Keeping a Laboratory Notebook
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Introduction
Laboratory Notebooks properly written up provide important reference and source data for regulatory submission. The policy of Laboratory Notebook is designed to ensure well documented research records and will ensure maximum efficiency. Properly completed notebooks also present evidence that the laboratory has discharged its duty of care under Health and Safety legislation.

Issue and Identification
- The Laboratory Manager or his staff will be responsible for the issue of all laboratory notebooks.
- Each laboratory notebook will be issued to a specific individual for a specific project and be given a specific number.
- Each laboratory notebook will be assigned an unique number, and will be issued to a specific individual. The number will be in the format; MLSnumber/year e.g. MLS10/00.
- Different notebooks should be used for different projects, and an individual may possess more than one notebook.
- The notebook number, project, name, and date of issue are to be entered at the time of assignment on the page provided in the front of the notebook.
- The signature page is intended to allow the identification of all staff who make entries in the notebook, or who witness such entries. It should contain their names together with specimen signatures.
- All writing should be in black or blue permanent ink. No pencils should be used.
- All dates should be in the format; DD/MM/YY.
- Any times should be written down using the 24 hour clock. Notebooks should not be taken off University premises unless the author is on sabbatical at another location. Laboratory notebooks remain University property at all times.

Index
- The index is to be entered in ascending page number order at the start of each experiment and dated. The index must contain the full title of each experiment.
- The title should be unique to each experiment and enable the precise nature of the experiment to be identified.
- Where two or more experiments are being conducted concurrently, it may be confusing if all work is reported literally chronologically.
- The use of separate notebooks for different series of experiments is preferable to the serial recording of contemporaneous work, as the recollection of events may change with hindsight.
- A line must be drawn through any unused part of the index.
Contents

• A comprehensive set of instructions is included inside each notebook.
• These instructions must be adhered to in order to ensure well documented research and to achieve maximum patent protection.
• All entries must be made in blue or black ink or ball-point. Where possible the use of red should be avoided. Pencil must not be used.
• Should an error be made in a notebook entry the author should draw a line through the incorrect part; obliteration with "liquid paper" must not be used. Blank pages or unused parts of pages are voided by crossing them out with diagonal lines. All corrections or deletions should be accompanied by an explanation signed and dated by the author.
• The author should include all experimental results and conclusions legibly in the book. Entries should be sufficiently explicit to enable that experiment to be repeated by a fellow scientist.
• Where other forms of data recording are used the author must cross reference both the notebook and the raw data such that future retrieval and reference are made possible.
• Graphs, spectra or other data formats should be attached to a notebook page using adhesive rather than paper clips or staples. The author should sign across the join between the attached material and the underlying page. Data can be stored separately in a file bearing the same unique notebook number, but only if it is not possible to fix it permanently into the notebook. A separate file is required for each notebook. The attachment whether included in the notebook or filed separately should be annotated with the notebook number and page signed and witnessed, and be clearly referred to in the text.
• Notebook entries should be signed and dated by the author at the end of each experiment and in a long experiment at suitable intervals during its course. The entries must be countersigned by the supervisor as soon as possible. This will indicate that the witness has read and understood what has been recorded.

Witnessing and Audit

Laboratory notebooks must be witnessed as soon as possible after a particular entry has been made. The date of entry is the effective date for patent protection purposes. As a general rule the book will be witnessed by the worker's main supervisor. In the absence of the appropriate witness the witness should be a project leader of the group of the witness or their nominated deputy.

What are the general expectations of maintaining a lab notebook?

The following are rules and reasons for maintaining your notebook. Deviations from the rules will affect your grade.

1. Do not erase - cross out instead. Do not remove pages.

• All entries must be made in blue or black ink or ball-point. Where possible the use of red should be avoided. When recording experiments, do not use pencil or strange-colored inks. Ensure that the ink is permanent, not water or solvent reactive, and does not smear. It should also be light stable. Permanent ink is necessary to maintain an accurate record of observations and actions.
• Should an error be made in a notebook entry the author should draw a single line through the incorrect part; obliteration with "liquid paper" must not be used. Never cover a mistake with Liquid Paper, White Out, or any other type of "corrective" material. This will allow you or another person to see what error was made (quite often, the perceived error is actually useful data and needed at a later date). You should never white-out, erase, or completely block out any marks in your laboratory notebook. Your mistake may end up being necessary information. It is very difficult to recover information from mistakes that are completely covered or erased.

• Entries should not be changed at a later date. Make a new entry, pointing out any change.

• Blank pages or unused parts of pages are voided by crossing them out with diagonal lines.

• Calculations or graphs may be made in pencil if desired. All computations done in the laboratory are to be entered in the notebook.

