

## GUIDELINES FOR WRITING PRACTICAL AND PROJECT REPORTS

An important skill that all scientists must acquire is the written presentation of their findings, either in the form of a report or scientific paper. Two of the aims of laboratory classes and field trips are :- 1) training in the collection of data and 2) developing skills (through writing and feedback) in the presentation of data. The results from laboratory practicals, field work and undergraduate projects must be written in a standard format. **This is normally in the form of a scientific paper.** The standard format of scientific papers was developed by scientists over years and there are many good reasons for the format that has been agreed upon. Perhaps the most important reason is that it ensures that information is presented logically and in a uniform way.

All scientific papers are structured in the following way. They begin with a title to the work and an abstract, following on from which are an introduction, methods section, a results section, a discussion and a reference list. (Note: there are a few journals where the order is Title, Abstract, Introduction, Results, Discussion, Methods, References). Most undergraduate laboratory experiments reports need not be long or detailed (between 3 and 5 double-spaced typed A4 pages should be regarded as the maximum) but they should contain all of the above elements. The abstract, which is a summary of the contents, is important to scientific documents as this is recorded by abstracting journals such as Biological Abstracts. The abstract, along with the title, allows scientists to determine whether the contents of your paper, or thesis, may be relevant to their work without having to read the entire manuscript.

Before beginning a report it is advisable to look through some published papers in biological journals to give you a better idea of the correct approach and what information each section contains. In short, the introduction and methods respectively tell why and how you got your results, the results section explains what the main findings were, and the discussion explains what they mean.

### General information

As computers are readily accessible to students, it is expected that student reports are printed using a good quality printer. Basic use of a computer is an essential skill that all university students should acquire as soon as possible. Reports should be printed on **one side** of the paper only and the text should be **double spaced** using at least a 12 point font size. This

document for example has used 12 point Times Roman font. The reason for this format is that it allows markers or reviewers to read the information more easily and provides space between the lines of text in which to insert comments on what you have written. It is also important that the report is written in good, concise English, with no typographical or spelling errors. Such errors indicate a lack of care in the final production of the report and possibly with the rest of the work. Most word processing packages have spell checkers, but **beware**; these do not detect words that are used incorrectly even though they may have been spelt correctly, and also tend to correct English spelling to American. You must proof read your report carefully. Always prepare a rough draft of your report before typing information into the computer. Never be satisfied with your first effort. A good report is usually one that has been edited and rewritten several times.

### **The Title**

The title should be short, but informative and enable a reader to grasp immediately the subject of the report. For example a project report entitled “Estuaries practical” is vague and uninformative. The only thing that a reader would understand from such a title is that the report has something to do with estuaries. A title such as “Distribution and abundance of zooplankton in the Kariega estuary” would at least inform the reader of what was studied (zooplankton), what aspect of its biology was investigated (distribution and abundance) and where the study was carried out (Kariega estuary). If the title contains the scientific name of a species, this name should be followed by further information on the group of animals to which it belongs, for example, *Sesarma catenata* (Crustacea, Brachyura). Whereas some researchers may not know what type of animal *Sesarma catenata* is, all zoologists should know what crustaceans and brachyurans are.

### **The Introduction**

The purpose of the introduction is to supply the readers with sufficient background to allow them to understand and evaluate the results of your work without needing to refer to previous publications on the topic. It should:

- Explain what problem was investigated, referring to previous published studies to place the work in context.



- Present the nature and scope of the problem investigated.
- Mention how you approached the problem.
- Present the rationale for the study - why is the work being undertaken?
- Give the aims of the study.
- Present a hypothesis to be tested or questions that are being asked.

### **Materials and methods**

The materials and methods must provide enough detail on how you did your experiments, or collected the data, to enable experimentation and data collection to be repeated by someone else. **N.B.** Methods are not a set of instructions or a recipe e.g., "Put six limpets in a glass jar and place them in a water bath. Measure the temperature with a thermometer".

Methods are usually (but not always) written in the 3rd person and past tense. For example "Six limpets were put in a glass jar placed in a water bath. The temperature was measured using a...." Important information that might be needed could include information on number of animals used, number of times the experiment or sampling was replicated, controls used, area sampled, time and date of sampling, duration of experiments, experimental conditions (e.g. temperature, humidity, salinity - were these environmental conditions kept constant and if so how?), if experiments were on aquatic organisms was the water aerated, etc.

