APPENDIX E: WRITING SCIENTIFIC REPORTS

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 in the journal ‘New Phytologist’.

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 and 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• do not quote; paraphrase instead and cite the author(s)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:
• Format. Be sure to follow all of the formatting requirements. Failure to do so will result in a loss of marks.

✓ Microsoft® Word document in .doc or .docx format only. Any other file format will not be accepted.
✓ 1.5 spacing (except for the Reference section)
✓ 1.0 inch margins on all sides
✓ 12 point font, Times New Roman
✓ 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
✓ student name and number in top right header
✓ lab section and instructor’s name in top left corner
✓ file name format: Lastname_Firstname_Course_TermYear
  ○ e.g. Smith_John_Biol225_Summer2018

• 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
  ✓ genus and species should be written out in full in the title, abstract and when starting a sentence
  ✓ ‘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 error (S.E.) or British Columbia (B.C.)
  ✓ for numbers ≤ ten use words, for numbers ≥ 11 use the number (except when providing a measurement, e.g. 5 cm or 8°C)
  ✓ do not begin a sentence with a number, use the word
  ✓ a space should follow a number before the symbol or unit, except for % or °C
    e.g. Correct: pH 7; 76%   Incorrect: pH7, 23 °C
• **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…’)

• **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.

**NOTE:** Lab instructors will not ‘read over’ your paper to see if it is sufficient; that is your responsibility. They will, however, be happy to assist you by answering any specific questions you have. We highly recommend that you visit the lab instructors in the help centre. See the schedule posted on the CourseSpaces website.

**Organization of a Scientific Paper**

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

**Title:**

- accurately describes the contents of the paper and contains key words
- answers ‘What?’, ‘On whom?’; attempts to answer ‘How?’, and ‘Why?’
- includes scientific name(s) of organisms studied, when appropriate
- is generally no longer than two lines
- tries to include the key finding(s) of the experiment

**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 approximately 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 (including any required primary references)
• links background information with rationale for the study.
• concludes with a short paragraph stating specific objective(s) of the study
• objective paragraph provides information regarding ‘What?’, ‘On whom?’, ‘How?’, and ‘Why?’
• is written in past active tense, using “I” or “we”
• is approximately 1.5-2 pages long

METHODS:
• provide a concise summary of the procedure(s) in enough detail that another researcher could replicate the study; includes all important variables
• do not include very general or common techniques and equipment that may have been used (e.g. type of glassware used or pipettes), but do include the spectrophotometer and software used
• include the type(s) of data analyses performed (e.g. number of replicates and summary statistics (e.g. average, standard error)
• 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
• report volumes of solutions as final concentrations, percentages, or ratios to the final volume
• are written in past tense (active voice) and assuming that you did the entire experiment
• cite the lab manual in a single sentence at the beginning of the Methods; do not cite the lab manual in any other section
• subheadings are acceptable

RESULTS:
• begin with a paragraph to describe the results and to state observations (do not interpret)
• analyze the data in paragraph form by:
  ✓ synthesizing raw data
  ✓ presenting a written summary of trends, accompanied by appropriate figures, tables, and/or the results of statistical analyses
  ✓ providing specific values of each key result
  ✓ addressing variability within the trends
• cite figure(s) and/or table(s) in numerical order in the body of text
• present figure(s) and/or table(s) after the body of text
• are written in past active tense and in chronological order
• subheadings are acceptable

Figures and Tables
✓ include a figure or table 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 (answers ‘What?’, ‘On whom?’, ‘How?’, and ‘Why?’)
✓ should be an appropriate size and layout to show sufficient detail
✓ if a figure or table requires multiple pages, it is split, in which case the column headings are required on each page

Presenting Tables
✓ caption appears above table
✓ no vertical lines
✓ horizontal lines are kept to a minimum
✓ column headings and units clearly indicated

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

Presenting Graphs and Figures
✓ caption appears below figure
✓ do not use ‘vs.’ in the title or caption
✓ 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 research objectives and summarizes major results
- 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 human errors
- provides suggestions for future research
- concludes with a brief summary of objectives, major results, and suggestions for future research
- is written in past active tense and in chronological order
- is approximately 1.5-3 pages long

**REFERENCES:**
- this is your work; do not quote
- list all and only the references cited in your report
- you are responsible for verifying each reference against the original article
- all 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 websites**

It is important to cite all sources from which you obtain ideas or facts. Not only is it essential to give credit where credit is due, but it also shows that you understand the context within which your work fits and shows you have done your homework to create and support valid and sound arguments.

**Need help finding references?**

The research help desk in the UVic libraries (main floor) can help you find the best sources of information and help you formulate your search strategy. To find out more information, visit the UVic libraries website. If you visit the research help desk, bring the lab manual with you to the library for fast and effective help.

Your lab instructor can also answer questions about how to write effectively. Prepare a list of questions for the on-duty lab instructor in the Biology Help Centre (Cunningham 011) and they will be happy to help.
Conventions for citing references in main body of report:

- cite each reference in the text using the surnames of the authors followed by the year, e.g. ‘(Walpole, 1985)’, ‘Green and Brown (1990) found …’

- examples for citations
  - with one author: ‘According to Smith (1980)…’ or ‘(Smith, 1980).’
  - with two authors: ‘Courtship behaviours of mallards…(Brown & Smith, 1976).’
  - with more than two authors: ‘A Marbled Murrelet juvenile …(Winchester et al., 1995).’
  - with unknown author: ‘This drug is used to …(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 1983a, 1983b; Green and Brown 1988a, 1988b, 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 at the end of the report:

- alphabetical order (not numbered) according to the last name of the first author
- 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
- unless required (e.g. genus), only the first letter of the first word in the title is capitalized

Examples of types of references, including electronic references

The following bibliographic references illustrate the punctuation, style, and abbreviations required in the reference section of the report:

**Journal article:**


**Journal article with more than 10 authors:**


**Book:**


**Book chapter:**


**Thesis:**


**Laboratory Manual:**

Mitchell G. 2006. *Biology 190A laboratory manual*. Department of Biology, University of Victoria, Victoria, BC, Canada.
Web document:


References that are available online:


In press article:

**Schowalter TD. 2012.** Insect herbivore effects on forest ecosystem services. *Journal of Sustainable Forestry,* in press.

Unpublished reports, private communications, and in press references:

Cite references 'in press' only if accepted by a named journal. All other references (including submitted papers and abstracts, personal communications and personal observations) must be cited in the text as unpublished (C. J. Frost & H. Liang, unpublished; R. J. Norby, personal communication) and should not be included in the reference list.

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 in the sciences. These include, but are not limited to:

- **Williams JM. 1990.** *Style toward grace and clarity.* Chicago, IL: The University of Chicago Press.

Appendices:

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