



GUIDELINES FOR LABORATORY BOOKS AND DATA

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BACKGROUND

This document provides guidelines on best practices for laboratory notebook records and accompanying data storage in the Bowdish Lab. These guidelines are not meant to restrict how you record your notes and data – they are meant to provide suggestions to help you maintain a complete and accurate record of your experiments that you (or anyone) can refer to at a future date. You are not going to necessarily remember all the details of an experiment that you did a year ago (or even a week ago), yet you or another individual may need to repeat that experiment in the future, or write up the results.

Ultimately, this record will be kept by Dr. Bowdish, who is responsible for ensuring validity and quality of all data in publications. If she cannot verify from your lab book that your data is valid and of high quality, and where your electronic records are stored for future analyses, then you are negatively affecting the lab's ability to publish.

WHEN YOU START A NEW LAB BOOK

At the beginning of the new lab book, write your name, your role in the lab, and the date you started the new lab book. Include the lab name (Bowdish Lab), its location (McMaster University, MDCL 4077) and phone number (905-525-9140 ext. 21551) in case the lab book is left outside the lab.

Use the **table of contents** section (or reserve a few pages at the front of the book to create a table of contents and number those pages with roman numerals). If the lab book does not have pre-numbered pages, **number all the pages**. Record all entries in the table of contents as you do experiments.

The table of contents can be organized by your own preference, but it's always a good idea to indicate in some manner how the experiments relate to each other within a certain project, to identify biological replicates, new methods, important data, etc... so that anyone can find relevant information quickly if they do not have the page number as a reference.

Alternatively, record all experiment records in order by page number and then devote several blank pages after the table of contents to cross-reference experiments under different aspects of your project.

Your lab book should enable anyone in the lab to identify **why** you did an experiment, **how** you did it, **where** the materials are/were ordered from, **what happened** (or did not happen), your **interpretation** of the results, and your planned **next steps**.

EACH EXPERIMENT RECORD SHOULD CONTAIN THE FOLLOWING

Experiment Date – Record the date in the *lab book* by writing out the entire date rather than using one or two-digit numbers, as this could cause confusion as to when an experiment was carried out. For example, 05/04/03 could be interpreted as May 4 2003, April 5 2003, April 3 2005, or March 3 2005, whereas 5 Apr 2003 or April 5 2003 is unambiguous. For *electronic experiment records*, use a numerical Year-Month-Day format (e.g. 2016-11-15) so that the files will appear in chronological order within a folder.

You may also want to include the *time* that you start and finish an experiment so you will know in the future the amount of time that a particular protocol requires.

Experiment Title – This title should be sufficiently descriptive to identify what method was used and why the experiment was done. For example: ‘RNA extraction from male TNF α KO mouse livers for qPCR’. This title should be used in the table of contents to identify the experiment. Biological replicate (BR) experiments should also be identified in the experiment title and within the table of contents. ‘MARCO-expressing CHO cells bind *S. pneumoniae* – BR #2’ provides an example of biological replicate identification.

Objective/Purpose – For a new study, write a brief description of why you are starting the study, list the objectives, and state any specific hypotheses of the experiment. You may also want to indicate how this experiment relates to previous experiments or indicate which step it is within a project.

Material and Methods – The first time that you do an experiment, record a very detailed account. Include in the material and methods:

- Where your samples were obtained from (provide the lab book page number and date, a reference to another individual’s lab book record, or a description of prior collection/processing methods if the samples were obtained from another lab)
- How the experiment was done
- If you would do anything differently in the future
- If any issues were encountered
- What equipment was used and where it is located
- Who showed you how to calibrate equipment or demonstrated a certain technique

This level of detail will allow you to refer to this protocol in the future if you repeat the experiment, perform a similar experiment, or if you need to troubleshoot the experiment’s results. If there is an established protocol (e.g. on the lab website), you may reference that protocol instead of completely rewriting it in your lab book, but be sure to include sufficient information to identify that specific protocol in the future (e.g. person who wrote the protocol and date it was originally written or updated, as well as version number if applicable). You can also paste a print-out of the established protocol in your lab book. **If you make modifications to an established protocol, those must be recorded in your lab book.** Similarly, if you follow the protocol of a published paper, or use it to develop your own protocol, include the reference for the paper or a copy of the protocol with any changes, in your lab book.

Regardless of the number of times you have done an experiment, always record all calculations and summarize formulas for future reference – if you make a mistake you will later be able to determine why your experiment may not have worked. In addition, always record where you obtained your samples and any information about their handling and storage that may later be pertinent (e.g. who provided your samples, how they obtained them, if the samples were at room temperature or on ice, the time between collection and processing, etc..).

Optional: Record the company source and serial number of important reagents (e.g. *Taq* polymerase, antibodies, enzymes). If the experiment is successful, you will likely want to continue using the same materials (from the same company) in the future. To contrast, if the experiment is unsuccessful, or does not work as well as a previous experiment using a different kit/reagent source, it could be because of the kit/reagents you used, so you will have that information readily available if you later compare results between multiple experiments and/or with another student in the lab.

Results – Record data directly in your lab book when feasible, and always **indicate if the experiment fulfilled its objective/purpose.** If you made or collected samples during the experiment, record this in your lab book, and label them in a way that will allow you to quickly find the experiment from which they originated. Record how you choose to label your samples at the beginning of your lab book so that anyone looking in your lab book will be able to easily find the information they are looking for about a specific sample and *vice versa*. If you use a sample again in a later experiment it’s easy to use the date to refer to the original experiment to determine how the sample was collected, treated, and stored.

