UVic Biology laboratory reports are to be written in the style of a scientific paper, which demands conciseness, explicitness, organization and attention to format. Your lab reports for this course should follow the format for scientific papers used in journals published by the National Research Council of Canada (NRC).

We have high expectations of you regarding the quality of your work. The general requirements that we have established reflect the expectations of the Biology Department and create a 'level playing field' for markers to assess your work. Make sure that your submitted work is consistent with these requirements. Reports that do not meet the standards will lose marks; this includes deductions for each unique spelling or grammatical error. Ignorance of these requirements will not be accepted as an excuse for substandard work.

Follow the instructions, as they are the general requirements for writing formal scientific reports. The Senior Laboratory Instructor will inform the class of any changes.

The steps involved in preparation of scientific reports include the following:

- organization of data
- literature research to prepare an introduction & discussion
- preparation of the first draft
- critical revision of the paper
- editing and proofreading
- critical review of the work by colleagues (other students)
- appropriate changes and revisions of the paper
- final editing and proofreading
- final submission before the deadline

Before you begin think about the direction you will be taking. If you draft a plan, it will help you stay on track. Make sure you understand the basic concepts. It is extremely important that you understand why you have done something and of what relevance it is.

While Writing:

- write so that the reader is logically drawn from one step to the next; if the reader has to re-read earlier pages to determine your meaning, it is unclear
- use simple, concise phrases
- provide clear descriptions and explanations
- always distinguish speculation from fact; you may express your opinion based on what your data suggest, but this does not necessarily make it a statement of fact
- focus on the relevant points of your work; other topics, while perhaps equally interesting, do not have a place in a tightly focused report
- back up your statements with references
- do not quote; paraphrase instead and cite the author(s)
- start each paragraph with a topic sentence and provide continuity of flow between paragraphs so that the present paragraph leads into the next
ADDITIONAL REQUIREMENTS:

- **back up** your work. Once you have lost one report, you will never need reminding of this again. Be responsible and constantly save your files (make back up files in case your computer crashes, gets lost or stolen). Never rely on one single file on one single computer!!! We suggest storing a backup copy on a flash-drive and on your email account.

- **Proofread;** it is your responsibility to make sure you write what you intend to say (do not rely on a computer program to do this for you):
  - use proper spelling (the words “beet” and “beat” are both real words but have vastly different meanings)
  - use complete sentences
  - use proper punctuation
  - use proper grammar
  - do not use contractions (‘don’t’, ‘haven’t’, ‘weren’t’, *etc.*)
  - write in past active tense (*e.g.* ‘We I conducted the study in order to…’)

- **follow scientific writing rules:**
  - only use acronyms if they are common for the field you are writing about, and you intend to use them often throughout your paper
  - *e.g., i.e., et al., in vitro, and in vivo* should all be italicized, as should genus and species names
  - if you use *e.g.* do not use *etc.* as well
  - once an organism’s genus and species name has been stated in full, it can be shortened to the first letter of the genus followed by a period and the full species name, *e.g. Homo sapiens* can be shortened to *H. sapiens*
  - ‘data’ is plural, therefore write ‘data are’ (the singular is ‘datum’ and is rarely used).
  - if using abbreviations, define them first before you abbreviate, *e.g.* standard deviation (S.D.) or British Columbia (B.C.)
  - for numbers ≤ ten use words, for numbers ≥ 11 use the number

- **edit** your paper; follow the required format for biology reports:
  - Microsoft® Word document in .doc or .docx format only
  - 1.5 - spacing (except for the Reference section)
  - 1.0 inch margins on all sides
  - 12 point font, Times New Roman
  - bold type for headings
  - italicized Latin or Greek genus and species names
  - pages numbered in bottom right of footer using Arabic numerals only (*i.e., 1, 2, 3; not i, ii, iii, or I, II, III*)
  - title of report centered at top of first page, followed by abstract
  - student name and number in top right header of first page
  - lab section and instructor’s name in top left corner of first page
  - grade sheet attached
Organization of a Scientific Paper

UVic Biology scientific papers consist of seven separate sections in the following order: title, abstract, introduction, methods, results, discussion, and references.

