

Format Guidelines for Lab Write-Ups (Clay Runck)

You will be doing three types of write-ups for laboratories in this course: Results; Formal Reports; and Oral Presentations, with Results. This guide specifies how each type of write-up shall be formatted in this course. The score you receive on a write-up will be determined, in part, by adherence to the specified format details. The format guidelines are rather detailed, so you will need to read the guide carefully and follow the format to the letter to receive maximum marks for the format score.

Format Requirements Applicable to All Write-Ups

Text citations. Do not use footnotes. Use parenthetical references that give names and dates that are keyed to the *Literature Cited* section. This may be done in several ways, as indicated here: "Tillman (1994) found that ..."; "The spatial competition hypothesis (Tillman 1994)..."; or "At Cedar Creek Natural History Area (Inouye *et al.* 1987), plants compete....". The abbreviation *et al.*, which is Latin for "and others" is used when more than two authors exist. Since *et al.* is Latin, it must be italicized.

The format for citations in the *Literature Cited* section shall be followed exactly as presented here.

- **Journal article.** The reference includes the name of the author or authors, the year of publication, the article title, the fully spelled journal name, and the volume and page numbers of the article itself. Within a single citation, indent all lines below the first line by five spaces.
 - Tilman, D. 1994. Competition and biodiversity in spatially structured habitats. *Ecology* 75: 2-26.
 - Tilman, D., T.L. Root, and D.H. Lawrence. 1995. Patterns of fish diversity in urban streams. *Journal of the North American Benthological Society* 11: 22-30.
- **Article in edited volume.** The reference includes the article author, date of publication, article title, pages in volume, names of volume editors, volume title, and the publisher's name and location. Within a single citation, indent all lines below the first line by five spaces.
 - Root, T.L. 1993. Effects of global climate change on North American birds and their communities. Pages 280-292 in P.M. Kareiva, J.G. Kingsolver, and R.B. Huey, editors. *Biotic interactions and global change*. Sinauer Associates, Sunderland, Massachusetts, USA.
- **Book.** The reference gives the author, date of publication, title, and the publisher's name and location. Within a single citation, indent all lines below the first line by five spaces.
 - Louw, G.N. 1993. *Physiological animal ecology*. Wiley & Sons, New York, New York, USA.
- **Internet document.** This reference gives the title and author, if appropriate, of the document, the date of posting or updating, and the URL of the site.
 - The Nature Conservancy, Wildland Invasive Species Program. *Acroptilon repens*. (Updated May 2000) URL:<http://tncweeds.ucdavis.edu/esadocs/acrorepe.html>

Quotations. Do not use extensive quotations in scientific writing. Usually, the *only* reasons for using exact words of another author are because (1) it is this exact wording that is the focus of discussion, or (2) the exact wording carries the intended meaning in so striking a fashion that it cannot easily be paraphrased.

Page numbers. All pages shall have typed page numbers; handwritten page numbers are not acceptable. The

location of the page number on the page is your choice, but the location must be the same on all pages.

Margins and line spacing. All pages shall be double-spaced and have one-inch margins on all sides. Legends, tables, and appendices shall be single-spaced.

Font style and size. New Times Roman 12-point font shall be used for all text and legends. Font size may be reduced to 10-point for particularly large tables or appendices. Use appropriate font styles for symbols (e.g., a, m, °, ±, <, >, £, ³, , etc.) and use superscripts and subscripts when appropriate (e.g., mm², CO₂, g m⁻² yr⁻¹, etc.). Handwritten symbols and legends are not acceptable. Italicize all scientific names (*Homo sapiens*), or indicate by underlining (Homo sapiens) if italic font is not available.

Data reporting and statistical results. All data reported in the narrative, figures, and tables are to be reported as mean () values in *Système Internationale* (SI) units, with some measure of variation, such as standard deviation (e.g., ± 1 SD) or standard error (± 1 SE). Write numbers as numerals whenever they are associated with measurement units (e.g., 3 meters), or are parts of dates or mathematical expressions. In other cases, spell them out for numbers of ten or less (e.g., five rabbits), and use numerals for numbers greater than ten (e.g., 15 rabbits). All raw data are to be placed in appendices with explanatory legends.

