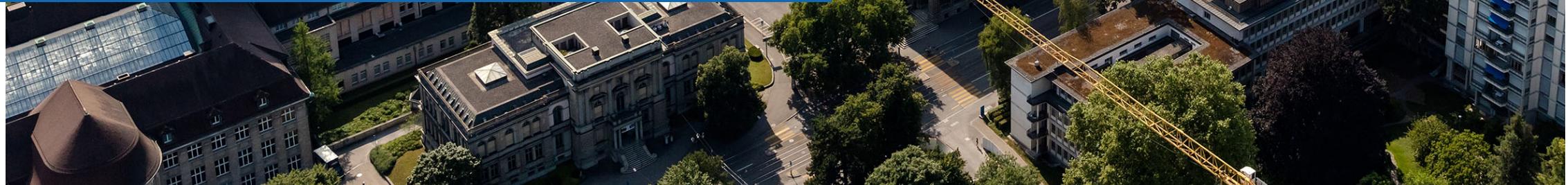




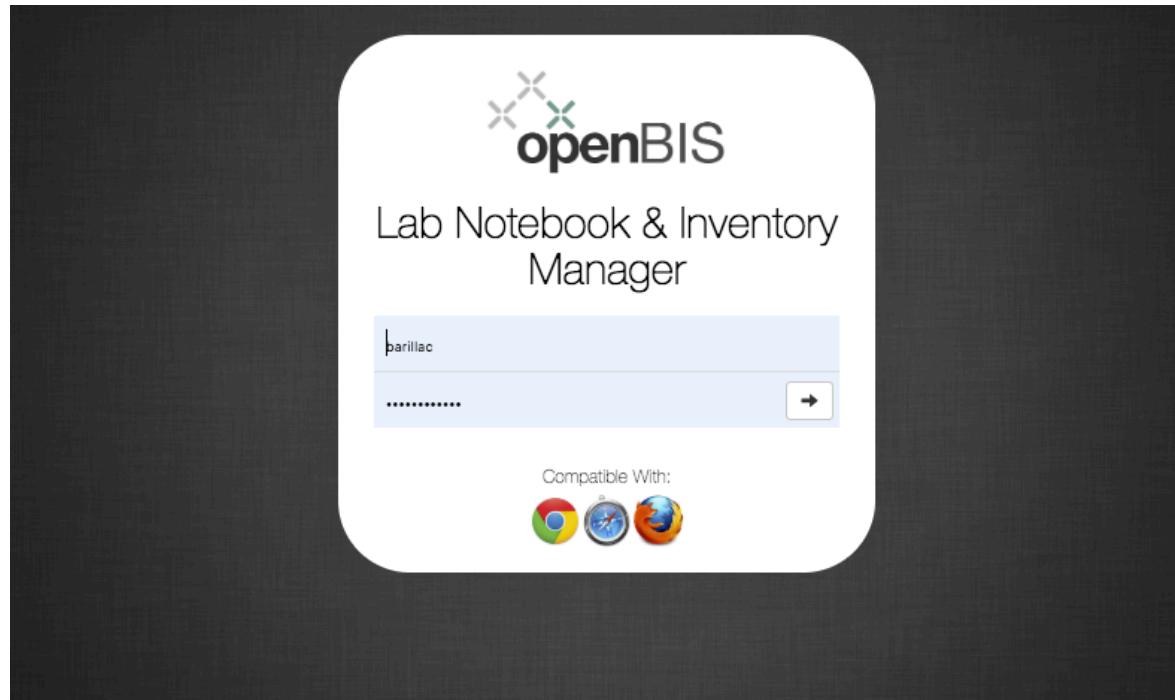
openBIS training

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18.05.2021



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



Overview of training

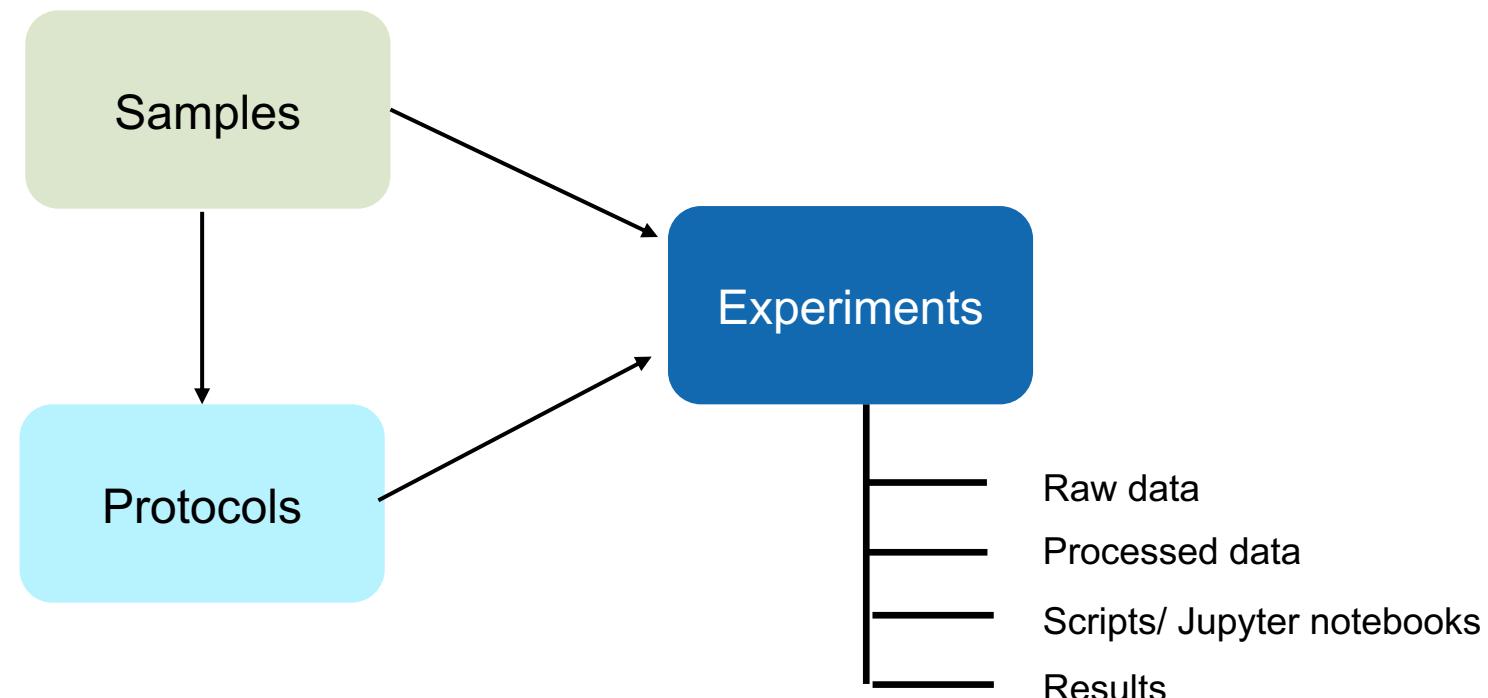
1. Introduction to basic openBIS concepts
2. Hands-on tutorial:
 1. Registration of samples in openBIS Materials Inventory
 2. Registration of protocols in openBIS Methods Inventory
 3. Recording experiments and uploading data in openBIS Lab notebook
 4. Searching the ELN
 5. Freezing entities

Basic openBIS concepts

How to use the openBIS Inventory & Lab Notebook

Inventory
Shared by all lab members.

Lab Notebook
Personal space. Can be shared with colleagues/collaborators.