• You are also to never remove pages.

2. Attach printouts, charts, etc. permanently.

• Paste, tape, or staple all computer outputs, photographs, or other similar information obtained during the experiment directly into the notebook with an adequate description. Do not use paper clips to secure documentation. The author should sign across the join between the attached material and the underlying page.

• Any loose material turned in with the notebook will be discarded. During a test, your lab notebook is subject to being shaken. Any papers that fall out will be confiscated and kept by the instructor.

• If you write anything down in the laboratory, put it in the laboratory notebook. You should write nothing, no matter how unimportant it seems, on loose sheets of paper. If you must write something on a loose piece of paper, glue or tape it into your notebook.

• The entire lab notebook should be collected at least once each term to make sure these rules are being followed on the white pages.

Storage
When a project is deemed to have finished (i.e. when no research or development work is being performed on that project), the completed notebook should be returned to the head of the laboratory, who will arrange for secure storage.

Good luck for a bright research
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Research Laboratory Notebook
Policy

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Meetings

• Seminar
• Workshop
• Conference
• Symposium
Seminars

• **A seminar** is a meeting with a limited number of experts to exchange experience on a specific subject with the purpose of enhancing knowledge and understanding of that subject.

• The duration of a seminar could be from 1 to 5 working days.
A Workshop is a meeting of individuals which usually cover one specific area. It includes group discussions, new organizational changes and several suggestions for coping with them.
Conferences

• A Conference is a meeting of individuals or representatives of various bodies for the purpose of discussing and/or acting on topics of common interest.
A Symposium is originally referred to a drinking party (the Greek verb sympotein means "to drink together").

How do we know what we know?

A formal meeting at which academics, researchers, clinicians and other specialists make presentations on particular subjects and discussed with a view to making recommendations concerning the problems under discussion.

It is characterized by an openly discursive format, rather than a lecture and question-answer format.
Lab Notebook

IT IS A MUST NOT AN OPTION

HTTP://WWW.BIO-LINK.ORG/GMP/INTROB.HTM
Steps of Doing Research

- Hypothesis/Planning
- Experimentation (Raw Data)
- Refine
- Publish

Notebook work
The Role of the Laboratory Notebook

The laboratory notebook is a complete record of what you have done in the laboratory.
The laboratory notebook is a draft of your papers!
The Role of the Laboratory Notebook

In both academic and industrial settings, the notebook is a legal document that records your original work.
The Role of the Laboratory Notebook

• In a "real life" research situation, someone may have to reproduce your work several years after you have left the laboratory.

• The only record they will have to rely on will be what you wrote in your notebook.
The Role of The Laboratory Notebooks

• Lab notebooks in general are used by scientists and technicians to document research, experiments and procedures performed in a laboratory.

• A lab notebook is often maintained to be a legal document and may be used in a court of law as evidence.

• Similar to an inventor's notebook, the lab notebook is also often referred to in patent prosecution and intellectual property litigation.
The laboratory notebooks are occasionally subpoenaed

- For example, in 1995 Exxon and Dow Chemical became embroiled in a patent dispute that arose when both companies claimed to have invented a catalyst within two weeks of each other.
- That dispute involves a product line worth hundreds of millions of dollars per year and has yet to be resolved.
- Both companies are building their cases around laboratory records and employee depositions.
- Corporations require employees to keep, sign and witness each the record week!
Types of Laboratory Notebooks

- A Composition Notebook
- An Electronic Notebook
- An Open Notebook Science
Composition Laboratory Notebook
Laboratory Notebook Specifications

• Most lab time should be devoted to experimental work rather than writing.
• It is useless to do the work unless it is properly recorded for later use and reflection.
• Your notebook should be neat, orderly and complete for someone else to be able to read it and to understand what you did and the results you obtained.
• NEVER use intermediate scratch sheets.
Laboratory Notebook Specifications

- The notebook should be bound, with numbered pages.
- The first three pages should be reserved for a table of contents which must be kept up to date.
- Each experiment should begin on a new page.
- Never put information from more than one experiment on a page.
- Include the following items on EVERY page:
  - The title of the experiment ("continued.." if applicable)
  - Your name
  - The date
• Mistakes are to be clearly crossed out but left in a legible manner. The reason for any correction should be noted.
• Do not skip pages in your laboratory notebook to allow space for the completion of an incomplete experiment.
• Instead, make references on the pages involved such as "continued from page 7" or "continued on page 9".
Alexander Graham Bell's notebook entry of March 10, 1876, describes the first successful experiment with the telephone, during which he spoke through the instrument to his assistant, Thomas A. Watson, in the next room. Bell writes, "I then shouted into M [the mouthpiece] the following sentence: 'Mr. Watson, come here, I want to see you.' To my delight he came and declared that he had heard and understood what I said."
Alexander Graham Bell's Laboratory Notebook

