

Keeping Lab Notebooks in the NIH IRP

Basic Principles & Best Practices: A PI's Perspective



Intramural Research Program
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What is a Lab Notebook?

- A research record that documents the entire research process:
 - formulating a question or hypothesis
 - designing experiments and studies
 - developing research protocols
 - generating, analyzing, and interpreting data
- A notebook provides sufficient detail so that the research can be reproduced.
 - A scientifically literate person should be able to use the documentation provided in the notebook to navigate rationale, methods, analysis, results, and basis for the major conclusions
- A record that may be used as evidence in legal proceedings.
 - The notebook may be used to support a patent application or resolve a patent dispute, as well as to defend research against accusations of misconduct.
- The notebook represents a scientific legacy of your research group.

Lab Notebook = Federal Record at NIH!

- Because your lab notebook is a federal record, there are special rules. First: NIH owns it!
- Research records document the *entire research process*, from formulating a question and applying for funding, to designing experiments and developing research protocols, to generating, analyzing, and interpreting data.
- NIH Manual Chapter – 1743 “*Keeping and Destroying Records*” – Note that records created at NIH must be in an **electronic format**.
- All employees are warned that destruction or removal of government records is a serious offense.
- *All records must be kept at NIH, stored only on NIH servers or scientific devices, and available for inspection at any time.*

A Lab Notebook is NOT:

- Personal property of the researcher
- A journal
- A record of all communications within a research group
- A record that can leave NIH (copies of a lab notebook may be removed only with express permission; please see the NIH Form 3000); <https://oir.nih.gov/sourcebook/personnel/policies-recruitment-processes/departing-staff-request-remove-copies-nih-records>

Scientific Data

- Data are a tangible record of observations made by a human being (e.g., clinical findings or observations of animal behavior) or a machine (e.g., sequence data or images).
- Primary (raw, original) data are data that are measured and directly related to the object of study.
- Secondary (or derived) data are data that are indirectly related to the object of study.
- Metadata are data about the data.
- Research materials are physical things (other than equipment or instruments) that are used to generate data (e.g., gels, DNA, cells, dyes, tissues).

https://oir.nih.gov/system/files/media/file/2023-11/guidelines-conduct_research.pdf

What type of information can be included or linked to an NIH IRP research notebook (now electronic)?

- Research data, including primary data, secondary data, and metadata, as well as research methods
- Rules or SOPs for collecting, labeling, annotating, storing, editing, cleaning, auditing, processing, excluding, and analyzing data
- Records of materials/reagents used in research
- Research protocols, such as protocols for conducting laboratory experiments or research with human or animal subjects
- Rules or procedures for calibrating scientific instruments
- SOPs for data collection, testing, animal care, patient care, and so on

Key Elements of Organizing a Lab Notebook

- Notebook Name/Unique Identifier
 - Name of author
 - Dates
 - Project title
 - Lab location
- Table of Contents
- Body of notebook/experimental entries

Experimental Entries

- Date
- Title
- Hypothesis or Goal: Brief statement of purpose
- Background
- How/Methods: Protocols, calculations, reagents, equipment.
- Observations:
 - All that happens (planned or unplanned)
 - Raw experimental data - Digital copies
 - Reference/links to external data locations
- Data analysis:
 - Processing of raw data, graphs, interpretations
 - Trouble-shooting procedures
- Ideas for future experiments

May be included in
other documents
kept with the
notebook

The Details of “How”

- Reagents: source, product number, lot number, expiration date, how and where stored. Consider using “Laboratory Inventory” features to cross-reference reagents.
- Solutions and how they were made
- Cells used: type, source, passage number, growth medium
- Instruments: type, name, location, serial number; instrument settings used
- Number and volume of washes
- Centrifuge speeds and duration of spins
- Heating rates and levels of agitation
- Time between and during steps
- Gel percentages
- Type of water used
- Copies of animal or human subject protocols should be uploaded into the Electronic Laboratory Notebook (ELN). For every experiment with animals, it is vital to name the strain, source, age, sex, injection sites, volume, important details about housing (single housed, fed ad libitum, etc.).

Research Integrity - Ethics

- All data go into the electronic notebook (or can be found using links)
 - Even "bad" data points or "outliers"
 - Failed experiments or contradictory experiments
 - Mistakes (experiments that were performed incorrectly, indicating so using proper annotation)
- Correct documentation errors, do not remove them
 - Electronic notebooks permit corrections, which are tracked by an audit trail
 - Outside of the NIH IRP, the users of paper notebooks cross out with a line, sign, and date the correction; no pages or folders are ever skipped or deleted – these precautions are not needed if you use an NIH-approved electronic lab notebook
- Honesty is the best policy
- Ask yourself: "Could an educated researcher repeat the experiment with the information I have provided?"