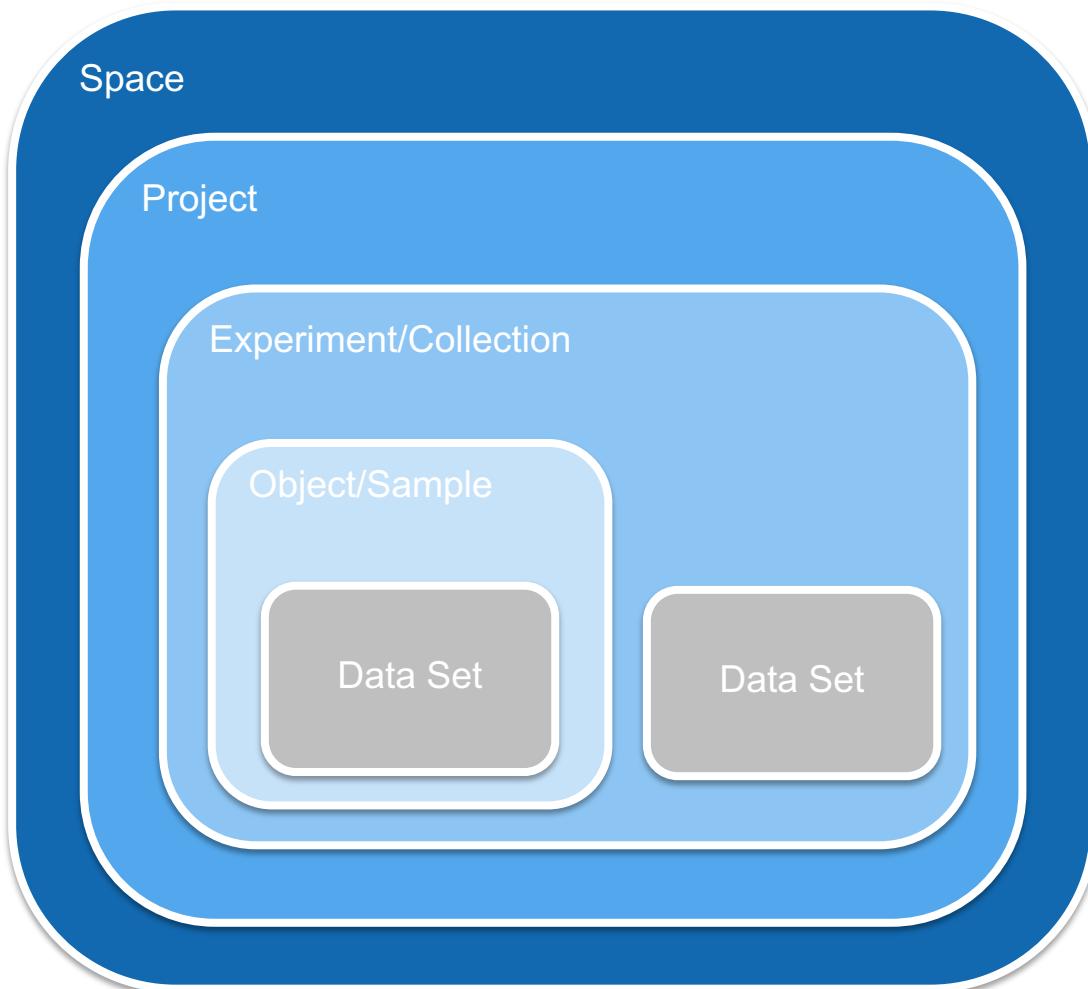
openBIS Inventory

- The default installation has two main folders in the Inventory:
 - **Materials:** all samples and materials can be stored in collections in this folder
 - **Methods:** all lab protocols (if used!) can be stored in collections in this folder

Organization of openBIS Lab Notebook

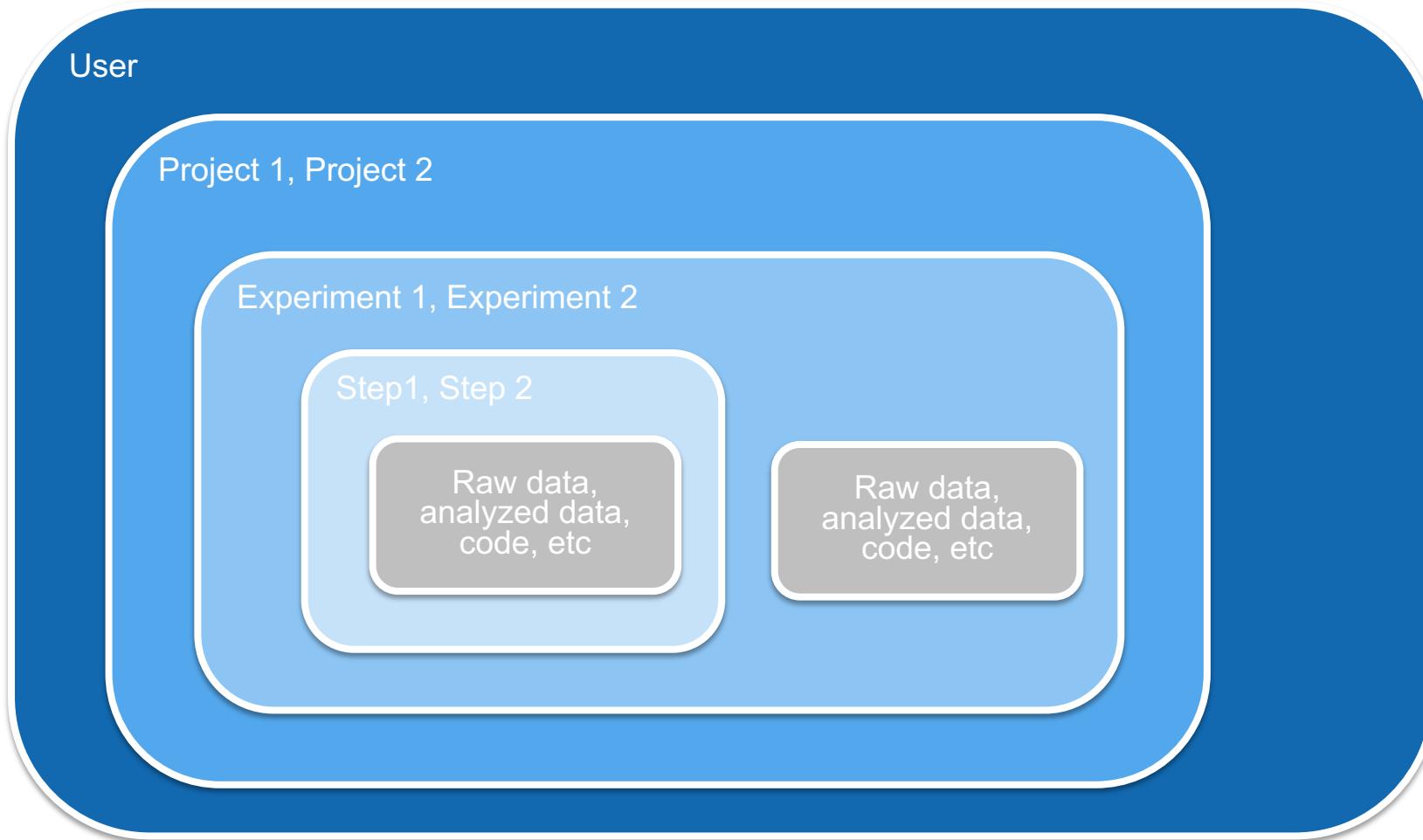
- In the Lab Notebook part of openBIS, usually each user has a **personal Space** where to organize **Projects** and **Experiments**
- An openBIS **Experiment** is a specific scientific question. The single attempt to answer this question can be modelled as **Experimental Steps**.
- **Experimental Steps** 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 data structure



