

# Electronic Laboratory/Field Notebooks (ELN)

Marek Cebecauer

J. Heyrovsky Institute of Physical Chemistry

Czech Academy of Sciences

AKVŠ Open Science Week 2024



Spolufinancováno  
Evropskou unií

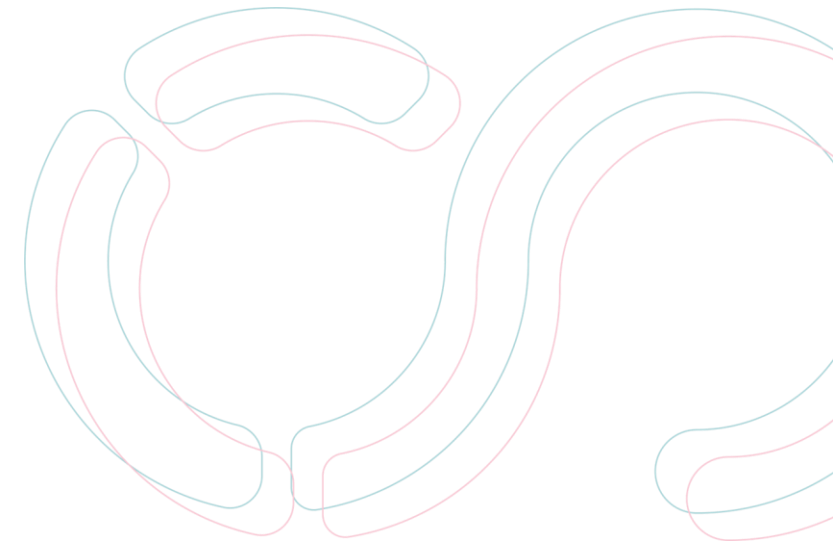


Registrační číslo projektu NRP

CZ.02.01.01/00/23\_014/0008787

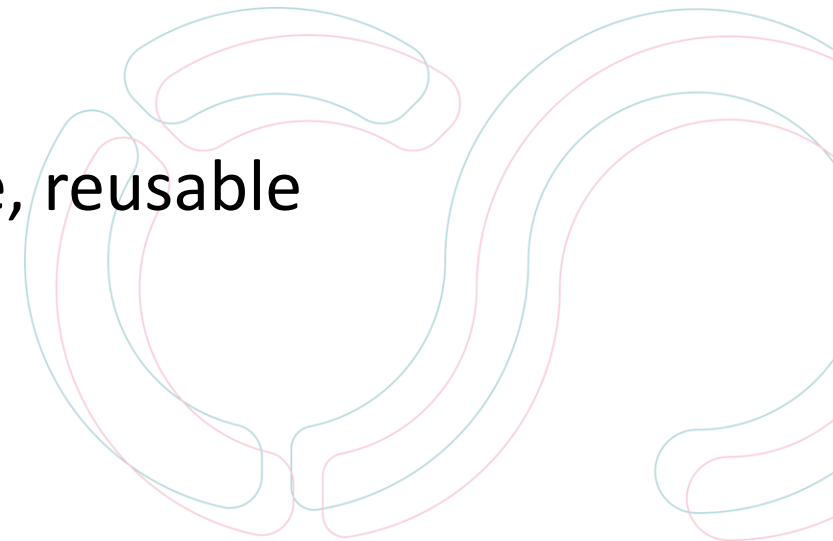
# Outline

- What is an electronic laboratory (field) notebook (ELN)?
- Why to use ELN?
- Which ELN?
- Comparison of selected ELN
- Practical example
- Q&A



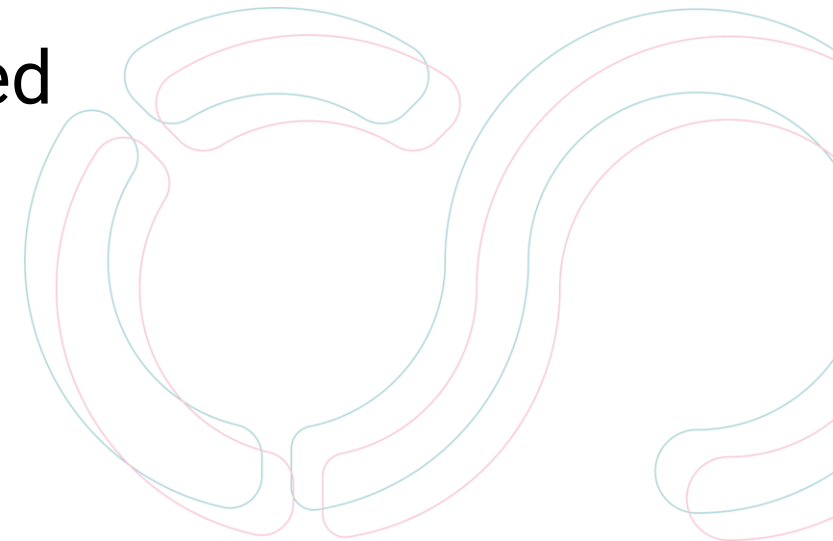
# Routine abbreviations

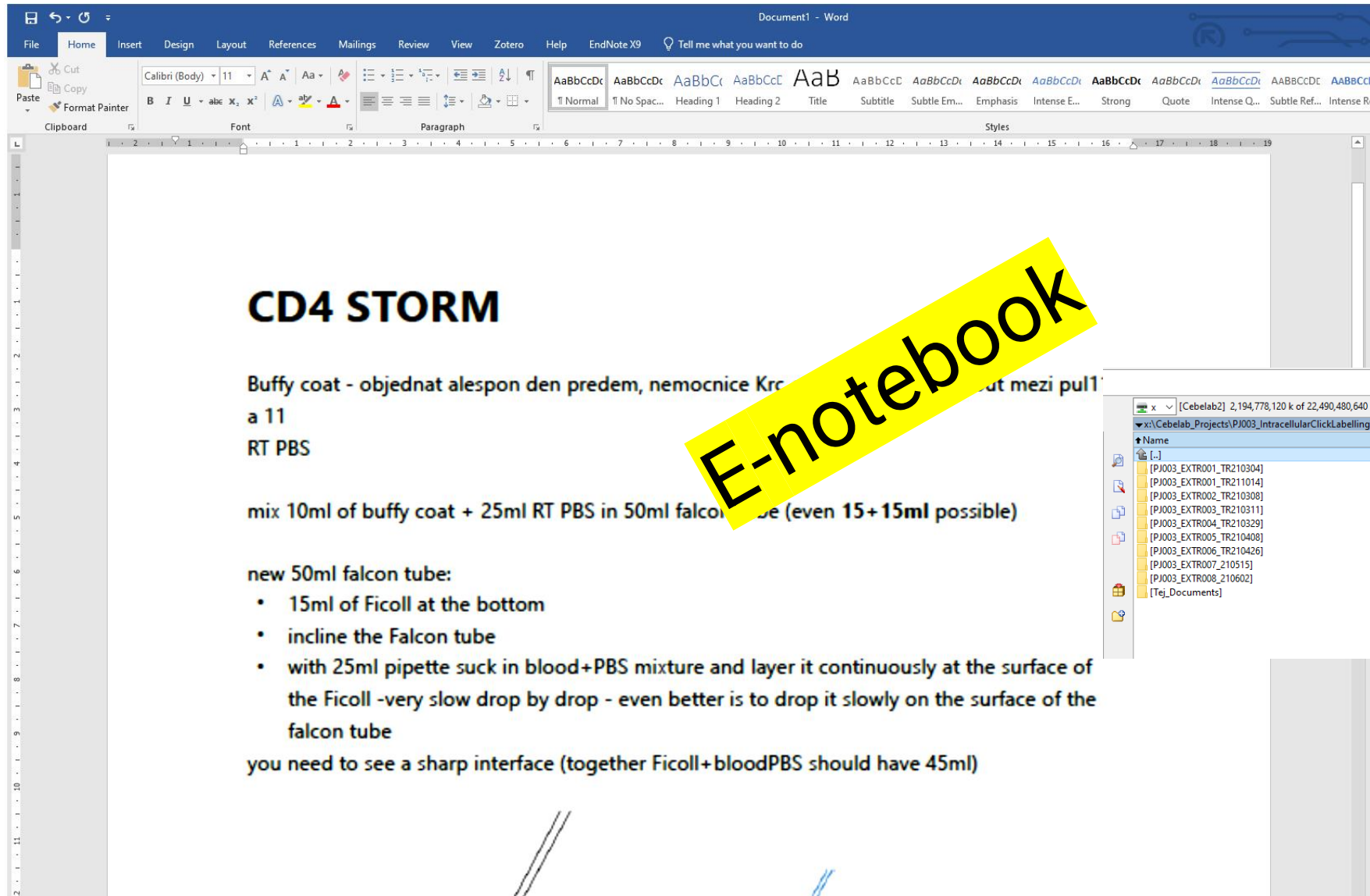
- Electronic laboratory (field) notebook (ELN)
- Laboratory Information Management System (LIMS)
- Research Data Management (RDM)
- National Repository Platform (NRP)
- FAIR principles .... Findable, accessible, interoperable, reusable
- Machine-actionable (MA)