Excessive detail, however, is not always needed. For example, the principles of operation of instrumentation (e.g. spectrophotometers, oxygen probes, osmometers etc.) need not be described. It is adequate to state what instrumentation was used. Some extra detail is, however, sometimes necessary. For example, because there are several different possible ways and configurations for measuring oxygen consumption in some animals it may be necessary to state that "oxygen consumption was measured in an open flow-through system" and to describe the order in which air passed through the different components of the system. It may be necessary to give some details on the make and model of equipment used.

The final information often placed in the Materials and Methods section is how the data were analysed statistically. This includes details on the statistical software package used (name, version, publishers: e.g. SigmaStat version 3, SPSS Science).

## The Results

The results section is where the data obtained are presented. Normally these are presented, where possible, in Figures (diagrams, photographs or graphs - see data representation and graphical techniques) and Tables.

**N.B.** It is not sufficient to present results as tables and figures **only**, leaving the reader with the task of interpreting them. The important results or trends from tables and figures **must** be explained using text, otherwise the reader might misinterpret results or overlook important points. All Tables and Figures must have a table or figure number (e.g. Figure 1). Readers can then be referred to the relevant table or figure in the text of the results section. For example "Oxygen consumption of large animals was double that of small animals at the same temperature (Table 2)". Rather use this parenthetical format and avoid self-evident phrases like "Table 3 shows that..." or "As can be seen in Figure 2.....". Each table and figure must be accompanied by a caption which briefly explains the contents of the table or figure. For example:

Fig.1 Relationship between external salinity and blood osmolarity in the intertidal limpet *Scutellastra cochlear*.

It is not necessary (or desirable) to present **all of your raw data**, although for some practical reports you may (consult with the lecturer in charge). For example, you may take numerous readings of a parameter over a period of observation, or readings from several animals. It is not necessary to present every reading for each animal when what is important is the mean values (and some estimate of the variability such as standard deviation or standard error, and the sample size).

Do not **discuss** results in this section.

## The Discussion

The discussion is where the meaning of the results is interpreted; **it is not where the results are repeated or new/more results reported**. Essential features of a discussion are:

- To present the principles, relationships and generalisations shown by the results i.e. put results into context.
- To point out any correlations or lack of correlations.

- To show how the hypotheses, results and interpretations agree (or disagree) with previously published information on the subject, citing references where appropriate.
- To state any conclusions and summarize evidence for them.
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**The Reference List (Note: to find out how to cite references in the text read pages 21-24)**

These are cited in alphabetical order and completely so that a reader may locate them if required. There are many different formats by which scientific references are presented in a reference list. What most have in common is that they are presented with the names of the authors first (surname followed by initials), the date of publication, the title of the reference, name of the journal (in full or abbreviated), volume number and then page numbers of articles. All this information enables readers to find the reference themselves.

For example:

Rahn, H., Ar, A. & Paganelli, C.V. 1979. How bird eggs breathe. *Sci. Am.* 240: 46-55.

*NOTE: Do not make up journal abbreviations. Journals have internationally recognized abbreviations and you can find these in handbooks in the library. To find the correct journal abbreviation, go to the Interlibrary Loan section and ask the staff there for the indices to journal abbreviations. Alternatively these are now online at <http://www.ru.ac.za/library/journals/journaltitleabbreviations>*

Within the reference list, references are placed in alphabetical order. Where more than one paper from the same author has been cited, the references are then placed in chronological order. If an author has published work on their own, as well as with other researchers, then these papers appear in the reference list as the single author papers in chronological order followed by multi-author papers in chronological order. An example of such a sequence is given below, the titles of the papers and journal names having been omitted for clarity.

Smith, J. 1990

Smith, J. 1995

Smith, J. & Jones, F. 1990

Smith, J. & Jones, F. 1995

Smith, J., Jones, F. & Brown, A. 1990

Smith, J. Jones, F. & Brown, A. 1995

### **Endnote**

The key to good writing is to consider your readers' needs, and to rewrite and edit the text several (e.g. five) times with that in mind.