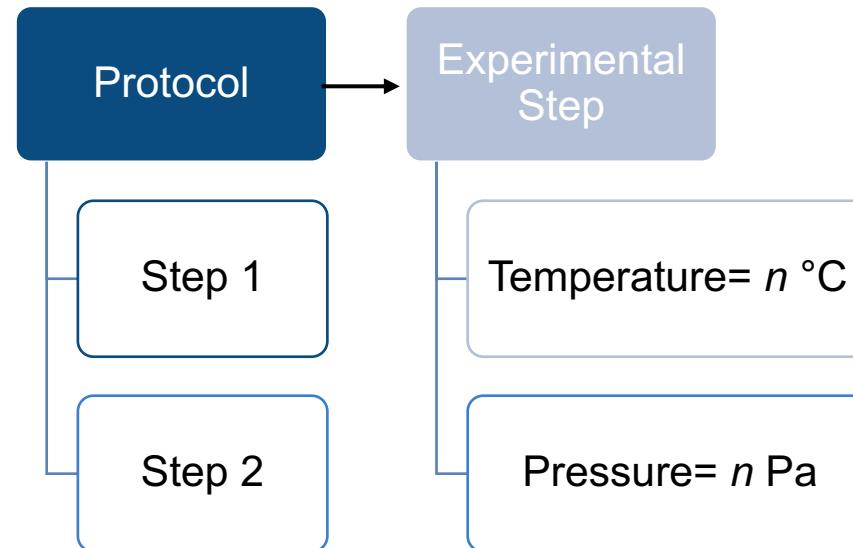
1. **Folder with access-control**
2. **Folder with access-control**
3. **Folder with user-defined properties.** There can be several types of Experiment/Collection, each defined by different properties. Example: *Microscopy experiment, PCR experiment etc.*
4. **Entity with user-defined properties.** 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 user-defined properties.** There can be several types of Data Sets, each defined by different properties.

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.
- If you do not follow standard procedures, you do not need to use the Inventory of Methods



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.

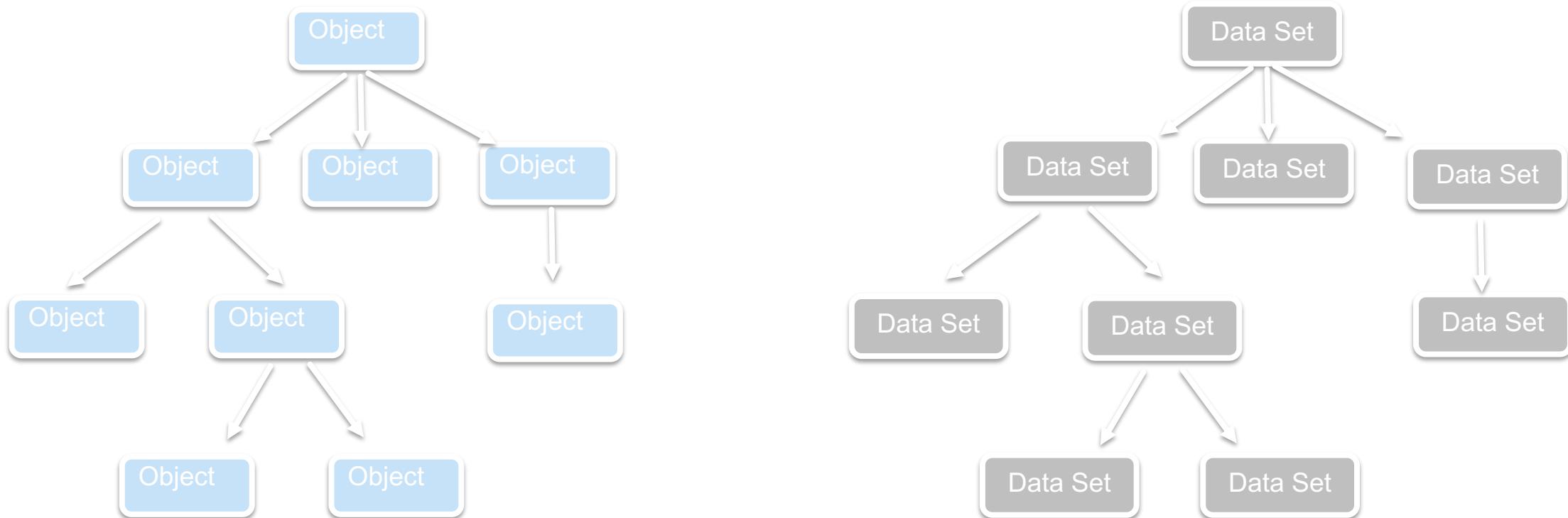
Experimental Step: making muffins

- 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 in the experimental description.