# Scientific notebook styles

- Paperback notebook
- Electronic notebook (e-notebook)
- Electronic laboratory (field) notebook – standard
- Electronic laboratory (field) notebook – advanced
- Inventory / LIMS





**CD4 STORM**

Buffy coat - objednat alespon den predem, nemocnice Krc... ut mezi pul1

a 11

RT PBS

mix 10ml of buffy coat + 25ml RT PBS in 50ml falcon tube (even 15+15ml possible)

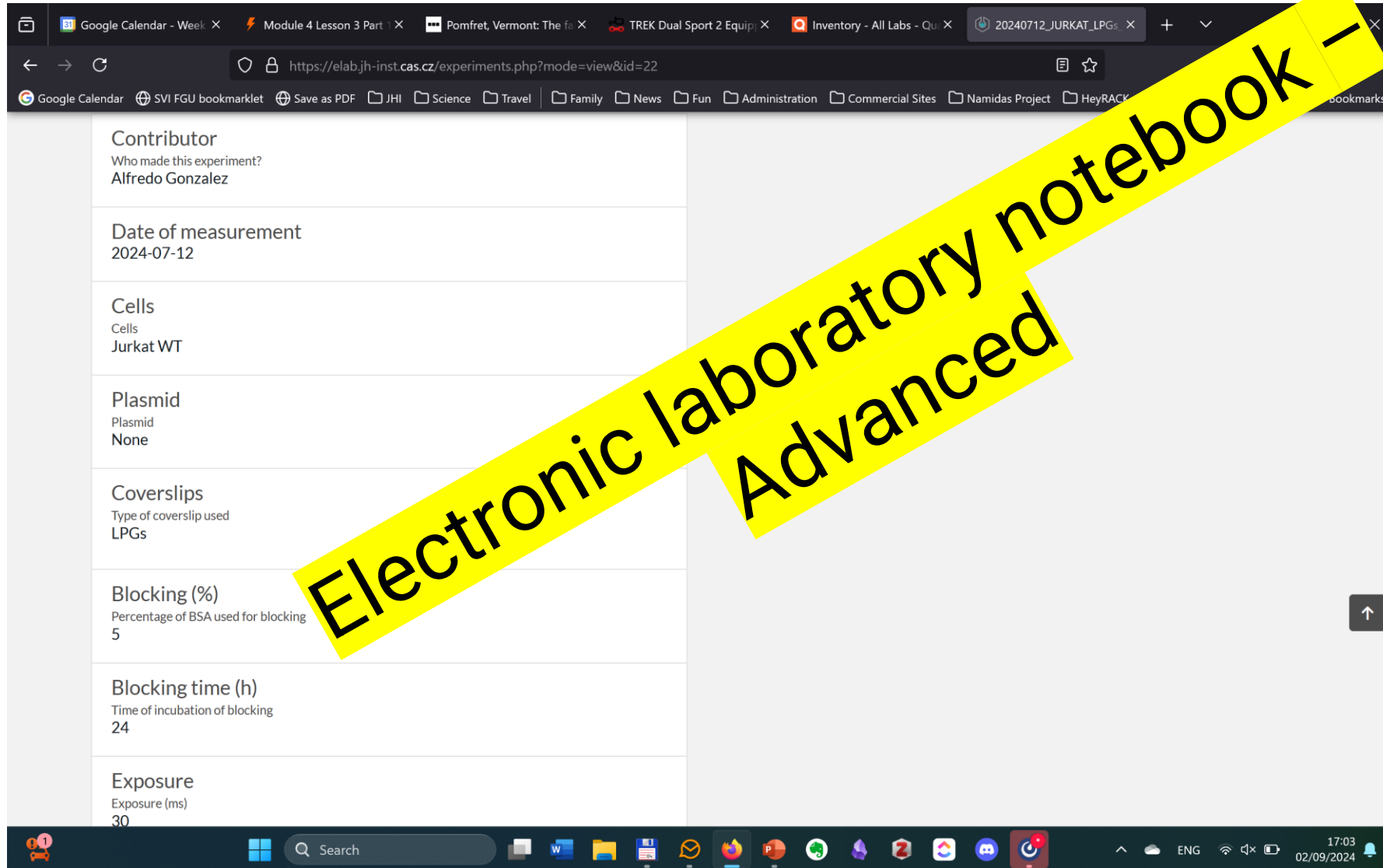
new 50ml falcon tube:

- 15ml of Ficoll at the bottom
- incline the Falcon tube
- with 25ml pipette suck in blood+PBS mixture and layer it continuously at the surface of the Ficoll -very slow drop by drop - even better is to drop it slowly on the surface of the falcon tube

you need to see a sharp interface (together Ficoll+bloodPBS should have 45ml)

The screenshot displays the RSpace Enterprise interface for an electronic laboratory notebook. The browser address bar shows the URL `rseln.jh-inst.cas.cz/notebookEditor/640?initialRecordToDisplay=755`. The interface features a top navigation bar with 'Workspace', 'Gallery', 'Messaging', 'Apps', and 'Inventory'. A left sidebar shows a file tree under 'Hard Work' with entries like 'STORM CD4 mutant X3', 'Untitled document', 'Epic experiment 1', and 'SMLM Image Acquisition'. The main workspace has a 'CREATE' button and a toolbar with icons for editing, deleting, and sharing. The notebook content includes the title 'STORM CD4 mutant X3', a search bar, and a search result for 'Buffy coat - ob... RT PBS...'. Below the text, there is a diagram of a pipette tip with a red liquid drop. The text describes a procedure: '... 25ml pipette suck in blood+PBS mixture and layer it continuously at the surface of the Ficoll -very slow drop by drop - even better is to drop it slowly on the surface of the falcon tube you need to see a sharp interface (together Ficoll+bloodPBS should have 45ml)'. The final step is 'Centrifuge at ROOM temperature (23C) 1250g (2500rpm big eppendorf centrifuge) 30min brake 2 - balance properly take out of centrifuge carefully - there is gradient'.





