
8. West Highland White Terrier

Overview of the study process



Results

RNA extraction from different types of dog tissues

RNA sequencing

Analysis of sequencing data

Overview of the study process

Experiments:

1. RNA extraction
2. RNA sequencing
3. Data analysis

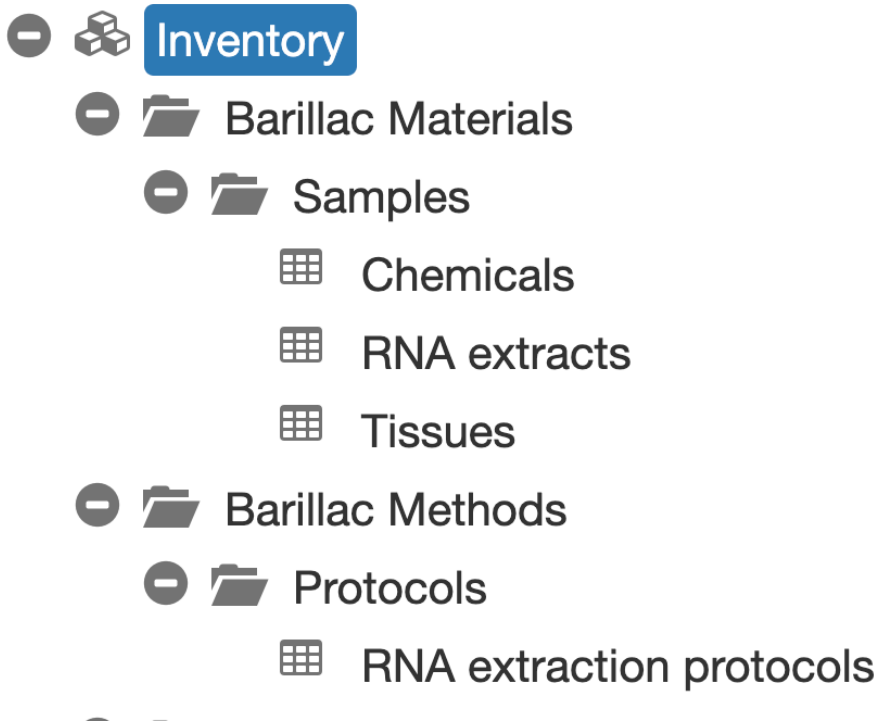
Protocols:

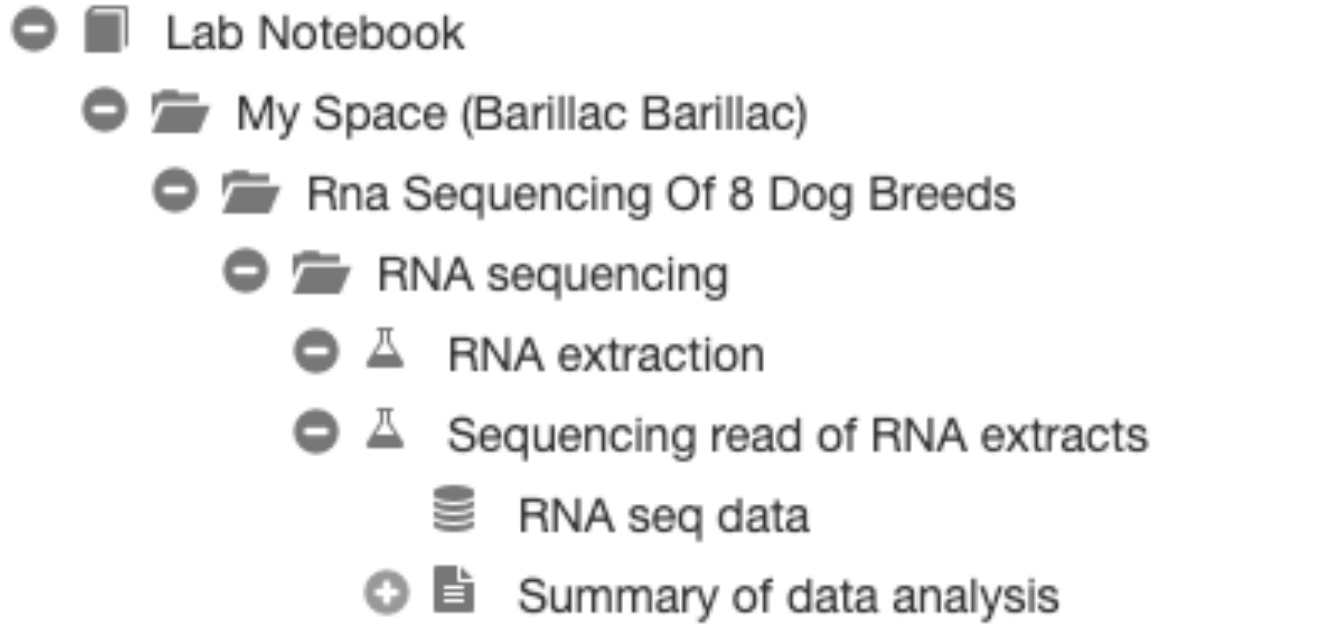
1. RNA extraction
2. RNA sequencing

Samples:

1. Tissues
2. Chemicals
3. RNA extracts

How does the process look like in openBIS?





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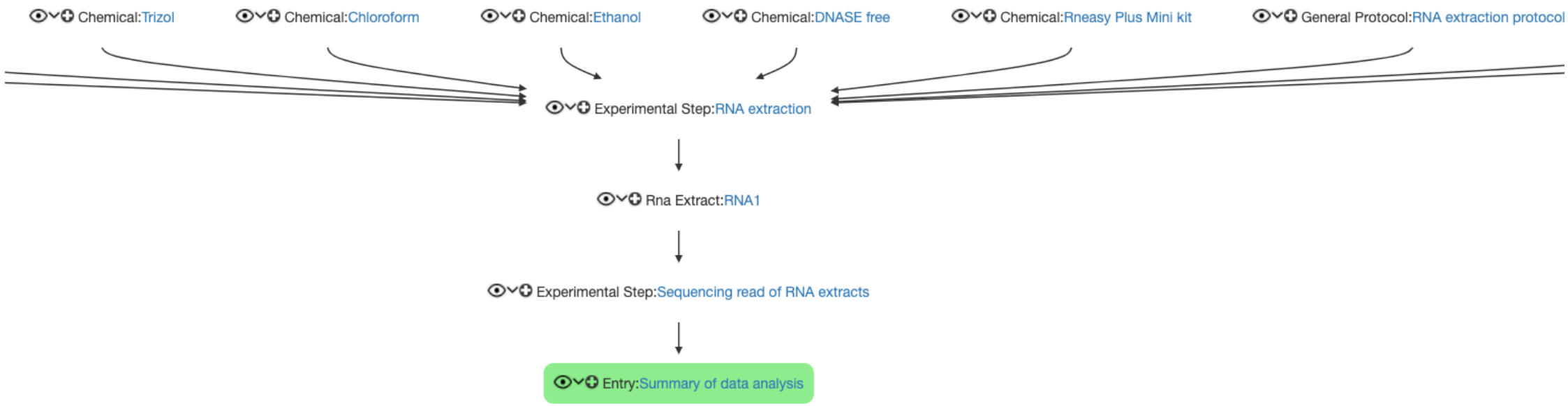
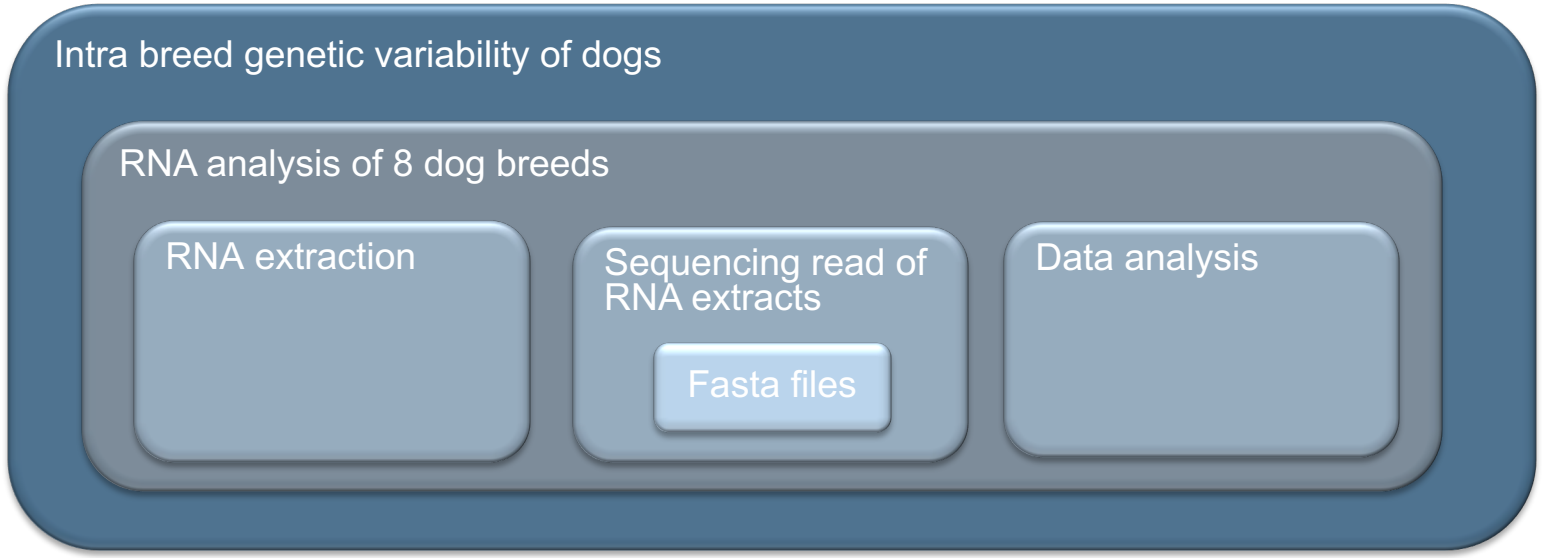