Linking objects and datasets

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

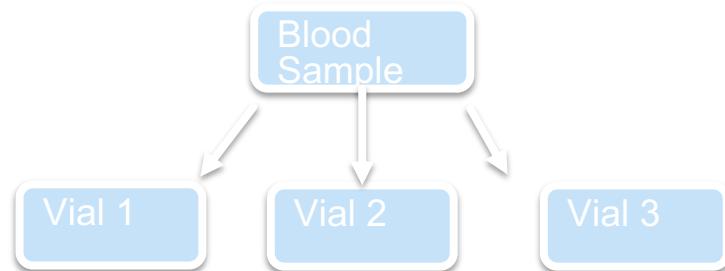


What are “parents” and “children”?

- They are a way of connecting entities together.

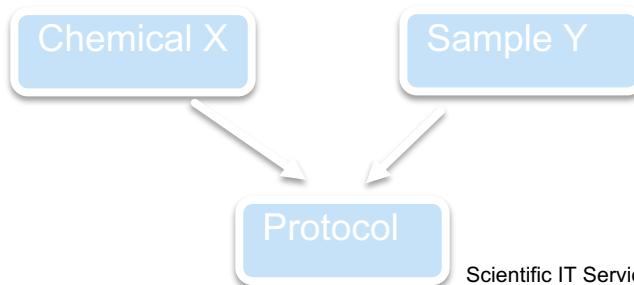
- Examples:

1. One sample is split into several vials and each of them is used for different types of measurements.



The Blood Sample is parent of the samples in each vial

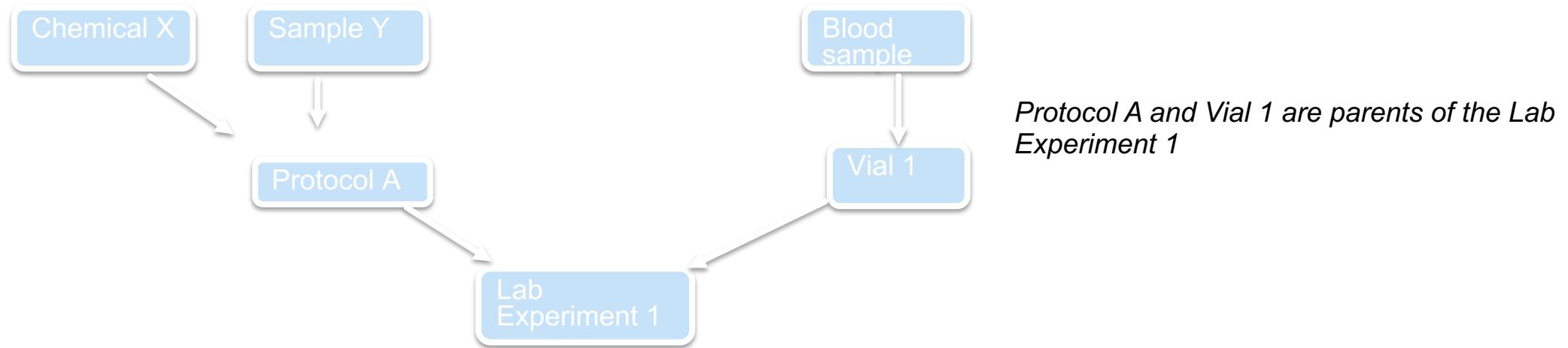
2. You write a protocol, and want to keep track of the samples used.



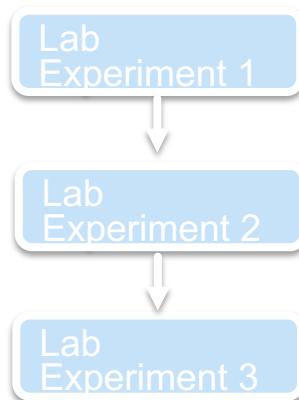
Chemical X and Sample Y are parents of the protocol

What are “parents” and “children”?

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



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



Roles

Roles	Capabilities
Observer (Space/Project or Instance)	Read-only access to given spaces/projects 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.
Instance admin	Space admin rights + create types. Has access to everything.