The screenshot shows a web browser window with the URL <https://elab.jh-inst.cas.cz/experiments.php?mode=view&id=22>. The page displays the following experiment details:

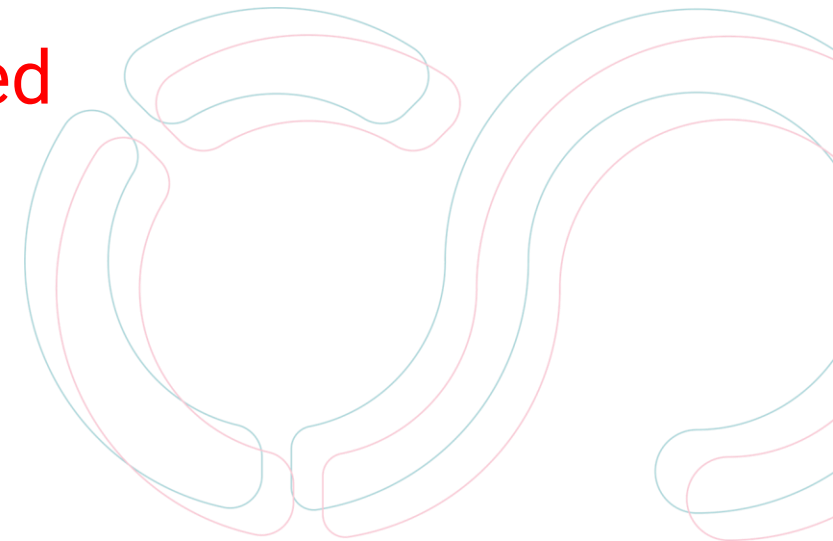
Contributor	Who made this experiment? Alfredo Gonzalez
Date of measurement	2024-07-12
Cells	Cells Jurkat WT
Plasmid	Plasmid None
Coverslips	Type of coverslip used LPGs
Blocking (%)	Percentage of BSA used for blocking 5
Blocking time (h)	Time of incubation of blocking 24
Exposure	Exposure (ms) 30

A large yellow diagonal watermark is overlaid on the screenshot, reading "Electronic laboratory notebook - Advanced".



# Scientific notebook styles

- Paperback notebook
- Electronic notebook (e-notebook)
- Electronic laboratory (field) notebook – standard
- **Electronic laboratory (field) notebook – advanced**
- **Inventory / LIMS**



# What is ELN?

... definitions ...

*Imperial College London:*

Lab notebooks are a way for researchers to remember vital information about their research through an organised and systematic manner. They may be considered part of your research data and will need to be archived along with your other data.

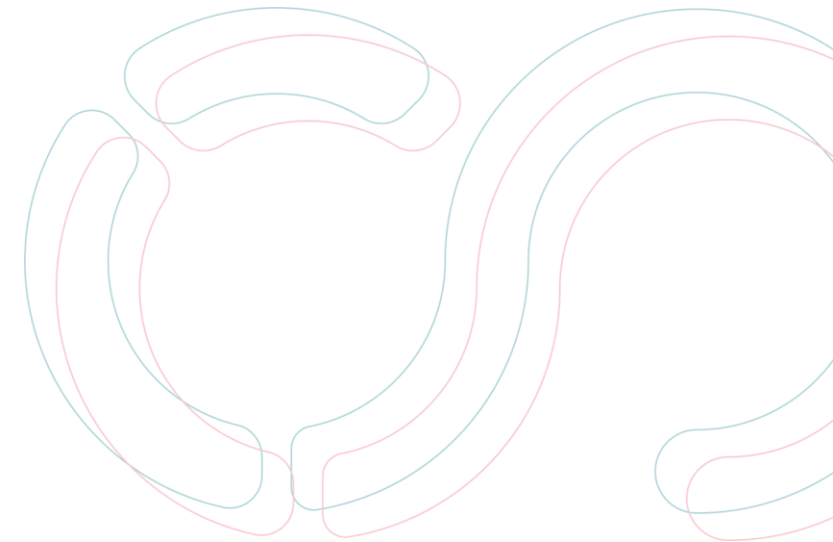


# What is ELN?

... definitions ...

*Imperial College London:*

Easy, real-time collaboration and data sharing. Custom and template experiment records. Protocol library. Version-controlled repository (datasets) ...



# What is ELN?

... definitions ...

*Harvard Medical School:*

Some ELNs can also manage inventories of samples, reagents, and other supplies, as well as keeping track of equipment and equipment maintenance schedules (LIMS functions). Additionally, some ELNs provide specialist scientific tools for chemical drawing or molecular biology.

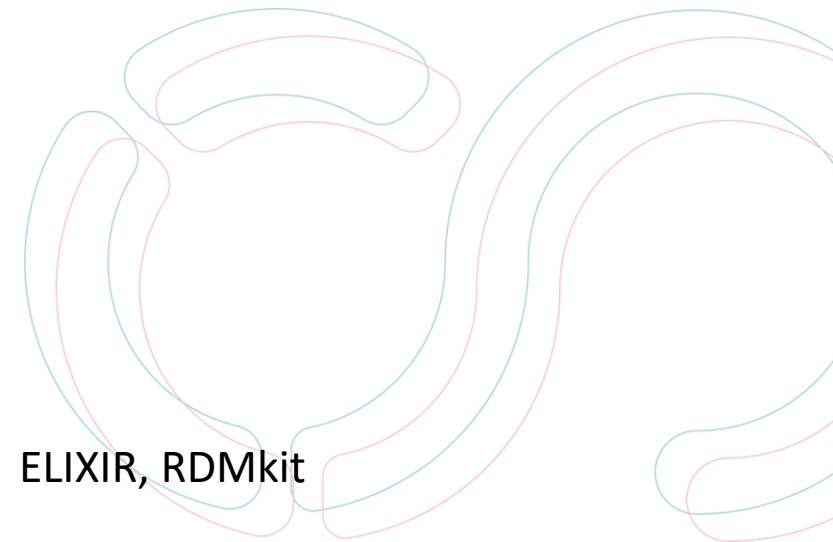
# What is ELN?

... definitions ...

*Research.com:*

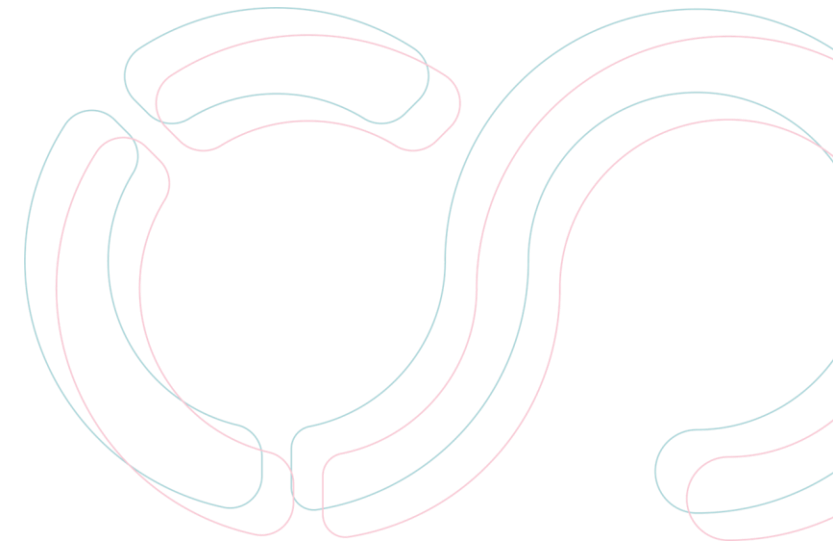
An ELN can automate many of the manual elements of laboratory note-taking. In laboratory processes, automation simplifies experimental procedures and helps researchers save more time for other tasks such as data analysis. ELNs also use advanced technologies to automate different data input and acquisition processes.