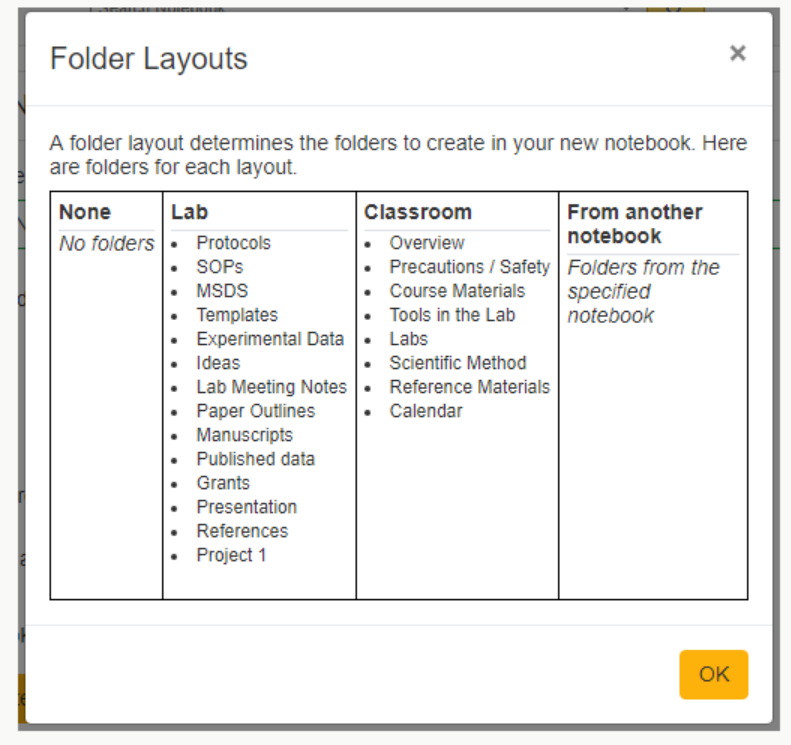
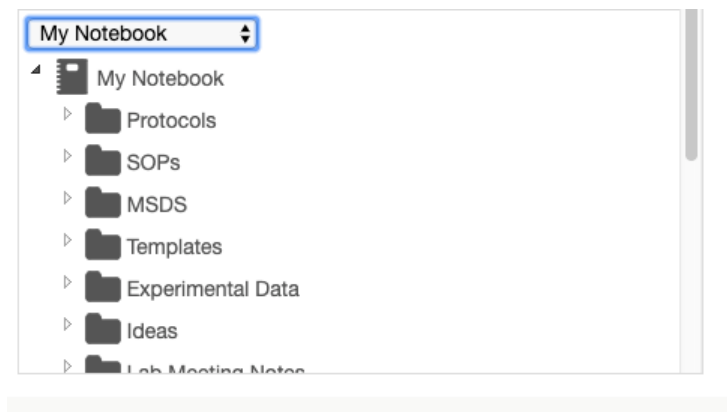
An Electronic Lab Notebook (ELN) is not just a digital version of a paper notebook

- An ELN is a system used to create, store, retrieve and share electronic research records in a manner that replaces all the functions of a paper notebook and complies with NIH records management and security requirements.
- At NIH, there are three platforms that will be the ELN default systems, but ICs may request other platforms
 - LabArchives
 - Signals
 - MS Documents (Word, Excel) with a Microsoft Records Management Module on either an NIH SharePoint or Teams server
- Although temporary paper notes can be taken for immediate transfer to an ELN, it is not permissible to create paper records that could have been created electronically and then scan them to electronic to serve as an ELN
- ELNs are more than a digital version of a lab notebook. An ELN allows for more efficient and fuller documentation and can link to many other documents, permitting a complete record of research activities.