Overview of openBIS tutorial

Example: RNA sequencing study of 8 different dog breeds

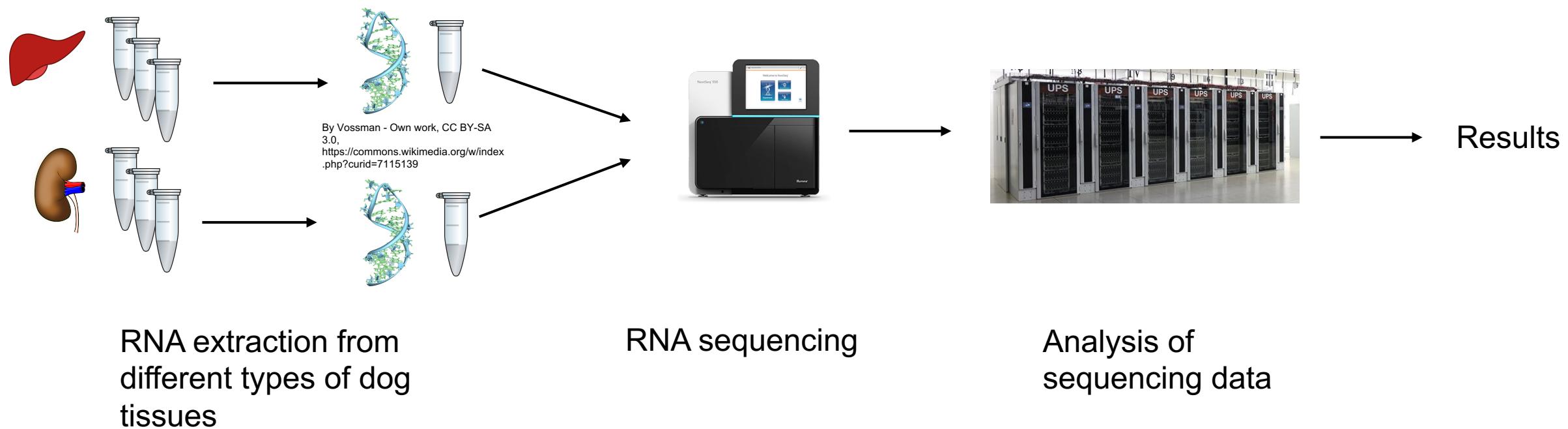
Goal of the study: *understand intra breed genetic variability of dogs with special reference to Beagle dog, since Beagles are used as an animal model for compound testing in the pharma industry.*

The eight different dog breeds are as follows:

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



Overview of the study process



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?

– Inventory

–  Barillac Materials

–  Samples

 Chemicals

 RNA extracts

 Tissues

–  Barillac Methods

–  Protocols

 RNA extraction protocols

–  Lab Notebook

–  My Space (Barillac Barillac)

–  Rna Sequencing Of 8 Dog Breeds

–  RNA sequencing

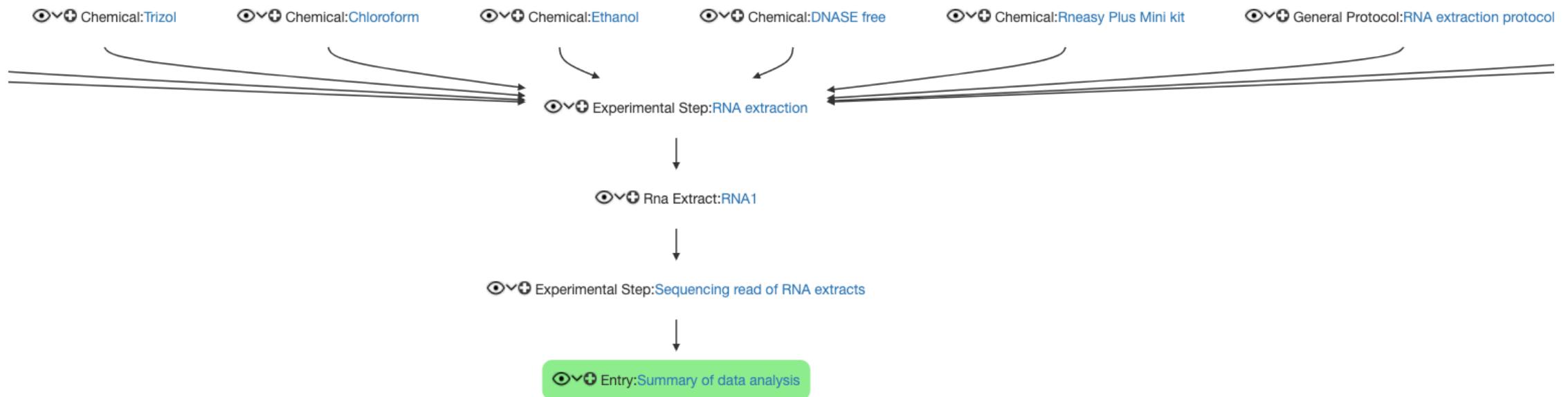
–  RNA extraction

–  Sequencing read of RNA extracts

 RNA seq data

 Summary of data analysis

How does the process look like in openBIS?