# Why to use ELN? ... Summary



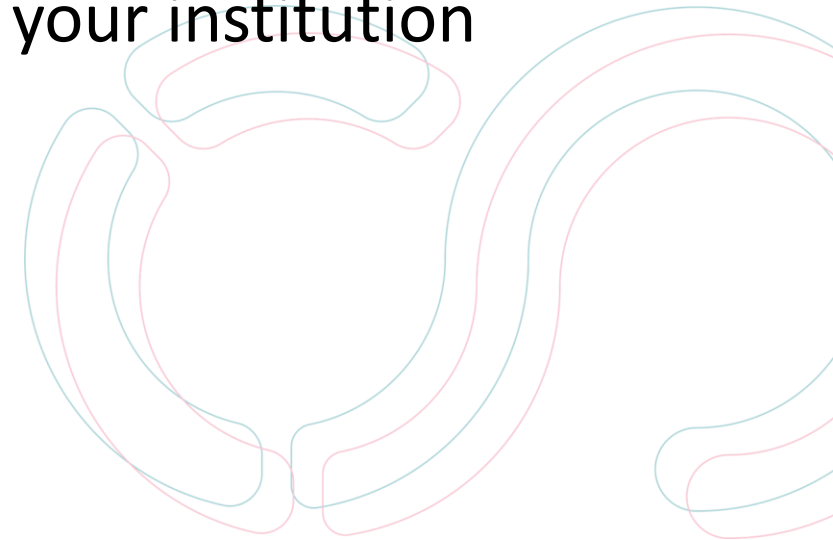
# Why to use ELN? ... Summary

- Records of experiments with relevant annotation and comments – structured/templates/links
- Register of digital objects including digital representations of physical and abstract entities
- Versioning
- Access control to (meta)data. Collaborative functions.
- Protocols/procedures/workflows
- Links to the relevant data
- Optional: Data storage
- Optional: Inventory (samples, supplies, literature, data files)
- Optional: Instrument booking/scheduler
- Optional: Offline functions (electronic filed notebook)
- Optional: Timestamps (e.g., legal support)
- Optional: Signatures/witnesses
- Optional: Scientific tools (e.g. data visualisation, schemas)
- Optional: Automatisations of RDM processes



# Which ELN?

- **Avoid 'one size fits all' solution**
- Personal preferences – the principal investigator's (PI) responsibility
- Provide recommendations and support – the PIs have to make the decision whether to use ELN or other tools.
- Offer more solutions (ideally diverse) for the RDM in your institution





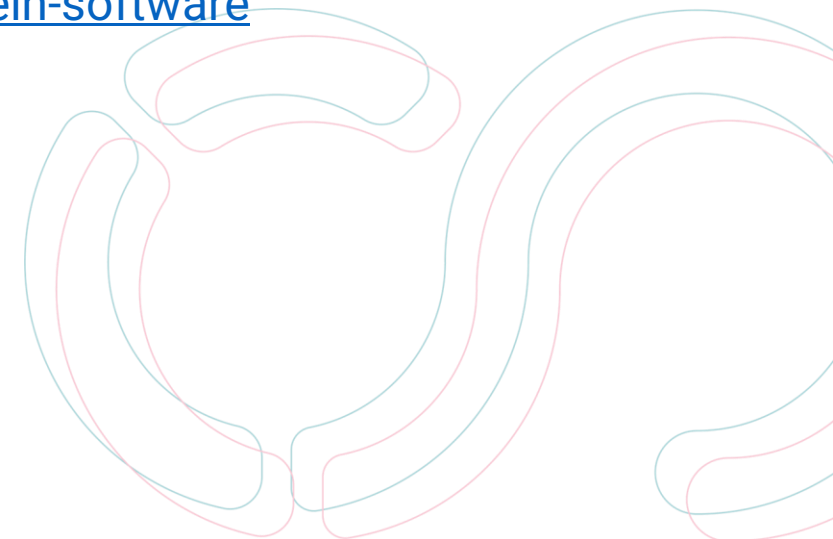
# Find the right ELN for you.



<https://eln-finder.ulb.tu-darmstadt.de/home>



<https://research.com/software/best-eln-software>



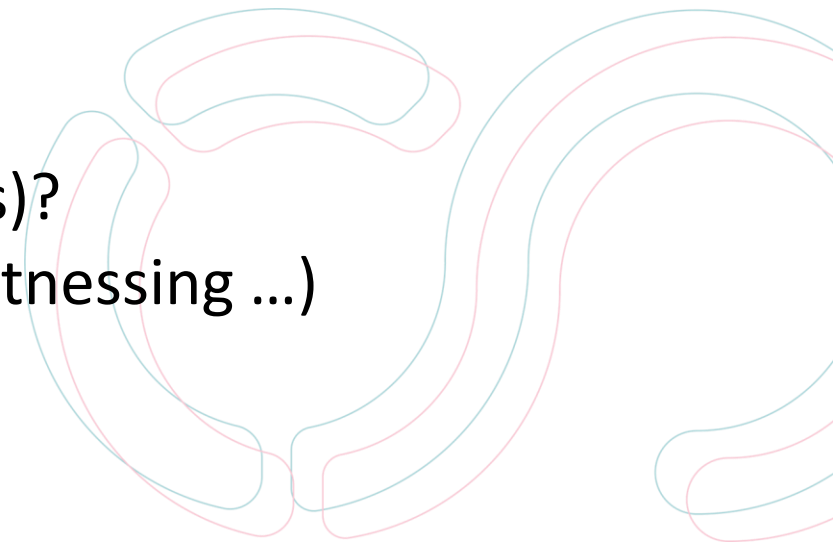
# Which ELN?



- Simple vs. complex
- Commercial vs. open-source
- Institutional instance vs. cloud version
- Does it support the export of FAIRified data?
- Sharing/collaborative options
- With LIMS vs. w/o LIMS (including scheduler and sample/equipment manager)
- Are specific scientific tools essential/needed?
- Integration with external scientific tools essential/needed?
- Is offline functionality essential/needed?
- Advanced functions: timestamping, signing, witnessing ... legal issues.

