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THE LABORATORY NOTEBOOK AND YOUR SUPERVISOR

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Documentation of experiments, either in the laboratory or in the field, is a vital aspect in one's scientific career. All experiments would eventually end up in a project report, thesis or a journal publication. The beginning and end of a research project would require a few months for an undergraduate or 3-4 years for a post-graduate thesis. The writing of the thesis is usually postponed to the final stages. This is when you look into your laboratory notebook and expect all the experiments to have been faithfully recorded in detail. The sad experience of many students is the lack of details, incomplete records, undated experiments etc. Paying attention to some simple habits would avoid much frustration after months or years of hard work. A well-documented notebook would ensure a better thesis and more time to spend on interpretation of your results. The following suggestions are to ensure a decent record of your experiments.

The Notebook

1. Use a bound notebook
   A bound notebook is a must. Spiral bound or loose-leaf notebooks are unacceptable, where the pages can be easily torn out and lost. Records should **never** be done on scraps of paper (or on your palm!).
2. The pages of the notebook should be consecutively numbered. On the first page include your name and contact details, institute address, supervisor's name, email address, telephone numbers etc. If more than one notebook would be used during the course of your research project, number the note book on the outside cover.
3. All records should be written with permanent water proof ink (e.g. "ball-point" pens). Do not use pencils. Mistakes during recording should not be scratched out or covered with correction fluid or a white marker. They should be crossed out with a single line – in case you later decide that the original value was indeed correct.
4. The names and contact details of others who helped you with the research, such as those in another institution or laboratory, in field experiments, or technicians who handled specialized instruments, should be recorded – you may need clarifications from them later.
5. Explain any non-standard abbreviations to be used in the notebook.

What should be Recorded?

Title and Identification of the Experiment

The title of the experiments reflects the objectives of your experiment. It should be informative, followed by a brief and concise introduction stating the objective of the experiments and the observations that would be made. The major experiments that are necessary to meet the objectives of your theses or report should be given a serial number. During the course of your experiments it may be necessary to conduct further smaller experiments. These should be numbered under the main experiments (e.g. 1 is the main experiment, and 1(i) or 1(a) are minor experiments). The necessity of further experiments usually occurs during a preliminary analysis of the results, where it may be necessary to further clarify the results.

Date and Location of the Experiments

Include the laboratory number or location of the field, where the experiments are conducted. The time of recording the data should be included. These are minor details which can be useful during interpretation of your results later. Include environmental conditions (e.g. temperature) in the laboratory, field or green house. A good scientist is always alert and observant during the experiment, either in the field or laboratory, and makes clear comprehensive notes immediately. Do not rely on your memory to record later, however unimportant an observation may appear to be. A meaningful report or thesis, which is to be written in the future, is based on an accurate description of the experiments, which are recorded now when conducting the experiments. This requires making immediate observations and records in the note-book, to be written up and used later.

Brief Outline

Write a brief introduction to the experiments stating the objectives of the experiments to be conducted and what observation and measurements would be made. Record the sources of external data you intend to use such as climate data, maps, statistics from government agencies etc. Include the major references relevant to the study. If chemicals are used, record the basic information from the container itself such as molecular weight, grade of purity, date of acquiring the chemical, date of expiry (is it old?), the name of the supplier and country of origin. Where chemical reactions are involved, balanced equations should be recorded.

Equipment and Chemicals

Before beginning the experiments ensure that all the necessary equipment, chemicals and glassware are available. If not available in the lab, they may have to be borrowed or orders placed with suppliers. Make a check list of all the necessary items and

indicate the status of availability. This is particularly important in chemistry and molecular biology where chemicals should be obtained from overseas suppliers. This also requires a long process of placing orders and clearing the chemicals.

Methods

Make an outline of the experimental procedure, perhaps using a flowchart. A lay-out of your experiment – whether in the field or in the lab-with replicates, and experimental units, gives an overview and any flaws in the design can be detected early. This should be discussed with your supervisor.

The procedure to be followed is usually a standard method available from a laboratory manual, publication or an established method in the laboratory. The source of the method should be recorded and a step-by step description of the protocol to be followed should also be recorded. During the course of the experiments, changes may have to be made to the original protocol. These deviations from the standard procedure should be recorded in the thesis or report. Printed protocols and hand-outs on safety measures should be securely filed (not-loose-leaf) and labeled. Output from instruments should be dated, labeled and pasted onto the notebook. Any deviation from a routine procedure should be noted. Such deviations or substitutions could be due to the absence of either a chemical or an instrument requiring the improvisation of a method. Thus, however, irrelevant or trivial, a change in methodology should be recorded, which would help to explain the future unexpected outcome of an experiment.

Interacting with your supervisor

Supervisors are busy people, particularly the senior staff, who have many obligations such as preparing and delivering lectures, attending to administrative duties, writing grant proposals and research publications, attending meetings, supervising research students besides you and many other duties. To make effective use of your supervisor's time, and perhaps create a good impression of yourself, you should pay attention to the following.

1. After the first discussion with your supervisor, where your topic is assigned to you, solve the many methodological problems with other senior members and technicians in the lab. Usually there would be a second supervisor who would be very helpful.
2. Always fix an appointment in advance for discussions unless something urgent needs to be resolved.

3. When attending a discussion carry a notebook and make notes of the discussion. Also note down first what you need to discuss with your supervisor.
4. Do not bother your supervisor frequently: it is an indication that you are not independent.
5. Once your research is progressing, give written material in advance for a discussion. This could be a short progress report, tabulated results, draft sections of the report or thesis etc. All the drafts should be dated and named.
6. Show the drafts first to your immediate supervisor in the lab.
7. Subsequent drafts should always be accompanied by the previous drafts, with the supervisor's comments, so that he/she can concentrate only on the changes.
8. Attend to all the comments by the supervisor and explain if you are making any changes.
9. Before submitting the draft thesis have it corrected for grammar and spelling (use the spell checker): the supervisor can then concentrate on the science and less on the English.
10. The supervisor is there to help and guide you. Always discuss any problems that you are unable to resolve. Undertake any changes to your experimental work only after consulting your supervisor.