The Bell papers were donated to the Library of Congress by his heirs on June 2, 1975, the centenary of the day Bell discovered the principle that made the invention of the telephone possible. This extraordinarily rich collection totals about 130,000 items and documents in great detail Bell's entire career, ranging from his work on the telephone to his interest in aeronautics and physics.
Lab Notebook: **Components**

1. Procedure
2. Data
3. Comments
4. Result evaluation

*Comments, Data and Procedure belong together. They should not be separated under 3 different headings.*
Components: Daily Procedure

• Procedure should be written as each portion of the experiment is performed.
• The procedure should be as short as possible and still contain enough of the detail that another BIOLOGIST could repeat your work.
Daily Procedure: Phases

• **Before** you come to lab..........................
• **During** each laboratory period..............
• **After** each laboratory period...............
Daily Procedure: Before

• Before coming to the laboratory, write a short paragraph stating....
  
  – the readout to be measured,
  – the method will be used to measure the readout.
  – the results which are expected to be obtained.
Daily Procedure: Before and during

• **Before** you come to lab,
  – review the experiment and make any necessary calculations in your notebook.
  – You will get out of lab MUCH faster if you are prepared ahead of time and understand the experiment you are about to perform.

• **During** each laboratory period,
  – enter data and comments in your book according to the guidelines given below.
Daily Procedure: At The End

- Clean up your lab area and equipment, making sure to leave common equipment in equal or better condition than you found it.
- Give your notebook to your instructor to inspect and initial. If everything is in order, the instructor will initial and date your book.
- If you perform calculations outside the lab or work up data, be sure to enter these in your notebook and turn in the duplicate pages during your next laboratory period.
Components: Data

- All data and descriptions should be entered directly into your lab notebook.
- Numbers must be written along with their units.
- There should be some explanation or heading for every set of numbers.
- You should do short calculations, such as subtraction of weightings, additions, etc., right on the data page before you turn it in and leave lab.
Components: Data

- Chemicals should be described by the name and formula.
- Manufacturer, grade, and lot number should be given where possible.
- Equipments should be described either by a labeled sketch or a complete reference to the detailed description in the literature.
Components: Data

• It is not necessary to describe standard or "everyday" glassware or hardware which might be used in any experiment.

• Larger or special equipment and instruments should be described:
  – Name of item (or description) and size if applicable
  – Manufacturer and model number or catalog number
Electron Beam Circuit Diagram

Heater +
Power Supply

Cathode

Anode

Acceleration
Power Supply

Chamber

* Electrons boiled off heated nickel cathode, accelerated to anode

* Chamber/anode connected to be at some potential (no E beyond anode)
This page from Brannock's laboratory notebook shows how he figured out how the device would work.

In 1925, Charles F. Brannock invented the Brannock Device to measure feet and determine shoe size. He got the idea while working in his father’s shoe store, the Park-Brannock, in Syracuse, New York. He was 22 years old.
Components: Comments

- Put down anything that might be pertinent or helpful.
- It is better to write down things which you may not need than to leave out something significant.
- The comments may be in "note" form as long as they are complete enough to be intelligible to others.
Components: Result Evaluation

• Collect your results and organize them so that they can be easily assimilated and compared.
• Tables and graphs should be titled and completely labeled.
• You may want to plot several pieces of similar information on the same graph for easy comparison.
Experimental: Result Evaluation

• Be familiar with generally used methods of treating experimental data.
• Include a discussion of the significance and reliability of the results with sufficient discussion to justify the use of your procedures.
• Illustrate all computations by writing the appropriate formula or equation, substituting a sample set of data (with units) and listing the answer.
• Propagation of Errors:
• If you are reporting a number, it MUST have an error!!
• If you develop a computer program for analyzing your data, the print out from the program must be neatly stapled into your notebook.

• Also include a listing of the program, which should be neatly stapled into your notebook.

• Acknowledge any help in programming from outside sources, including help from your fellow students.
Experimental: Result Evaluation

• Your experimental result should be compared with accepted or typical literature values.
• Record the source in your notebook for use in your lab report.
• Comparisons should include notations of significantly different experimental conditions or procedures.
• Both absolute and relative differences should be included.
Experimental: Result Evaluation

• If there is a circumstance which would explain good or bad results, describe it and give an estimate of its magnitude and effect.
• If you have suggestions for improvements in the design or recommended experimental procedures, make them clear in this part.
Example:

1. The page has the date.
2. That a typing error has resulted in a 033 when 003 was intended. The error is clearly indicated.
3. Whiteout has been used to correct a mistake. This is usually considered bad laboratory practice.