Title:
- accurately describes the contents of the paper and contains key words
- attempts to answer ‘What?’, ‘On whom?’, ‘How?’, and ‘Why?’
- when appropriate includes scientific name(s) of organisms studied
- is generally no longer than 2 lines

Abstract:
- provides a brief synopsis of the paper
- summarizes:
  - the objectives (what was studied and why?)
  - major methods
  - important results, including specific values
  - conclusions
- does not include references to literature, illustrations or tables
- is written in past active tense
- is no more than ½ page long

Note:
- ✓ when you write papers for publication, many readers will decide on the basis of the title and abstract whether or not to read the rest of the paper
- ✓ write the abstract after completion of all other sections

Introduction:
- appropriately introduces the general topic of the paper
- provides relevant background information for the study
- supports information with references
- links background information with rationale for the study.
- concludes with a short paragraph stating specific objective(s) of the study
- objective provides information regarding ‘What?’, ‘On whom?’, ‘How?’, and ‘Why?’
- is written in past active tense
- is no more than two pages long
METHODS:

- provide a concise summary of the procedure(s) in enough detail that another researcher could replicate the study. Include all important variables.
- do not include very general or common techniques and equipment that may have been used (for example, it is unnecessary to mention the type of glassware used, but it is advisable to name the type of spectrophotometer used).
- include a statement regarding the type(s) of data analyses performed.
- are presented in full sentences, not in point form.
- are written in chronological order therefore do not include words like then, next, first, finally, etc.
- never explain the theory behind the procedure in your method section.
- report volumes of solutions as final concentrations, percentages, or ratios to the final volume.
- written in past tense (passive voice) and assuming that you did the entire experiment.
- subheadings are acceptable.
- cite and reference the lab manual for the procedures.
- is no more than two pages long.

RESULTS:

- states observations (do not interpret) and gives the analyses of the data by:
  - synthesizing raw data.
  - presents a written summary of trends, accompanied by appropriate figures, tables, and/or the results of statistical analyses.
  - provides specific values of each key result.
  - addresses variability within the trends.
- in chronological order, written in past active tense.
- subheadings are acceptable.
- must include at least one table and one figure that represent the trends stated in the results.
- Never start your result section with a figure or table. First present your results in sentences.

Figures and Tables:

- should have a number and descriptive caption.
- descriptive caption should contain sufficient information so that the reader can understand what information is being presented without referring to the report. In other words answers the ‘What?’, ‘On whom?’, ‘How?’, and ‘Why?’ questions.
- should be numbered according to order of reference in report.
- must be referred to in the text first before presentation.
- should appear as soon as possible after mention in the text of the report.
- should be an appropriate size and layout to show sufficient detail.
- if a figure or table requires multiple pages, it should be split, in which case a title is required on each page.
Presenting Tables
✓ title appears above table
✓ no vertical lines
✓ horizontal lines should be kept to a minimum
✓ column headings and units clearly indicated

Presenting Drawings or Photographs
✓ title appears below figure
✓ includes appropriate reference if necessary
✓ different structures should be identified by labels
✓ each drawing must be accompanied by a scale bar

Presenting Graphs and Figures
✓ title appears below figure
✓ the independent variable is plotted on the x-axis and the dependent variable is plotted on the y-axis
✓ the axes must be labeled and the units indicated
✓ the intervals indicated on each axis should be evenly spaced and be appropriate for the range of data used
✓ line graphs are used for continuous data; data points are plotted as separate units and the lines or curves fitted
✓ bar graphs are used for discrete data

DISCUSSION:
• reintroduces the topic
• evaluates and interprets results in relation to published information
• compares and contrasts the key results to other relevant research in the field
• considers factors that may have influenced the results, but does not include your own human errors
• provides suggestions for future research
• concludes with a brief summary of objectives, major findings and suggestions for future research
• written in past active tense and in chronological order
REFERENCES:

- this is your work; do not quote
- lists all and only the references cited in your report
- you are responsible for verifying each reference against the original article
- All *five* of the required primary references:
  - must be refereed, which means they are published in edited journals and are peer reviewed
  - may include refereed online journals, **but not other Web sites**