The proper way to refer to Student's *t*-test is *t*-test: the "t" is not capitalized and it is written in italic font. Calculated *t*-values and P-values should be reported to three decimal places (if applicable), and the *t*-calc value should include the alpha-level, number of tails, and degrees of freedom (all as subscripts) in this format: $t_{0.05(2), 12} = 1.204$, $P < 0.01$. If the calculated test statistic is an *F*-ratio (e.g., from analysis of variance, ANOVA), it should include the numerator and denominator degrees of freedom (as subscripts), the value should be reported to three decimal places (if applicable), and the P-value should be included (to three decimal places, if applicable) in this format: $F_{1,8} = 6.327$, $P < 0.001$ (note the *F* is italicized).

Tables and figures. Tables and figures should be presented in a format that enables the reader to quickly perceive the numerical results of summary statistics and statistical tests. All tables and figures shall be numbered with Arabic numerals in the order in which they are presented in the text (e.g., Fig. 1, Fig. 2; or Table 1, Table 2) and they shall have clear, concise, and well-written legends that allow each to stand-alone (see details for legends). Legends for tables shall be placed at the top of the table, and figure legends shall be placed below the figure. If the data can be presented in either a table or a figure, use a figure. Figures are much easier for readers to see patterns or differences in the data.

Each table and figure shall be placed on a separate page (i.e., one table or figure per page) between the *Literature Cited* section (if applicable) and the *Appendix*, with all tables preceding figures. Each page must have a page number and 1-inch margins. Multi-panel figures or tables (e.g., Fig. 1A, Fig. 1B, etc.) may be placed on the same page.

Legends for tables, figures, and appendices. All tables, figures, and appendices must have legends that are clear and descriptive such that the table, figure, or appendix can stand-alone without reference to the text. In other words, everything should be defined, including any abbreviations or non-standard symbols (e.g., *, PS II; etc.). An example of an inappropriate legend description is: "Figure 1. Figure 1 shows the relationship between total surface area of stones and stone mass." Stating that "Figure 1 shows..." is redundant; obviously the figure is showing something, and the Figure is labeled Figure 1, so why start the legend off by stating "Figure 1 shows..."? An acceptable legend would be: "Figure 1. Relationship between total surface area of stones and stone mass."

I. Results

Results write-ups should be a brief summary of the project with the following sections:

- *Title*
- *Introduction*. States the question being addressed, or objective, and the null and alternative hypotheses (when appropriate).
- *Methods*. Give a brief overview description of the basic experimental or procedural methods used in data collection and statistical analysis (including identifying the computer software used, e.g., Microsoft Excel, or SPSS). An example of an abbreviated Methods could look like this: "Photosynthetic rate of phytoplankton was estimated at three depths in a pond by measuring the change in oxygen concentration in clear and dark bottles. Bottles were filled with pond water from specific depths and the bottles were then incubated at the appropriate depth for two hours. Initial and final oxygen concentrations were measured in each bottle with a dissolved oxygen sensor. Mean oxygen consumption in dark bottles was subtracted from the mean oxygen production in light bottles to correct for respiration. One-way analysis of variance was used to compare the mean quantity of oxygen produced at each depth. Specific details of the methods and procedures are given in the BIOL 364 Laboratory Manual (Spring 2005)."
- *Results*. You must describe the main results in complete sentences; you cannot simply direct the reader to a table or figure. The *Results* section should present the data free of any interpretation or speculation. Use topic sentences to introduce each paragraph or set of results. For example: "There was a significant difference in photosynthetic rate at the three depths (ANOVA, $F_{3,8} = 7.564$, $P < 0.001$). Photosynthetic rate was highest at the 0.5-m depth (Fig. 1)". Tables and figures must have legends that are clear and descriptive such that the table or figure can stand on its own.
- *Discussion*. Provide a brief interpretation of the results in context with the question or hypothesis addressed.
- *Appendix*. Place all the raw data and the output from statistical tests in appendices. Each appendix must have a legend that explains all the details of the data that are tabulated. The output results from statistical procedures must be reported in at appropriate level of precision. For example, if you measured the weights of acorns to 0.001 g, then all output (mean, variation, etc.) should be attenuated accordingly: 3.456 g, not 3.45557777 g.

