Department of Biology
Lund University

INSTRUCTION FOR PROJECT REPORTS

Why write a project report?

To write a project report is an opportunity to practice how to document an experiment/field study, to communicate your results, and to write scientifically. Writing skills are necessary to convey information and knowledge, and are required by future employers both within and outside academia. By describing the theory behind a project with your own words, and by reporting and discussing the results achieved, your understanding of the topic is enhanced. To write a project report is also good practice for the more extensive thesis report you will write later in your education.

General guidelines

The research question should be the common thread through the report: *Why* did you explore this research question (Introduction)? *How* did you address this research question (Material and methods?) *What did you find* in relation to the research question (Results)? *What do your results mean* in relation to the research question (Discussion)?

Write in a way that allows a fellow student that has not been involved in the project to understand the purpose, execution and outcome of the project, and follow the reasoning in the discussion. Write clearly and concisely and avoid unnecessary words. Use specific expressions (”Samples were taken when the experiment was started and after 24, 48 and 72 hours.”), and avoid vague and subjective expressions (”Samples were taken numerous times during a long period.”). Write in past tense when you account for what you have done (”I counted the number of seeds…”), but in present tense when you refer to general facts (”Formalin preserves the sample…”). You may use active form when describing what you yourselves have done: ”We counted the number of cells…”, rather than ”The number of cells were counted…”. Passive form can be used when you are not directly involved, *e.g.* ”The sample was centrifuged…”.

Species names should be italicized (*Canis lupus*) and the full-length name should be used the first time the species is mentioned in the text before the abbreviated version is used (*C. lupus*). Gene symbols should be italicized (*lacZ*). All abbreviations should be explained first time they are used.

An efficient method to make sure all information is included and presented in a logical order, is to first list as bullet points all information that should be included. After that the bullet points can be organized in a logical order, and finally a running text can be composed. Readability may be enhanced by dividing long paragraphs in several shorter and avoiding the use of too small fonts.

Structure and content

Title
Authors
Course name and date
Introduction
Materials and methods
Results
Discussion
References

Title

The title should be short and concise and describe the main conclusion/message of the study.

Introduction

The purpose of the introduction is to make the research question relevant, interesting, clear and understandable. Start by giving background information that shows why the research area is relevant. (”Bacteria are the most abundant organisms in nature and play a key role to the global carbon cycle.”). You can also connect to general biological theory or ecosystem services when relevant. Give information on the state of knowledge of the research area based on previous studies (”It is well known that bacterial activity in soils is regulated by pH (Baath et al., 1983), but limnological studies have focused on the role of temperature and resources and have generally ignored pH (Mostovaya et al., 2010).”)

Then present the research question that is the basis of the study (”The purpose of the current study was to explore what regulates bacterial activity in lakes.”). State the hypothesis/es (”We hypothesized that bacterial activity would be higher in lakes with higher pH”). You may also write something very brief about the approach used to test the hypothesis (”To test this hypothesis we measured bacterial production in 7 lakes that encompassed a wide pH gradient.”).

Materials and methods
The purpose with this section is to describe how you have gone about testing your hypotheses. The description should give enough detail to allow that the study could be repeated. A clear description of the methods is required for the reader to understand and evaluate the accuracy of the results.

Briefly describe how the study was designed to test the hypotheses. Describe field sites, experimental systems, organisms, analytical methods etc. Refer to species identification keys if used. Regarding specific methods applied, you may refer to scientific articles/books or course compendia for exact procedures, but information should be given so that the reader can understand the principles of the method without consulting the original source. (”Bacterial abundance was estimated by counting of DAPI stained bacteria in a fluorescence microscope according to Porter and Feig (1994).”). You need to state any deviations from the protocol you refer to. It is the *principle* rather than the *procedure* of a specific analysis that should be described. For instance, “The water was filtered through a 0.2-µm filter.” is more appropriate than “A 0.2-µm filter was placed on the bottom part of a magnetic filter holder and secured with the upper part. The water was poured onto the filter and by applying a negative pressure with an electric pump the water passed through the filter.”

Describe formula or equations that have been used for calculations of results. Describe and motivate which statistical methods have been applied to test the hypotheses. If you present lots of species names, e.g. after conducting an inventory, it is common to present the source of the names such as the flora or bird guide used.

Results
The purpose of the results section is to present the results necessary to test the hypothesis and validate the test conditions. Results are presented in figures/tables and in a running text that clarifies the most important aspects of what has been found. In the text you should describe the patterns, trends or relationships you have observed, without drawing conclusions. Select how the results are presented – in a table or figure and the type of diagram – based on what best illustrates your data. Raw data and calculations are rarely included in the results presentation, but may in some cases be placed in an appendix.

For tables, a legend that briefly describes what information is given is placed above the table, much like a heading (Table 1.). Specific explanations should be given in footnotes below the table. Figures should have a figure legend below the figure that describes the information given in the figure (Fig. 1). All axes should be graded and have units. Table and figure legends (in combination with footnotes) should contain enough information so that the table/figure can be understood independently of the running text.

Table 1. Physical and water chemical variables for the studied sites.