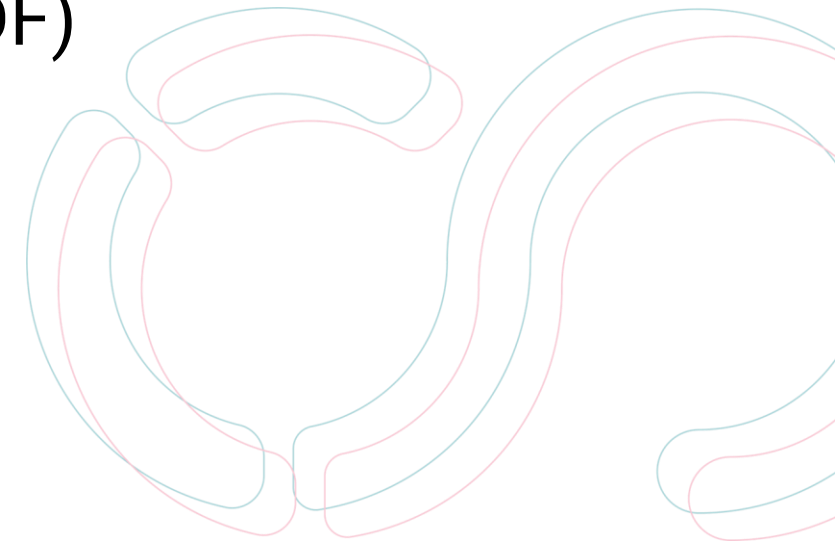
# Selection of ELNs for NRP/MATECH

- From simple to more complex
- Open-source
- Institutional/national instances
- Must support the export of FAIRified and machine-actionable data?
- Sharing/collaborative options
- With LIMS and w/o LIMS
- Specific scientific tools: non-essential/favourable?
- Offline functionality: non-essential/favourable (expenses)?
- Optional: Advanced functions (timestamping, signing, witnessing ...)
- Automatisatation processes: ready or not?
- **Team of developers**



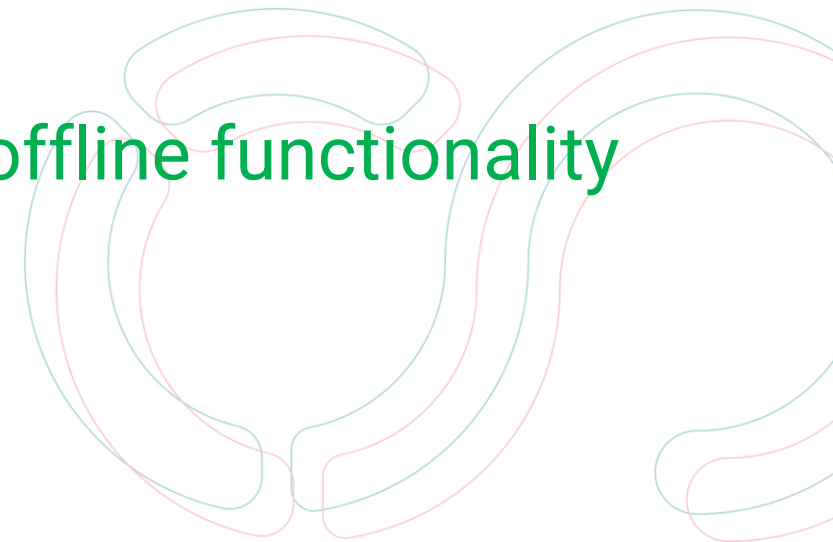
## Common features

- Creation of user groups and projects
- Access control (individual experiments, collections, (meta)data)
- Mandatory\*/Recommended metadata fields
- A panel formats for metadata export (including human and machine-readable formats (PDF, XML, JSON, RDF))
- **Customisable templates**
- Python scripts/APIs

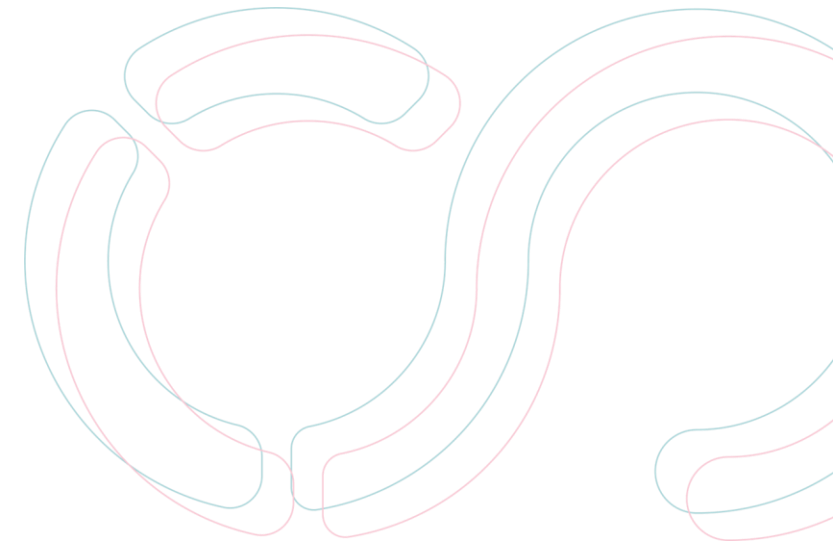


## Distinguishing features – focusing on

- Kadi4Mat: easy to start with, workflows
- eLabFTW: protocols, scheduler
- RSpace: sample management/EOSC integration
- openBIS: professional RDM tool, domain-specific tools
- **FAIMS3/Fieldmark: electronic field notebook – offline functionality**