The following is adapted from the ‘Instruction to Authors’ from the Canadian Journal of Zoology:

**Conventions for citing references in main body of report:**

- each reference must be cited in the text using the surnames of the authors followed by the year, *e.g.* ‘(Walpole, 1985)’, ’Green and Brown (1990)’…
- depending on the sentence construction, the names may or may not be in parentheses, but the year always is
- examples for citations
  - with one author: ‘According to Smith (1980)…’ or ’(Smith, 1980)’
  - with two authors: ‘Courtship behaviours of mallards…(Brown and Smith, 1976)’
  - with more than two authors: ‘A Marbled Murrelet juvenile was found… (Winchester *et al.*, 1995)’
  - with unknown author: ‘This drug is used to treat…(American Heart Association, 2007)’
  - with multiple references: ‘Canopy arthropods form a discrete… (Nadkarni, 1993; Stork, 1994; Winchester, 1995)’
  - that are not uniquely identified by the authors’ names and year, use *a, b, c*, etc., after the year, for example, Green 1983*a, 1983*b; Green and Brown 1988*a, 1988*b, for the text citation and in the reference list
  - with no date: ’(Miller, n.d.)’

*Note*: *et al.* is short for *et alia*, Latin for ‘and others’. There should be a period after ‘al.’. If a reference has more than two authors, the citation in the main body of the report should give the name of the first author followed by ‘*et al.*’. The full reference (including all of the authors) is given in the References section.
Conventions for listing references:
- alphabetical order according to the name of the first author; references are not numbered
- single-spaced
- begin at the left margin with subsequent lines indented
- multiple references with the same first author are listed in the following order:
  1. papers with one author only are listed first in chronological order, beginning with the earliest paper
  2. papers with dual authorship follow and are listed in alphabetical order by the last name of the second author
  3. papers with three or more authors appear after the dual-authored papers and are arranged chronologically
- when applicable, references to journal articles should include the issue number, which should be placed in parentheses after the volume number

Examples of types of references, including electronic references

The following bibliographic citations illustrate the punctuation, style, and abbreviations for references:

Journal article:

Note: Uniform reference locators (URLs) or digital object identifiers (DOIs) can be useful in locating references on the Web, and authors are encouraged to include these; they should be added to the reference in the reference list.

Journal article with URL:

Journal article available online only (with DOI):

Entire issue of journal:

Report:
Book:

Book in a series:

Part of book:

Paper in conference proceedings:

Institutional publications and pamphlets:

Corporate author:

Thesis:

Laboratory Manual:
Mitchell, G. 2006. Biology 190A Laboratory manual. Department of Biology, University of Victoria, Victoria, B.C.

Web site:

Web document:

Translation:
Unpublished reports, private communications, and in press references:

References to unpublished reports, private communications, and papers submitted but not yet accepted are not included in the reference list but instead must be included as footnotes or in parentheses in the text, giving all authors’ names with initials; for a private communication, year of communication should also be given, e.g., J.S. Jones (personal communication, 1999). If an unpublished book or article has been accepted for publication, include it in the reference list followed by the notation “In press”. Do not include volume, page number, or year in an in-press reference, as these are subject to change before publication.

Appendices:

Although these are not often seen in a formal scientific paper, you may be required to hand in raw data and calculations in an appendix. When required, calculations must include units of measurement.

Optional Additional Information:

While this set of instructions covers many questions concerning how to write formal reports, it is by no means a comprehensive list. Future courses in biology may expand on this basic framework.

There are several books, which offer more detailed information on how to write effectively. These include, but are not limited to:


There are also Internet sites that offer instructions for report writing, as well as gathering information. The UVic homepage has a link to the library, which in turn has links to reference tools and Internet searching.

Finally, your instructor can answer questions about how to write effectively, provided you approach her/him early enough with a list of specific questions. As instructors, we assume you will come to us with questions if they arise. Therefore, it is your responsibility to read over these instructions and ask for clarification when necessary.