

Tips for Record Keeping During Lab Work

Keep track of product and equipment details to allow tracing

- Staple in sample list/materials
- Write down all parameters of experiments to observe small changes
- Staple in pics of qualitative observations
- Don't record general statements – include time stamps in your book and put very specific times
- Keep order forms of product info you use
- Take pictures at each point through a process
- Keep a common spreadsheet of errors and problems to keep a record of issues – using google docs
- Use a table to compare experiments with similar conditions
- Record lot numbers of chemicals or reagents
- Use bar coding system for samples
- Use an electronic log of samples, reagents and solutions – can keep track of when things made, who made them and where they are stored
- If have time sensitive experiment note times things happened
- Summarize your good and bad findings in an ongoing table – it might be useful to have an excel sheet with each column being a parameter, and the last column being a “good or bad” and notes for your observations

Keep track of what you were thinking on a specific day when you did an experiment

- Write down objective or rationale for experiment and why trying it – to give a sense of thinking at the time of the experiment
- Write down trivial things about your day in the lab as it might help in identifying timing of issues/differences
- Use lab notebook to track calculations or any deviations from planned protocols and record everything else electronically
- Write down every variation from your planning (e.g. changing temperature from intended, every condition)
- **Make sure you date everything!**
- Ensure you write down all steps for each experiment - Do not assume some steps are obvious as you will undoubtedly forget these steps later, and/or minute changes in these steps could be important factors in your experimental success

- Spend a few minutes at the end of the day summarizing your findings (what worked/didn't work) into your logbook or a separate journal. Not only is this useful to look at later, but it helps you step back and synthesize what you've done to better prepare for future experiments

Think about the security of your notes and your data

- Back up your notes and data using a system like Evernote; take pics of notes and backup on your cloud storage
- Keep physical and electronic record of notes
- Save raw data on servers (two servers)
- Back up computer one time per week at least or have real-time sync set up
- Use version control
- Create a communal space to share data using google docs or sheets
- Store files on portable hard drive – but have more than just this for back up!
- Organize code using gitHub
- ***You MUST have a backup system for your notes and data***

Use a system to link different records

- Record lab book page numbers and links between files
- Keep table of contents at beginning with page numbers
- Split notebook into different sections to gather similar things together to find things more easily
- If experiments run multiple days, use physical lab notebook in time but then have electronic book for experiments, which is easier to search
- Index lab notebook
- Review lab notebook with protocols and safety check, and write summary at end of each week
- Divide electronic notebook into protocol versus results sections, and link to raw data in a specific folder
- Create a consistent referencing system for lab (notebooks, files, samples, etc)
- Use ID number for samples, and record everything on the lab notebook or connect samples with lab notebook pages

Create checklist for experiment performed frequently to ensure your records are consistent

- Use checklists to keep track
- Create checklists for parts of experiments that are critical steps
- Print off run sheets and then records on a structured results sheet
- Consider filing system for whole group so can find data from others in the group
- Print out protocols so can note any deviations from protocol

Create a system for organizing and storing processed data

- Put graphs into PowerPoint files and organize in one folder
- Have a folder for data from each experimental technique and subfolders for each day the experiment was performed to allow easy raw data retrieval
- Organize files based on experiments and use corresponding titles to a specific experiment number

Tips for record keeping during computational research

General coding best practices:

- **Version control** – when working on code with others ensure group members keep a descriptive change log
- Construct modular and well documented code such that debugging is easy and when errors arise changes only need to be made in key function files. Write files with the intention of publishing on git-hub
- Save data frequently in large pipelines, export data at steps such that for any software crashes, the pipeline can be picked up close to where it was interrupted

Model formulation:

- Discuss with peers and **have someone double check** the formulation you develop to ensure correctness and formulation is computationally efficient. The same goes for proofs and theorems
- When programming model formulations, construct test cases to ensure outputs are correct when translating from paper to code

Data management:

- When dealing with private information such as patient information, ensure appropriate measures are taken such that the data is protected.

- Ensure you understand how each data variable is collected, the estimated quality of data, and to what specifically it refers to ensure computational experiments are meaningful and well designed.
- Develop data dictionary for all sources and variables
- **Identify sources of data and their methods and assumptions during recording**

Data collection:

- When you collect data, always keep an original version of the data. For example, if you download a dataset from a website, don't directly work on this dataset, but on a copy of this dataset. If something goes wrong with your data during the processing stage or simulation, you can always go back to the original version of your data.
- When you collect data, keep track of the collection date. Sometimes, the sources will change the dataset, update it, or remove it. If you work with the same dataset for some years, regularly update the data and keep earlier versions.
- Dataset will have different columns names, variables and units. For each dataset, create a .txt document that summarizes the source of the dataset (e.g., the website, the authors), the meaning of the columns/variables (e.g., full name of abbreviations, some description), and the unit of the values.

Tips for Research Meeting Records

- **Create a system to keep a record of regular meetings and discussions.** Consider sharing this with all team members to keep everyone aligned on agreed goals and action items.
- Consider setting a structure for your meetings with supervisors or collaborators where you review action items for each team member from the last meeting and assess what was completed or not (to ensure everyone is accountable for what they said they would do). Also meeting records provide a history of what was agreed on and discussed to keep projects on track.
- A potential meeting record document could cover:
 1. **Action items from last meeting**
 2. **Work Completed in last 2 weeks**
 3. **Next Week(s) Work Plan / Action Items**
 4. **Questions/Concerns/Comments**
 5. **Action items for my supervisor**
- Keep handwritten notes of research meetings in a meeting notebook – this might be easier during the meeting but is harder to search later so consider typing up if you have time.