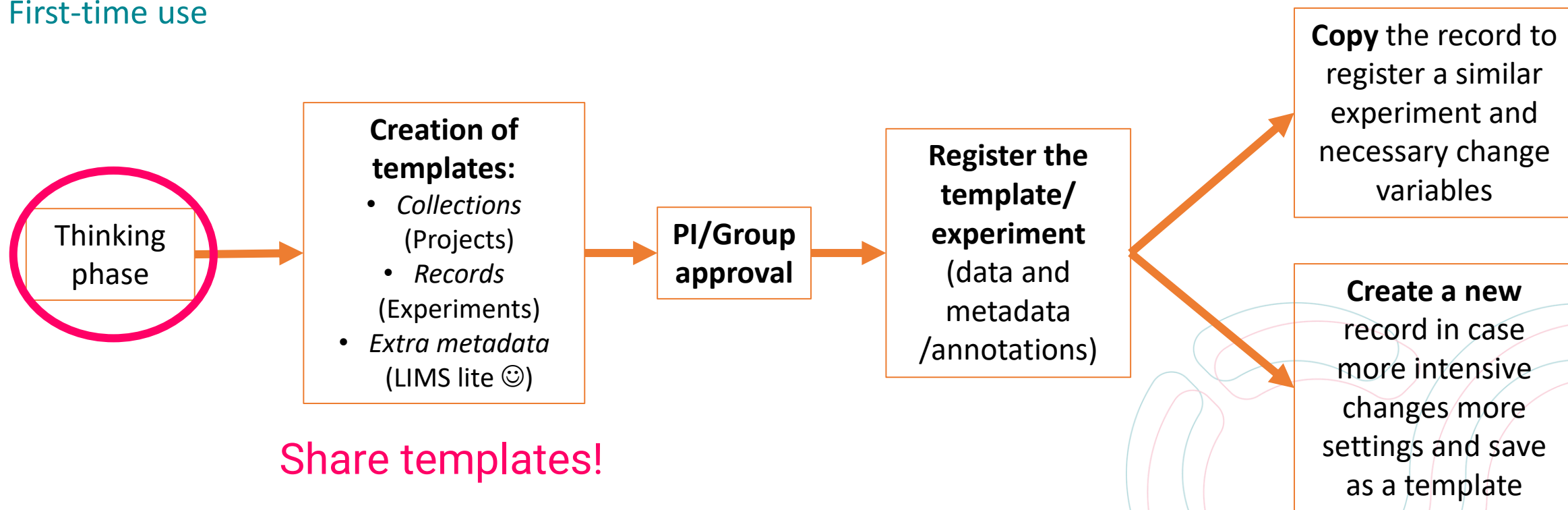


## ELN in praxis



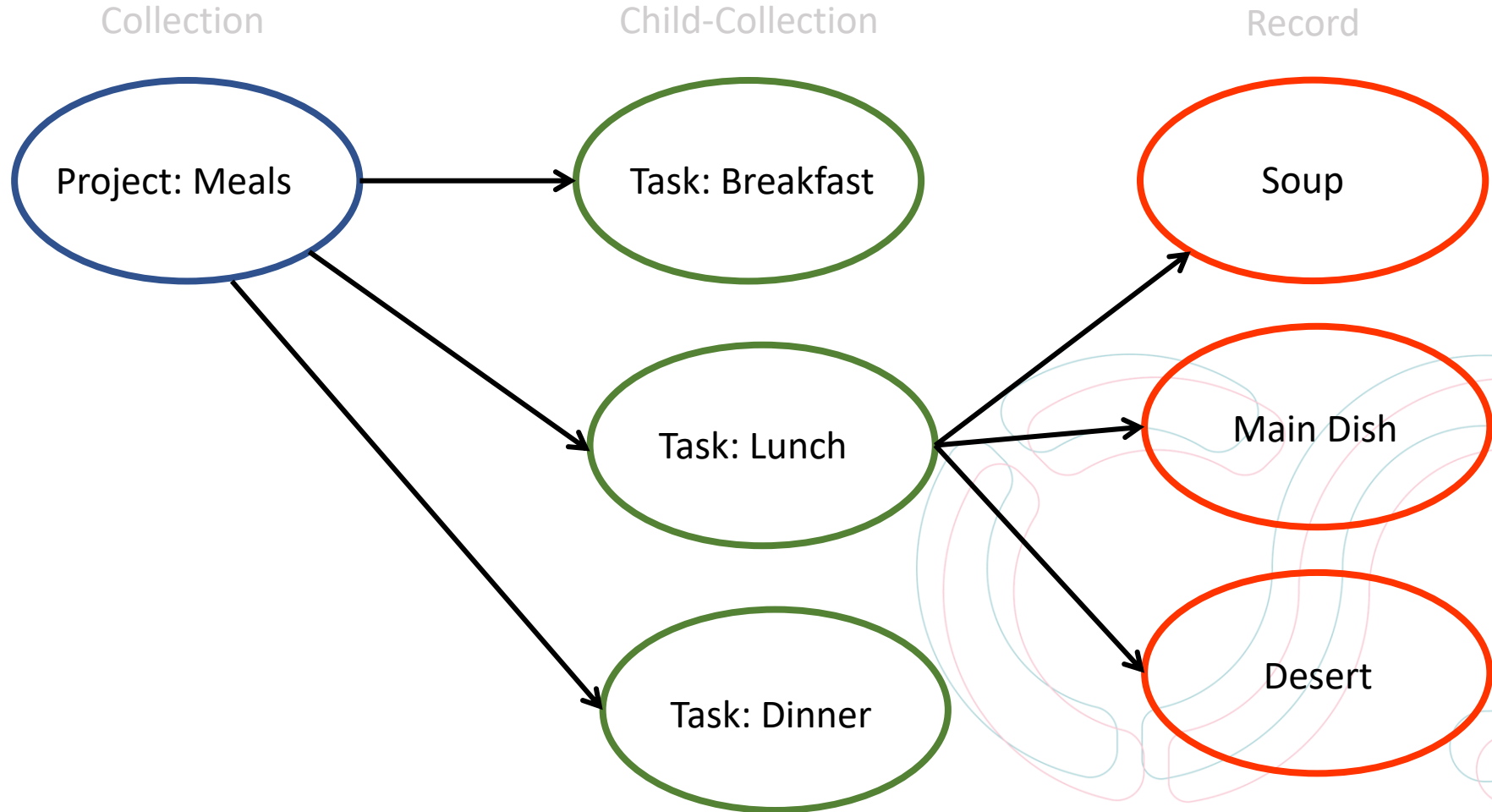
# How to use ELNs?

