

# Documenting your research

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STARTneuro

Adapted by J. Gleason from Branchaw, J.L., Pfund, C., & Rediske, R. (2010). *Entering Research: A Facilitator's Manual*. New York: WH Freeman & Co. Branchaw, J. L., Butz, A. R., & Smith A. (2018). *Entering Research* (2nd ed.). New York: Macmillan.

# Community guidelines

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- Be kind and respectful of each other's ideas and experiences.
- Keep an open mind and heart when learning from and listening to others.
- Be mindful of who is speaking and make sure air time is equitable, not equal (uplift marginalized voices).
- Lean into and honor your discomfort - it is the first step towards growth.
- Assume good intentions. Own your impact.
- What is said here, stays here - keep all conversations confidential.
- Be mindful of keeping this a brave space.



# STARTneuro specific guidelines

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- Everyone can bring their full selves into this space
- Do not assume any part of someone's identity
  - Sharing pronouns (<https://pronouns.org/what-and-why>)
- Be curious, not judgmental
- Communicate about missing portions of the program, or about any reason that would take away from you bringing your full self to this space
  - (And receive communications from us – check your UCSD email!)

# Related to bringing your full self to the program!

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For tomorrow morning, please prepare a “where I’ve been & where I’m going” ~5 minute introduction to yourself.

Recommended format: one slide for where you’ve been, one slide for where you’re going.

# By the end of this session, you will be able to:

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- Explain why it is important to accurately document your research.
- Identify key elements in research documentation.
- Identify commonalities and differences in documentation associated with different types of research.
- Understand the ethical implications of documenting your work.



# Why is it important to keep detailed research documentation?

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- to be able to repeat the experiment
- to be able to write up the results for publication
- to share protocols & preliminary results with lab members & scientists outside of the lab
- to defend against accusations of fraud/plagiarism
- for your own sanity & organization

The notebook needs to be detailed enough for you or other lab members to do follow up experiments.

# What elements of research need to be documented?

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- **Procedures**, including descriptions of experiments, observations and computer scripts
- **Raw data** (e.g. images, recordings)
- **Data analysis**, including the preprocessing and/or statistical procedures used to analyze the data
- **Processed data**

The specifics of what and how to document research will vary depending on the nature of the research (e.g., bench, behavioral, computational)

# Questions for consideration

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- How does a lab's research documentation protocols reflect the **culture** in the research group?
- How do they reflect the **communication style** in the research group?



# Research documentation format

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- Many labs still maintain physical (hard copy) laboratory notebooks, which may also contain PCR results, animal information images, etc.
  - Benefits: easily carry this around the lab with you and take notes as you go, less worry about spilling/damage
- Most labs use both physical & digital (usually cloud storage) documentation
  - Documents (Word, Google docs, Notion) for protocols
  - Slides (Powerpoint, Google slides) for data & research synthesis

For more ideas: <https://www.science.org/content/article/how-keep-lab-notebook>

# What should be included in a research notebook entry?

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- Date
- Hypothesis
- Explanation of goals/rationale for the experiment
- Detailed procedures identifying experimental and control treatments
- List of reagents (and where to find them)
- Key for labeling and identifying tubes, animals, etc.
- Raw data, both successful and unsuccessful results
- Analyses of data
- Interpretation and thoughts about what to do next
- Computer scripts for data mining and data analysis
- References to locations of specimens and electronic data
- Citations for methods, reagents, analyses, etc.



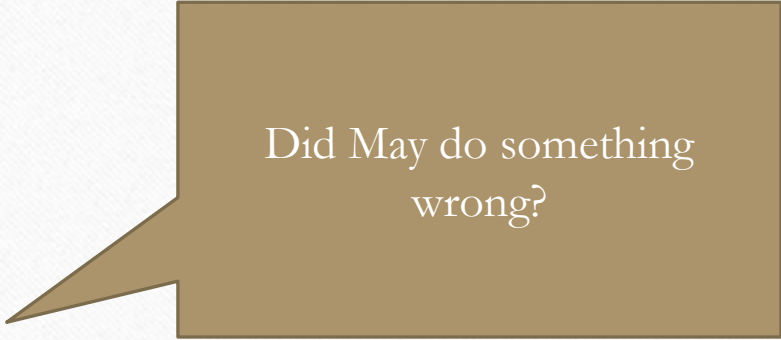
# Best practices for data storage

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- Data should be stored both **physically** (on the computer hard drive and/or on a storage hard drive, ideally SSD) and **on the cloud** (e.g. Google Drive, Dropbox, Amazon)
  - Labs that work with very large data will often have a private storage server setup, or will pay for a university or public storage service
- Data should be organized in a hierarchy:
  - By project
    - By animal (if relevant)
    - By date

# Case study

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Did May do something  
wrong?

May, who has been doing research with Professor Gonzalez for 2 years, is preparing to present her research results at the campus wide Research Symposium. Because some of her findings are quite novel and contradict reports of similar experiments in the literature, Professor Jones asks to review the raw data before signing off on her presentation. When he looks through the lab Dropbox, he doesn't see the data anywhere. Instead, May says she has stored the data on her personal computer.



# Why scientists have an obligation to share data

Obligation	Rationale
<b>Replication</b>	The ability to replicate results of analyses is a fundamental element of the scientific process, but for many types of time-sensitive environmental data, replication is possible only if the original data are available for reanalysis.
<b>Human rights</b>	Article 15 of the International Covenant on Economic, Social and Cultural Rights dictates that everyone has the right to “enjoy the benefits of scientific progress and its applications,” but failure to share data restricts that right.
<b>Data preservation</b>	Data that are not systematically archived are frequently lost as a result of computer failures, software obsolescence, or simple neglect.
<b>Scientific progress</b>	The scientific community, as a whole, benefits from the ability to discover, access, and analyze diverse data sets.
<b>Data integrity</b>	Multiple users make it more likely that deficiencies in data will come to light.
<b>Public trust</b>	In the face of controversy, the willingness to share data can be a key factor in increasing public trust in the results of scientific research.

# Starting the conversation about documentation, once you join a lab

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1. Meet with your mentor to go over the protocol you should follow when documenting your research
2. Discuss the **level of detail expected** in the documentation for your research group and ask your mentor show you an exemplary notebook.
3. **Write an outline of the documenting protocol** you should use when doing research and identify the parts of the process that are common to your entire research group and which are specific to your project. In addition, address the following questions:
  - What kinds of notes are kept? Are they hard copy documents or electronic files?
  - Where are the notes kept?
  - What parts of the research are documented? What level of detail is needed?
  - How are data recorded?



# Additional reading & resources

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- <https://www.labmanager.com/laboratory-technology/document-or-die-8119>
- Documenting data: <https://libguides.mst.edu/c.php?g=335446&p=2257031>
- How to keep a lab notebook  
<https://www.science.org/content/article/how-keep-lab-notebook>