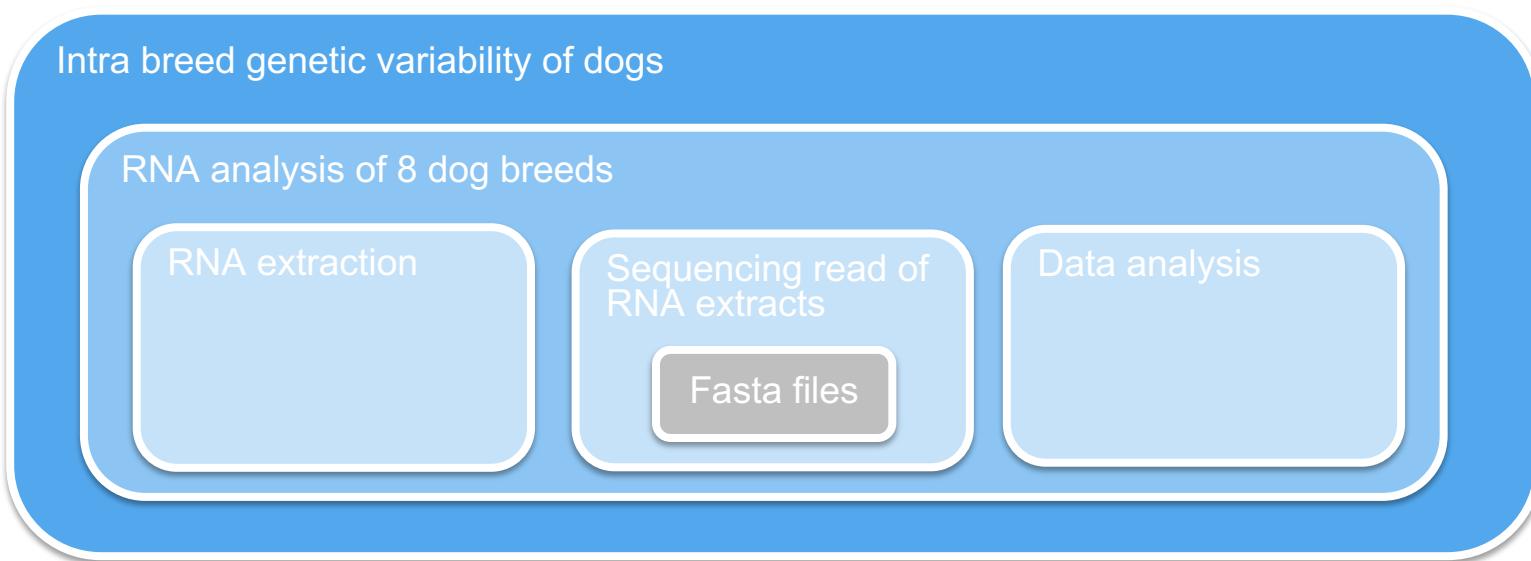


Management of samples and protocols

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.

Practical sessions

Session 1

- Registration and copy of tissue samples: *sections 3.1.1 + 3.1.2*



10 min

- Inventory
- Barillac Materials
- Samples
- Chemicals
- RNA extracts
- Tissues

Session 2

- Visualization of storage positions in the Storage Manager: *section 3.2*

● To do together

Session 3

- Batch registration of chemical samples: *section 3.3.1*
- Deletion of duplicate objects: *section 3.3.2*
- Batch modification of chemical samples: *section 3.3.3*



20 min

- Inventory
- Barillac Materials
- Samples
 - Chemicals
 - RNA extracts
 - Tissues

Session 4

- Registration of RNA extraction protocol: *section 3.4*



5 min

- ⊖ Barillac Methods
- ⊖ Protocols
 - RNA extraction protocols

Session 5

- 📄 Lab Notebook
- 📁 My Space (Barillac Barillac)
- 📁 Intra Breed Genetic Variability Of Dogs
- 📁 RNA analysis of 8 dog breeds
- 🧪 RNA extraction

- Registration of project and experiment: *section 4.1, 4.2*
- Registration of the first Experimental Step: *section 4.3.1*



15 min

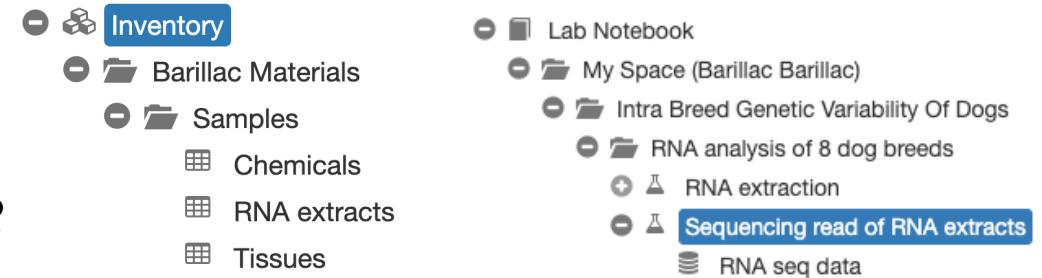
Intra breed genetic variability of dogs

RNA analysis of 8 dog breeds

RNA extraction

Session 6

- Registration of RNA extracts in Inventory: *section 4.3.2*
- Registration of RNA sequencing Experimental Step + data upload: *sections 4.3.3, 4.3.4*



10 min

Intra breed genetic variability of dogs

RNA analysis of 8 dog breeds

RNA extraction

Sequencing read of
RNA extracts

Fasta files

Session 7

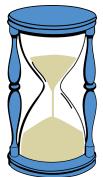
- Data visualization: *sections 4.3.5*
- Data & metadata exports: *4.3.6*