## First-time use



# How to use ELNs?

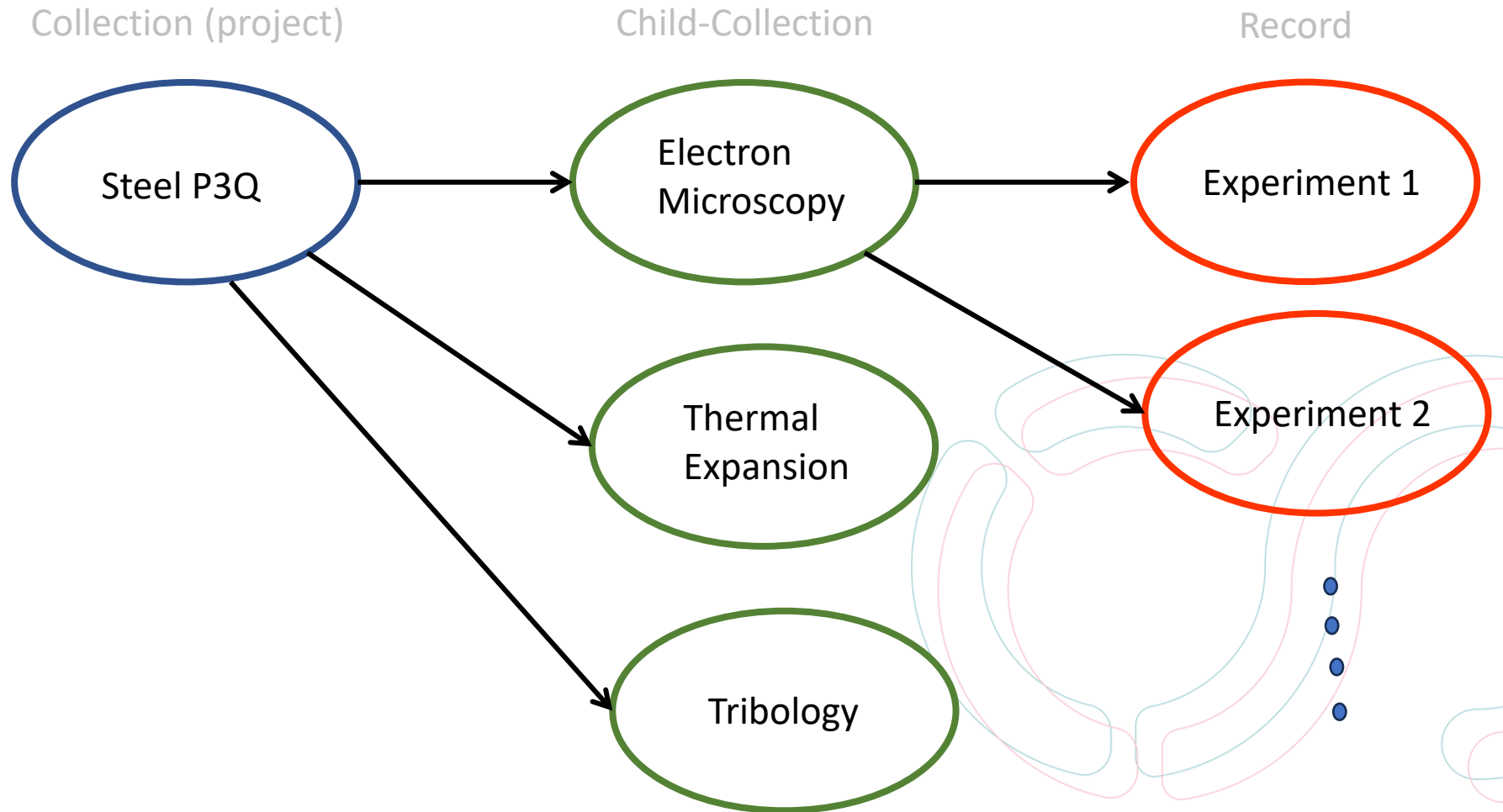
## Structure of my project





# How to use ELNs?

## Structure of my project/collections

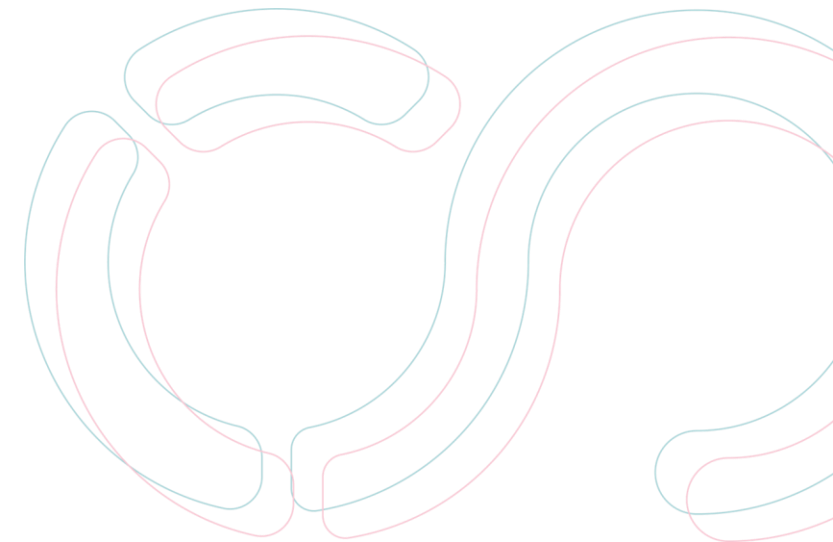


# Fields in the record – metadata schema

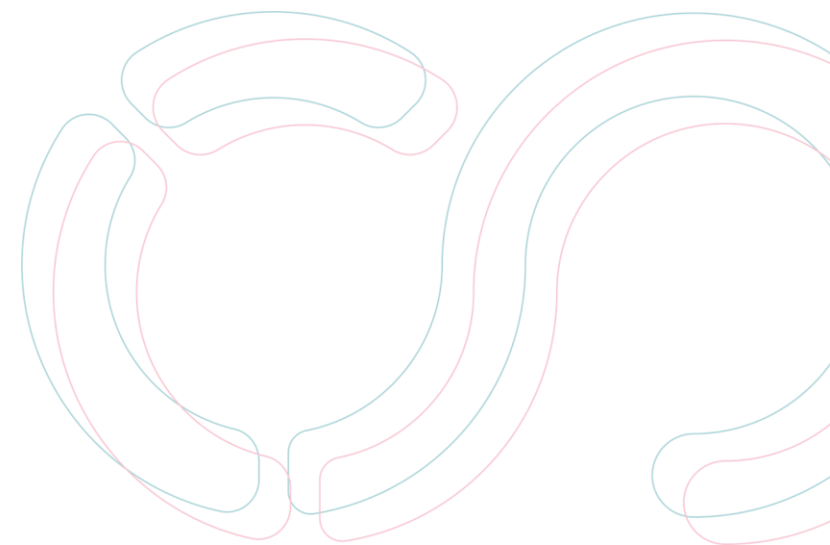
Creator	Creator ID	..... ORCID	
Owner	Owner ID	..... ROR	
Date	..... Date of the measurement		
Sample	Sample ID	..... IGSN	
Instrument	..... Select from the list	Instrument ID	..... PIDINST
Temperature	..... Integer: range 200-400 K		
Pressure	..... Integer: value		

Mandatory

Recommended



## Live demo



# Collection

Kadi4Mat Records Collections Templates Users Groups Workflows Beta Quick search

Recently visited

- Steel P3Q @steel-p3q (Collection) Last visited 41 minutes ago
- Electron Microscopy @electron-microscopy (Collection) Last visited 42 minutes ago
- SteelP3Q\_EM\_clean @p3q\_em\_clear (Record) Last visited 43 minutes ago
- Electron Microscopy @electron-microscopy-workshop (Collection) Last visited 44 minutes ago
- Steel P3Q Project @steel-p3q-project (Collection) Last visited 44 minutes ago

Home / Collections / Steel P3Q

Overview Links Permissions Revisions

Edit collection Copy collection Link record Export as Publish via

### Steel P3Q

@steel-p3q  
Persistent ID: 24

bla

Created by Test User  
Created at November 16, 2023 11:10:26 AM (10 months ago)  
Last modified at September 4, 2024 4:08:14 PM (42 minutes ago)

Tags: props, steel

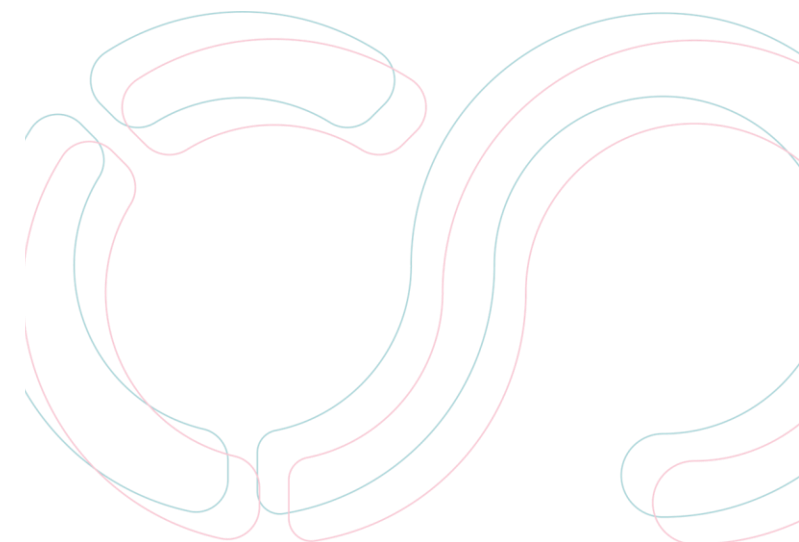
Records 1

- SteelP3Q\_EM\_clean @p3q\_em\_clear (dataset) Last modified 42 minutes ago

Filter

Child collections 1

- Electron Microscopy @electron-microscopy Last modified 42 minutes ago



# Template

Kadi4Mat
Records
Collections
Templates
Users
Groups
Workflows
Beta
Quick search

**Steel P3Q** Collection

@steel-p3q

Last visited an hour ago

**Electron Microscopy** Collection

@electron-microscopy

Last visited an hour ago

**SteelP3Q\_EM\_clean** Record

@p3q\_em\_clear

Last visited an hour ago

**Electron Microscopy** Collection

@electron-microscopy-workshop

Last visited an hour ago

✎ Edit template
📄 Copy template
📄 Apply template

Export as
☆

**🔒 Electronic microscopy experiment** Record

@electronic-microscopy-experiment

Persistent ID: 43

description of the method

Created by Test User Created at November 23, 2023 3:26:46 PM (9 months ago)