At minimum, include the **date** and a **brief descriptor** on the sample tube (e.g. 'Oct 14 2016 pGFP') and place it in a labelled box with your name indicating the type of sample(s) within and the date the samples were obtained. Please note that these guidelines are also applicable to microscope slides and tissue cassettes. The date and your name/initials are necessary to enable anyone to search through your lab book to find information about a sample.

Include the date on buffers, solutions, or other reagents that you make for an experiment, so that you can refer to the recipe recorded in your lab book to make more at a later date, and/or to check your calculations if an experiment had unexpected results.

Maintain a binder/folder of records that indicate the locations where your samples are stored, whether at 4°C, -20°C, -80°C, in formalin, paraffin-disc, a microscope slide box, etc... Box maps are useful for this purpose to decrease the time required to find a sample, and help to avoid accidental thawing of frozen samples.

Reference the lab book page, date, and provide a description of the samples with the brief descriptor used to label the sample tube. If a large portion of a box is used to store samples from a single experiment, then include a title on the box map that refers to the experiment lab book page, date and purpose of the samples, for example: 'THP-1 cell lysates collected for qPCR analysis of mRNA expression after time course LPS stimulation BR #3, pg. 23, Nov 15 2016'.

You may have large quantities of physical data such as paper print-outs or Western blots, and/or electronic files of data, which are not feasible to directly place in the lab book. Therefore, at minimum write a summary of the experiment results and indicate where the data is available for review. Ideally, also include one or more summary figures of the final analyzed data.

Securely attach (glue, tape, staple) any loose paper(s) into the lab book if feasible. Physical copies of data may also be stored in separate folders/binders with a table of contents. Organize experiment data that is not attached to the lab book by **lab book and page number and date**, and include a note in the lab book as to where you can find the separately stored data. Following this approach will ensure that anyone referring to your lab book can find the correspondingly named external files.

All electronic files should have a copy within a folder with your name on the lab computer VAULT drive. It is extremely important that you **regularly back up your electronic data in multiple locations** so that loss of data from one file location (e.g. laptop or USB key) does not prevent you from accessing the data again. You can also back up data on the lab Google Drive. As described above, organize these files in folders with the lab book number and page reference for the associated experiment. Include the experiment title or an abbreviated version with biological replicate number if appropriate after the numerical labels. Label the data files within the folders with the experiment date in a Year-Month-Date format (e.g. 2016-11-15) to ensure all data is organized chronologically, followed by a description of the data.

Conclusions/Next Steps –

Record:

- The overall outcome of the experiment
- Things you would have done differently
- Things that you want to continue to do in future experiments
- What your next steps are based on the results

If you refer to this section of the lab book record the next time you plan a similar experiment, these notes will be helpful in designing your experiment. Your notes will indicate where the work left off with the experiment and how it may be continued in future experiments.

ADDITIONAL CONSIDERATIONS

- When you add a new entry into your lab book, separate it from the previous entry so it's clear when one entry ends and the other begins.
- You should start each lab book entry before beginning an experiment and record the details of the procedure while you are conducting the experiment. If this is not possible, record the experiment information as soon as possible after you complete the experiment. Similarly, add the results and conclusions sections promptly after analysis of the data.
- Keep records in chronological order. In industry, records must be chronological to be legally valid. If you are conducting multiple procedures on a single day and they all have long waiting periods, use your best judgement as to how you want to record the experiments. You can divide a single page into columns and write in them as each experiment progresses, or use consecutive pages. If you continue an experiment over multiple days, but are doing other experiments in that time as well, don't leave space to record each day's record for that single experiment. Instead, write '*Continued on page _____*' at the end of each day, and then '*Continued from page _____*' the next time you continue the experiment. This ensures that everything is still recorded chronologically and you can easily navigate through an entire experiment. Think of this like reading through a newspaper or magazine – articles are often continued later in the paper on another page.
- Each page should be numbered and dated consistently. Never leave blank pages – if you are leaving them blank for a future purpose (e.g. table of contents pages, cross-referencing of related experiments, adding summary of results or a figure after analysis), then indicate this on the blank page. In labs that perform proprietary research, such as in industry, or wherein results may dictate national policy (e.g. government), it is essential to never leave blank space because you or someone else could go back to change something and falsify your record. (In those labs, you are also often required to initial your own work daily, your supervisor will sign and date each experiment, and an independent person will also be required to review your notes as the lab book is essentially a legal document that can protect your legal rights (or your company's rights) to your work).
- Write in pen (preferably black or blue) so that your notes will not smear or be erased. If you make a mistake, cross it out with a single line – don't scratch/scribble it out or use whiteout. Every part of a page should be legible and filled with information or with crossed out blank space. If you like to write using abbreviations, include a list of them at the beginning of the lab book so anyone can follow what you have written.
- Use your lab book to record rough notes, or transcribe all notes directly into the lab book during or immediately after the experiment. Loose leaf paper or pads of tear-out paper (or paper towels) can easily fall out of pages within the lab book. It should not be possible to remove a page from the lab book without leaving evidence that it was removed.
- The lab book and its contents should be considered confidential and you must be careful to ensure that it is not lost or stolen. Immediately report if your lab book is missing to Dr. Bowdish. Ideally you should not remove your lab book from the lab without permission.