II. Formal Reports 1

Formal Reports will conform to a standard format for scientific papers that contains the following sections, exactly as listed and in the order listed: **Title** (including author and institutional affiliation, e.g., Vertical Distribution of Phytoplankton Photosynthesis in a Pond, Clay Runck, Department of Biological Sciences, Benedictine University), **Abstract**, **Introduction**, **Materials and Methods**, **Results**, **Discussion**, **Literature Cited**, **Tables**, **Figures**, and **Appendix** (or Appendices). The prose should be organized and flow smoothly, and be free of grammatical and typographical errors. Detailed guidelines for each of the different sections in a report are given below.

Abstract. Concisely summarize the main sections of the report in 250 words or less giving relevant details, including the hypothesis and critical methods unique to the study, summaries of the numerical results, and a cogent synopsis of the discussion.

Introduction. In 1-2 pages, introduce the research topic in such a way as to motivate interest in the reader and lead the reader without digression through the process of constructing the specific research question of the study.

Materials and Methods. In 1-2 pages, include a clear description that explains and shows the pertinent details needed to replicate the collection of data. In addition, summarize salient methods from the lab manual (but in much less detail than the manual) and any methods unique to your study in sufficient detail to enable all steps to be replicated exactly. The statistical tests and data transformations (if used) that were performed are stated last, and include the computer analysis software used and/or statistical reference text.

Results. This section presents the numerical results of summary statistics and statistical tests of the hypothesized differences in treatment effects in clear and concise sentences. Do not present raw data; actual data sheets should be placed in an appendix. The Results section should be free of **interpretation of the data**. The narrative text should guide the reader through the results, describing patterns and/or relative magnitudes or differences in the data, with reference to summary data contained in tables and/or figures.

Combine statements about the significance of differences examined by statistical tests with precise indication, in parentheses, of the test used and the probability level chosen. For example, one might say, "The difference between means of the two samples was highly significant (paired t-test: $t_{0.05(2), 11} = 6.350$, $P < 0.01$)." A parenthetical expression such as this might not need to include all of the information indicated, provided that this information was available elsewhere in the *Materials and Methods* section. It is essential, however, that the reader be able to ascertain all of these details for each test utilized.

The narrative text should deal only with results and refer to tables or figures which display the summarized data; however, you cannot just refer the reader to a table or figure without any description of the data. Do not duplicate summarized data in both a table and a figure; this is redundant. Also, do not simply list all the data in the text (narrative) that are presented in a table or figure.

Discussion. In 1-2 pages, **interpret** the data presented in the *Results* section in light of the hypothesis presented in the *Introduction*. Sentences should convey insightful and thought-provoking points that are substantiated by details of both content and context (i.e., by referring to the data presented in the tables and figures). Alternative hypotheses should be insightfully discussed. Implications or extensions of the results of the study should logically lead from the material presented and elicit clear and interesting directions for future research.

Appendix. An appendix is used to present a copy of the original (not summarized) data with clear, unambiguous labels for measurement units. In addition, clearly labeled original printouts of all statistical analyses should be included. Each appendix shall be numbered and have a clear, concise, and well-written legend that allows the appendix to stand-alone.

III. Oral Presentations²

- Compose an outline as if you were writing a formal report, and then distill salient features for your 13-minute oral presentation, with a 2-minute question and answer (Q&A) period.

Oral reports should contain four sections, each of which serves a specific function:

- Introduction (3 minutes), (Note: Clearly state your hypothesis);
 - Materials and Methods (3 minutes);
 - Results and specific discussion of them (3 minutes);
 - General Discussion of results and future research directions (4 minutes).
- The principal differences between oral reports and written reports are that:

- oral reports do NOT start with the Abstract, they start with the Introduction;
 - oral reports do NOT detail the methods as extensively;
 - oral reports present the results and offer brief discussions interpreting the results as they are presented, whereas written reports only discuss results in the Discussion section.
- You should think very carefully about how to use visuals (overheads, computer projectors, etc.) to convey your findings, and you are encouraged to use presentation development software (such as Microsoft PowerPoint).
 - NEVER read your talk, however, neither should you ad lib. Use a normal speaking voice, address your audience (NOT to the projector image), and explain what you asked, what you did, what you found, what it means, and what you would do next to follow up. Rehearse your talk at least three times!
 - Lastly, your peers will be asking you questions during the 2-minute Q&A session after your talk. Your task for the Q&A period is to move things along and answer clearly and succinctly.

References

1, 2 Modified from: Grant, B., I. Vatnick, and the Ecological Society of America. 2004. Teaching Issues and Experiments in Ecology, TIEE Volume 1 (www.tiee.ecoed.net).