Investigator Responsibilities for an ELN

- Access Control:
 - Establish an electronic system for the research group, with the PI as the sole “Owner”
 - Ensure each researcher in the group has a unique PI-owned notebook or a folder within the PI’s ELN
- Maintain oversight of the ELN at all times; review new entries periodically
- Standardize naming conventions
- Standardize folder conventions
- Create an Index Record to document all ELNs and legacy paper records used to document the group’s research
- Establish rules for either linking to or importing primary data files
- Protect primary data from alteration if they exist outside the ELN (e.g., instrument data)

Table of Contents and Folder Organization: Examples



<https://help.labarchives.com/hc/en-us/articles/11728907409556-Create-New-Notebook>



Project A [example]/Templates/Experiment Template

Stacey Glik Nov 03, 2018 @06:32 PM EDT

Experiment and Date

Stacey Glik Nov 11, 2018 @08:21 PM EST

Name format: Notebook Expt# initials year/month/day

Experiment Dates

Stacey Glik Oct 30, 2018 @12:42 PM EDT

Objective/Rationale

Stacey Glik Nov 11, 2018 @08:22 PM EST

Why are you doing this experiment, and what are you testing?

Stacey Glik Oct 30, 2018 @12:43 PM EDT

Plan/Flow Diagram

Stacey Glik Nov 11, 2018 @08:27 PM EST

Controls, flow chart if helpful, etc

Stacey Glik Oct 30, 2018 @12:42 PM EDT

Protocol

Stacey Glik Nov 13, 2018 @08:39 AM EST

Protocol, including dates of individual steps if a multi-day experiment

Include catalog numbers for key reagents, including antibodies (at least for the first experiment)

Stacey Glik Oct 30, 2018 @12:43 PM EDT

Data

Stacey Glik Nov 11, 2018 @08:25 PM EST

Include links to data stored in appropriate Box folder

Stacey Glik Oct 30, 2018 @12:45 PM EDT

Results and Interpretation

Stacey Glik Nov 11, 2018 @08:28 PM EST

Put graphs, etc here. Include information on how you analyzed the data

Stacey Glik Oct 30, 2018 @12:45 PM EDT

Conclusions and Troubleshooting



LYPLAL1 Activator Compound SAR

Small Molecule Library

Documentation

Cell Culture

Crystallography

Gel ABPP

+ New...

Data

Raw Data Files

Analysis Files

For Publication

Compound 882-1

WEH Analog Library A

WEH Analog Library B

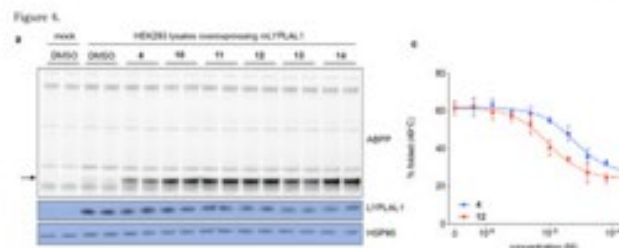
WEH Analog Library C

Supplementary Figures

ABPP Figures - LYPLAL1 OVXP Cell Lysate

John Doe - Jun 16, 2023, 1:53 PM PDT

LYPLAL1 ABPP 1R01AG065456-01A1



LYPLAL1_ovxp.png (219 kB)

John Doe - Jun 16, 2023, 1:53 PM PDT

(a) Representative analogues of **4** that display greater potency and efficacy on LYPLAL1 overexpressed in HEK293 cells, as assessed by gel-based ABPP. Western blots of LYPLAL1 and HSP90 (loading control) are shown in the bottom panels.

(b) Endogenous LYPLAL1 is selectively activated in total HepG2 proteomes treated with 10 μ M **12** (or PAL-12) for 1 h and then labeled with FP-alkyne for 20 min prior to attachment of an azide-biotin tag and ABPP-

What about temporary paper data?

Paper records that cannot be produced as digital files must be captured in acceptable electronic file formats with specific metadata no later than 72 hours after production, using GFE or compliant applications running on personally owned equipment (POE) to an NIH-approved ELN platform.

- The electronic copy must be a true and accurate representation of the paper original, with sufficient resolution and contrast to be readable by a human.
- Acceptable formats include Tagged Image File Format (TIFF) v. 4,5&6, Jpeg 2000 (Jpeg2), Portable Network Graphics 1.2 (PNG), Portable Document Format/Archival (PDF/A) PDF/A-1.
- Specific metadata as mandated in NARA Bulletin 2015-04 (filename, title, description, creator, creation date) must accompany the uploaded file.

Resources

- NIH IRP Conduct of Research - https://oir.nih.gov/system/files/media/file/2023-11/guidelines-conduct_research.pdf
- IRP ELNs - <https://oir.nih.gov/sourcebook/intramural-program-oversight> (coming soon ...)
- NIH Manual Chapter 1743 – *Managing Federal Records* - <https://policymanual.nih.gov/1743>