Management of samples and protocols

We will register a few samples and one protocol in the inventory, covering different topics:

1. Single sample registration
2. Batch registration of samples
3. Batch modification of samples
4. How to assign storage positions to samples
5. How to register a standard lab protocol

Lab notebook

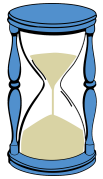


- We will create **1 Project, 1 Experiment and 3 Experimental Steps** in your personal space.
- We will see how we can **link** samples and protocols stored in the Inventory to the Experimental Step.
- We will **upload data** to the Experimental Step.

Exercises

Exercise 1

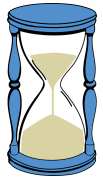
- Registration and copy of tissue samples: *sections 3.1.1 + 3.1.2 on pages 3, 4*



10 min

Exercise 2

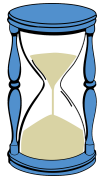
- Batch registration of chemical samples: *section 3.1.3, page 4*



5 min

Exercise 3

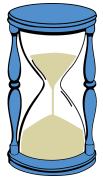
- Deletion of duplicate objects: *section 3.1.4, page 4*



5 min

Exercise 4

- Batch modification of chemical samples: *section 3.1.5, page 5*



10 min

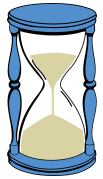
Exercise 5

- Visualization of storage positions in the Storage Manager: *section 3.2, pages 5,6*

🔴 To do together

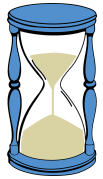
Exercise 6

- Registration of RNA extraction protocol: *section 3.3.1, page 6*



5 min

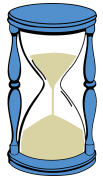
Short break



10 min

Exercise 7

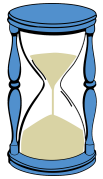
- Registration of project and experiment: *section 4.1, 4.2 pages 7,8*



5 min

Exercise 9

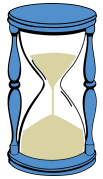
- Registration of an Experimental Step: *section 4.3, pages 8, 9*



5 min

Exercise 10

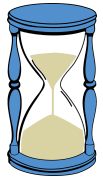
- Registration of RNA extacts in Inventory: *section 4.3.1, page 9*
- Registration of RNA sequencing Experimental Step + data upload: *sections 4.3.2, 4.3.3, pages 9, 10*



10 min

Exercise 11

- Registration of Data Analysis Entry: *section 4.3.4, page 10*



10 min

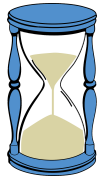
Exercise 13

- Data visualization + data export: *sections 4.3.5, 4.4, page 11*

🔴 To do together

Exercise 14

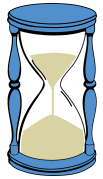
- Assign access rights to notebook: *section 4.5, page 11*



5 min

Exercise 15

- Searching the ELN: *sections 5.1, 5.1.1., 5.2, pages 12, 13*



15 min

Exercise 16

- Freezing entities: *section 6, page 13*

- To do together

Data analysis with Jupyter notebooks and MATLAB

Henry Lütcke

Contacts & useful info

Documentation & video tutorials: https://openbis.ch/

SIS website: https://sis.id.ethz.ch/

Twitter: https://twitter.com/ETH_SIS

SIS helpdesk

sis.helpdesk@ethz.ch

Caterina Barillari

caterina.barillari@id.ethz.ch

Priyasma Bhoumik

priyasma.bhoumik@id.ethz.ch

Henry Lütcke

hluetcke@id.ethz.ch