	Temperature (°C)	pH	DOC (mg/L)	Total phosphorus (µg/L)
Fiolen creek[a]	22	4.2	25	15
L. Skärsjön	21	5.5	20	12
L. Hjärtsjön	21	5.8	15	15
L. Lammen	19	6.2	15	10
L. Fiolen	19	6.7	10	7
L. Trummen	20	7.8	8	18

[a]Eastern inlet

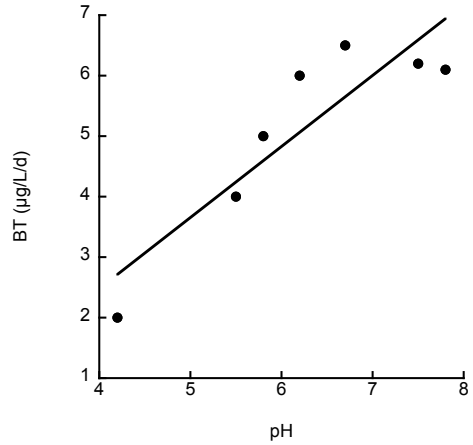

Figure 1. Bacterial growth (BG, µg/L/d) as a Function of pH across the studied sites.

Refer to figures and tables in the running text. Number and place figures according to the order in which they are mentioned in the text. Highlight the most important aspects of the results in the running text. Write: ”Bacterial growth was higher in lakes with higher pH, but the effect seemed to level off in waters with pH > 7 (Fig. 1).” This is an interpretation of the data and informative. Do not write: ”Fig. 1 displays the results.” This is not informative.

The hypotheses should be tested statistically. The statistics should be used as support of your interpretation, but not be the focus of the text. Write which differences/relationships you have found: ”Bacterial growth was higher in lakes with higher pH ($r^2 = 0.79$, $N = 30$, $p < 0.001$).” Do not write: ”The regression was significant.” Here the statistics is in focus, but it is not clear what it says about your data. Report both p-values, sample size/degrees of freedom and the specific test statistics, *e.g.* t , χ^2 or r^2.

Data should be reported with a reasonable number of significant figures. The results section is written in past tense and without any references.

Discussion

The purpose of the discussion is to argue, based on your results, whether the hypotheses can be falsified or not, to compare your results with other studies, to draw conclusions and to discuss what the implications of your results are. Explain if the results confirm what you expected, and discuss potential explanations. Discuss sources of error, for example weaknesses regarding sampling design or analytical errors, if you believe they affect your results or conclusions (”pH of the study lakes varied between 4 and 8, but most lakes were in the lower pH range. The relationship with pH may have turned out different if we had included more lakes with higher pH.”)

Reconnect to the purpose of the study and finish by relating your results to the broader research area that you introduced in the introduction. You may suggest future studies that could further enhance the knowledge regarding the research question (”Future studies should include lakes with even higher pH to allow testing if the positive relationship between pH and bacterial growth holds also over a wider pH range.”).

References

Here you list literature that is referred to in the report. At the Department of Biology we use the system classical Harvard. More information is available at http://libguides.lub.lu.se/c.php?g=297505.

In the running text you refer to literature by giving the author (surname) and year of publication. If there are two authors of a source, both names are given. If there are more than two authors, the name of the first author is given followed by ”*et al.*”, which means ”and others”.

Example: Persson (1985) demonstrated that the common crucian carp and pond crucian carp is one species. The common crucian carp and the pond crucian carp have been shown to be the same species (Persson, 1985). The common crucian carp and the pond crucian carp have been shown to be the same species (Persson *et al.*, 1997).

The reference list is arranged in alphabetical order of the publication's first author. If more than one reference with the same first author is used, order these by the surname of the second author. The references above should therefore be organized accordingly:

Persson, A. 1985. The fascinating life of the crucian carp. Oikos 45: 23-28.
Persson, A. and Andersson, L.P. 2001. The confusing systematics of carp. Oikos 124: 433-451.
Persson, A., Jönsson, B.F. and Andersson, L.P. 1997. No crucian carp are alike. Oikos 93: 148-151.

If there is more than one article by the same author/s, they are organized chronologically, *i.e.* Persson, A. 1985 is listed before Persson, A. 1987.

Below is a description of how to write references for scientific articles, books, book chapters and websites.

Articles
Arendt, J.D. 1997. Adaptive intrinsic growth rates: an integration across numerous taxa. Q. Rev. Biol. 72: 149-177.
Truant, R., Fridell, R.A., Benson, E.R., Herold, A. and Cullen, B.R. 1998. Nucleocytoplasmic shuttling by protein nuclear import factors. Eur. J. Cell Biol. 77: 269-275.

i.e. surname, initials, year of publication, title, journal, volume, pages.

Books
Beletsky, L. 1996. The red-winged blackbird : the biology of a strongly polygenous songbird. Academic press, London. 314 pp.

i.e. surname, initials, year of publication, book title: subtitle. Publisher, place of publication. Number of pages (pp).

Book chapter
Partridge, L. and French, V. 1996. Thermal evolution of ectotherm body size: why get big in the cold? In: Johnston, I.A. and Bennett, A.F. (eds.). Animals and temperature: phenotypic and evolutionary adaptation. Cambridge University Press, Cambridge, pp 265-292.

i.e. surname, initials of chapter author, year of publication, title of chapter. In: Surname/s of editors (ed(s)). Book title: subtitle. Publisher, place of publication, chapter pages.

Website
Lindén, J.W. and Persson, R. 25 January, 2013. How to read a scientific article. [http://www.biochem.arizona.edu/classes/bioc568/papers.htm]. 24 August, 2014.
Environmental Protection Agency. 12 December, 2007. Greenhouse gases 1990-2006. [http://www.epa.us/Menue/Climate Change/Grennhouse gases/Emissions-1990-2006/]. 26 August, 2008.

i.e. surname, initials, date of publication or last update. Title. [URL address]. Accession date.

"Authors" of webpages are often an organization, authority or university.