Last modified at September 4, 2024 3:47:46 PM (an hour ago)

**Template data**

Collections	-
Description	-
Identifier	-
License	-
Record links	-
Roles	-
Tags	electron microscopy temperature
Title	Electron Microscopy
Type	dataset
Extras	<span style="float: right;">🗑️ Hide null values</span>

Creator (ORCID)	null	String	✎
Owner	null	String	✎
Date of experiment	null	Date	✎
Sample Name	null	String	✎
Temperature of treatment	null K	Integer	✎

24 October 2024

Electronic Laboratory/Field Notebooks (ELN)

34




# Record

🏠 / Records / SteelP3Q\_EM\_clean / Edit record











⬅ Back to record

Save changes and quit Save changes Delete record


**Title\***  
SteelP3Q\_EM\_clean

**Identifier\*** p3q\_em\_clear  **Type** dataset    
Unique identifier of this record. Optional type of this record, e.g. dataset, experimental device, etc.

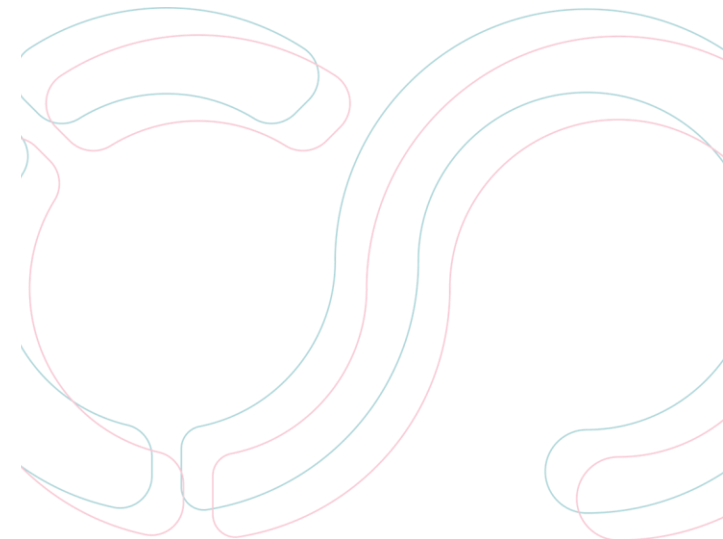
**Description**

Preview | H B I   $x^1$   $x_1$    $\sqrt{x}$    “ -      


Important measurement|

This editor supports Markdown, including math written in LaTeX syntax rendered with  KaTeX. Note that HTML tags and external images are not supported.

**Tags**



## Record – from template

This editor supports Markdown, including math written in LaTeX syntax rendered with  KaTeX. Note that HTML tags and external images are not supported.













**Tags**

steel x

An optional list of keywords further describing the record.

**Extra metadata**

Simple mode Tree view

Type	String	Key	Creator	Value*	Marek Cebecauer	+	x				
Type	String	Key	Creator ID	Value*	orcid 5555	+	x				
Type	Date	Key	Date of measurement	Value	November 16, 2023 12:00:00 AM	+	x				
Type	String	Key	Instrument	Value*	JEOL 333	+	x				
Type	Integer	Key	Temperature	Value	300	Unit	K	+	x		
Type	String	Key		Value		+	x				

+ Add extra

Select a template

**License**

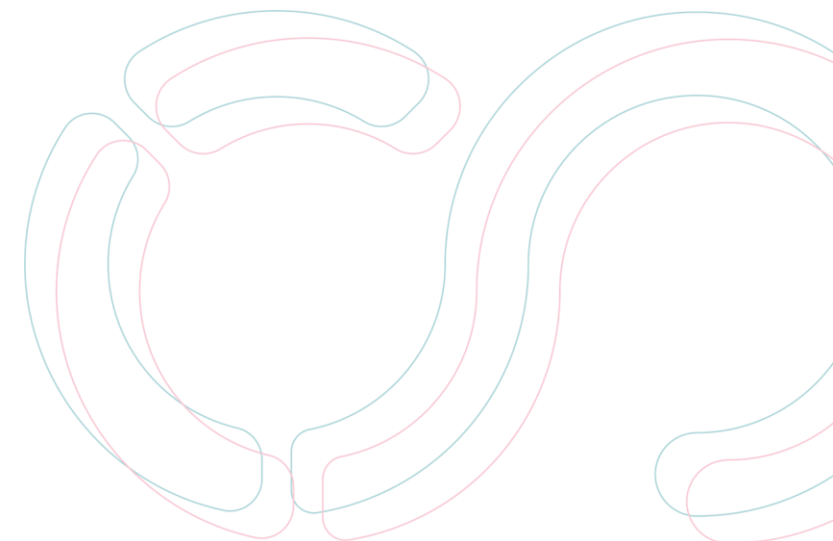
Search for a license

Specifying an optional license can determine the conditions for the correct reuse of data and metadata when the record is published or simply shared with other users. A license can also be uploaded as a file, in which case one of the "Other" licenses can be chosen.

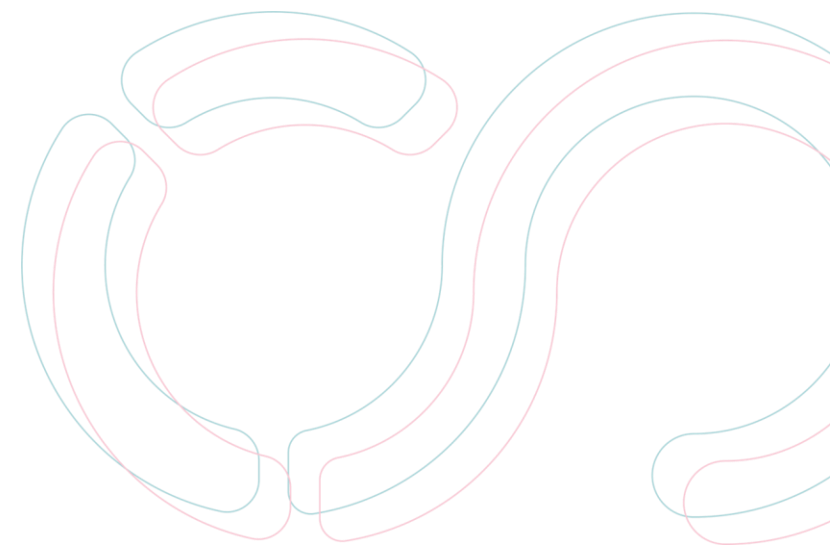
**Visibility**

Private

Public visibility automatically grants EVERY logged-in user read permissions for this record.



## Discussion





# Thank you for your attention.

marek.cebecauer@jh-inst.cas.cz



Spolufinancováno  
Evropskou unií



MINISTERSTVO ŠKOLSTVÍ,  
MLÁDEŽE A TĚLOVÝCHOVY



J. Heyrovský Institute



Czech Academy  
of Sciences

Registrační číslo projektu NRP

CZ.02.01.01/00/23\_014/0008787

# Partneři



UNIVERZITA  
KARLOVA



Univerzita Palackého  
v Olomouci



Středisko společných činností  
Akademie věd ČR