 To do together

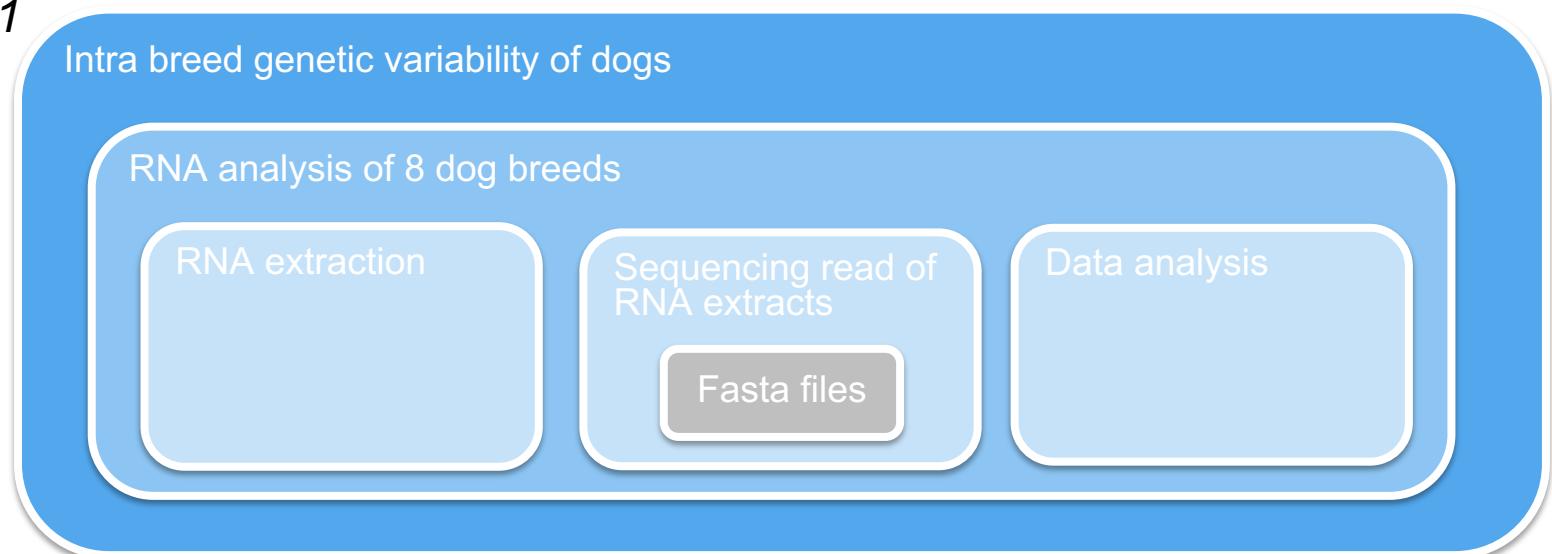
Sessions 8 + 9

- Registration of Data Analysis Entry: *section 4.3.7*
- User access rights: *section 4.4*
- Searching the ELN: *section 5.1*

- Lab Notebook
- My Space (Barillac Barillac)
- Intra Breed Genetic Variability Of Dogs
- RNA analysis of 8 dog breeds
- RNA extraction
- Sequencing read of RNA extracts
- RNA seq data
- Summary of data analysis



10 min



Session 10

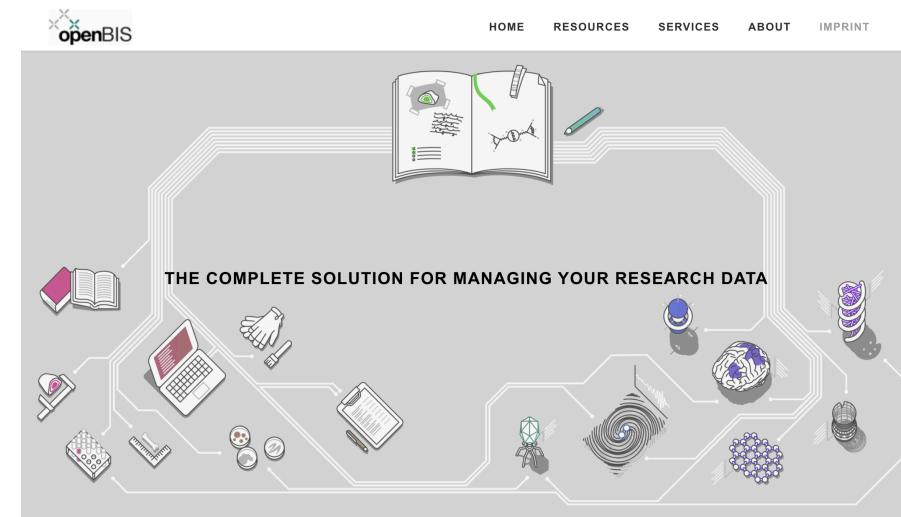
- Freezing entities: *section 6*
- Jupyter notebooks: *section 7*
- To do together

Contacts & useful info

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

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

Twitter: https://twitter.com/ETH_SIS



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