From the research Notebook of Professor (Emeritus) R.E. Azuma of the Department of Physics, University of Toronto
This is a series of notes on some of the computer issues relating to these experiments.

Note that Professor Azuma has two clear opinions on some of the conventions of his software environment.
The first page shows some bad news: much of the proceeding work will have to be re-done.
NEW ENERGY CALIBRATION

Use Spec. 002.DAT.

$E_p = 800 \text{ keV}$

Energy levels from A-Selone.

$Q(\text{Se Li}) = 90^\circ \quad \text{NO DOPPLER.}$

Final Calibration

$I = -0.039 \text{ MeV.}$

$m = 0.002225 \text{ MeV/channel.}$

Alternatively

Use $b = -0.03383$

$m = 0.0022228$

$qwd = 6.4 \times 10^{-10}$

The second page shows The new calibration.
The third page shows a new experimental set-up.

1. **Target Chamber**
   - Insulating beam pipes
   - 3/8" collimator
   - N2
   - HVDC Insulated Filling

2. **Preliminary Vacuum Test**
   - Pump down overnight for **FIRST TIME**
   - Vac = $2 \times 10^{-6}$ Torr.
   - Bake Out started at **11:00 AM**.
   - Max press. of $8.2 \times 10^{-6}$ reached at **3:00 PM**
   - Press. now begins to drop.
   - Bake Out turned OFF at **4:30 PM**, Press. $7 \times 10^{-6}$
Bad Example
General Attitude

It is better to put in too much data than too little!
Electronic Laboratory Notebook
Electronic Laboratory Notebooks

• An electronic lab notebook (ELN) is a software program designed to replace paper laboratory notebooks.

• ELN are a fairly new technology and offer many benefits to the user as well as organizations.

• For example ELN are easier to search upon, support collaboration amongst many users, and can be made more secure than their paper counterparts.
Types of ELNs

- "Specific ELNs" contain features designed to work with specific applications, scientific instrumentation or data types.
- "Cross-disciplinary ELNs" or "Generic ELNs" are designed to support access to all data and information that needs to be recorded in a lab notebook.
A Good ELN

• Offers a secure environment to protect the integrity of both data and process.

• Afford the flexibility to adopt new processes or changes to existing processes without recourse to further software development.
A Good ELN

• Should be an "out of the box" solution for inclusion of structures, spectra, chromatograms, pictures, text, etc where a preconfigured form is less appropriate.

• All data within the system should be stored in a database and therefore be fully searchable.

• The system should enable data to be collected, stored and retrieved.
A Good ELN

• Should enable secure forms to be generated that accept laboratory data input via PCs and/or laptops / palmtops.
• Should be directly linked to electronic devices such as laboratory balances, pH meters, etc.
• Networked or wireless communications should be accommodated for by the package which will allow data to be interrogated, tabulated, checked, approved, stored and archived to comply with the latest regulatory guidance and legislation.
A Good ELN

• Should include a scheduling option for routine procedures such as equipment qualification and study related timelines.

• Should include configurable qualification requirements to automatically verify that instruments have been cleaned and calibrated within a specified time period, that reagents have been QC'd and are not expired, and that workers are trained and authorized to use the equipment and perform the procedures.
1. **Business perspective**: the admissibility of electronic records in support of patent interferences and patent infringements; the costs associated with an electronic solution, and compliance issues.

2. **Technology perspective**: doubt about the available technologies that are able to preserve electronic records over the long term.

3. **User perspective**: worry about change management and the impact upon scientists of replacing an established and proven documentation process.
Open Notebook
Science
Open Notebook Science (ONS)

- **ONS** is the practice of making the entire primary record of a research project publicly available online as it is recorded.
- This involves placing the personal, or laboratory, notebook of the researcher online along with all raw and processed data, and any associated material, as this material is generated.
Advantages of ONS

• Enables other scientists to obtain detailed descriptions of procedures, raw and analyzed data to either compare with their own work or to build on.

• Can improve the communication of science, increase the rate at which research can progress, and reduce time lost due to the repetition of failed experiments.
Disadvantages of ONS

• ‘Data theft’ or 'being scooped’
• ‘Data deluge’: how to cope with the huge quantity of non peer reviewed material most of which are of poor quality.
• ‘My notebook is too specific' for it to be of interest to anyone else.
• “Prior publication”: making it impossible to patent or publish the results in the traditional peer reviewed literature.
Our Status!!!!!!!!

What kind of Notebook we have??????????

What kind of Notebook we have???????????
Thank You

Dr. Mohamed Labib Salem