Guidelines and Tips for BIOL 300 Lab Report

Overall format
• 12 pt. font, double spaced, standard (1”, 2.5cm) margins, legible font (e.g. Arial, Calibri, Times New Roman)
• Do not use a double column format for text (like you may see in many published papers).
• 4 page limit (includes figures/tables). If you chose to use references, only your bibliography can be on the 5th page. **Points will be deducted for pages over length.**
• Write in paragraph form (not point form)
• Include headings for each section (Introduction, Methods,...)
• A separate abstract or summary section is not required
• General structure of paper: start broadly, get more specific as you go, then get broader again: start broadly about the topic in the introduction, get specific by the end of the intro and through the methods and results, be specific in the beginning of the discussion, and get broader by the end.

Writing style
• Use clear, concise language, avoid use of slang or flowery language, use active voice (“We collected data...” instead of “data were collected...”).
• Remember that ‘significant’ has a specific meaning in statistics, do not use it colloquially. Also, ‘data’ is plural, while ‘datum’ is singular.
• Abbreviations must be defined when first used. Do not use contractions (e.g., don’t, it’s).
• Numbers below 10 should be written out (e.g., “seven preferred darkness but 21 preferred light”)
• When writing about your experiment, results, etc., use the past tense: “Plots were subsampled...”
• Refer to actual published papers for examples – there is one on the course webpage, and there are several listed at the end of the lab manual, or go to the webpage of one of your professors or TA’s and look at their published papers. Keep in mind that every journal has a slightly different format (although Nature and Science are quite different), if you are unsure, see the guidelines below.

Below are step-by-step guidelines for each section. These are suggestions, and not strict requirements. However, they represent a commonly used framework for scientific papers that you are sure to encounter again.

Title
• Descriptive, summarizes main results or topic, while still being brief (5-20 words)
Introduction (~ 25 - 30% / ½ - 1 page)
Start with broad conceptual information and narrow focus to the point of the study by the end of the intro. If you reference other studies, only include information that is relevant to the question / topic you are addressing.

• broad opening statement
  o introduce main topic(s)
  o grips readers attention, why is this topic interesting and/or important?
• brief and relevant background information
  o define any important concepts/terms if necessary (but do not define commonly known terms like P-value)
  o what question(s) is/are still unanswered about this topic?
• Put study into context
  o Give brief overview of study (1 sentence)
  o State why this study is important/relevant/useful, how will it contribute to our understanding of this topic?
• State main question, hypotheses, predictions, or expectations

Methods (~15 – 20% / ~ 1/2 – 1/3 page)
Choose an appropriate level of detail so that another scientist could repeat your study. It is important to be honest and transparent in your reporting, but do not provide so much detail that the reader is overwhelmed or disinterested (we don’t need to know who in the group did what, the column titles in JMP, the brand of the ruler you used, etc.).

• Briefly but thoroughly describe how you collected/obtained the data: the reader should be able to repeat this based on your report, but don’t be overly specific or include arbitrary information
  o Describe the scale of the study, e.g. replicates, number of study subjects, size of area sampled, duration of the experiment...
  o Other specifics of your study, e.g. study site, types of subjects (e.g. students, men, sloths...)
• Data manipulation (if applicable: e.g. removal of outliers, correction of errors, transformations - any calculations you performed on your data before analysing it)
  o Justify any manipulation of your data
• Statistical analysis: type of test(s) you used, assumptions, program you used to do your stats
  o Justify why you used certain statistical tests

Results (~ 20 – 25% text, ~ 1/3 – ½ page; not including figures)
Report all findings that are relevant to your research question. Do not interpret your findings in this section. Use figures and/or tables, only if they help explain your results (see tips on figures
below). Figures can be incorporated in your results section, or at the end of the report under a separate subheading. Remember, the 4 pg limit includes figures.

- Report statistics (test statistic, degrees of freedom or sample size, p-value)
- Report results quantitatively (i.e. mean and uncertainty) and qualitatively (e.g. larger, less, etc.)

**Discussion (30 – 35 %, ~ 1 – 1.5 pages)**

- Briefly summarize results (1 – 2 sentences)
- Relate findings back to your initial question (from Introduction)
  - Did you reject or fail to reject H0? Did your data meet your initial expectations / predictions? Interpret your findings in terms of the original question / problem.
- Discuss the results and implications – why do you think you found what you found or why didn’t you find what you expected? what do your results mean? This is the most interesting part of the paper and should be the focus of the discussion.
  - Back up / relate findings with / to other research if necessary
- Were there any limitations (e.g., problems with experimental design, study subjects, etc.) of the study that may have affected your results (only include aspects that are relevant)? This section should be brief.
- What are some possible improvements if this experiment were to be repeated? Think carefully here, only include suggestions that are relevant to the topic, your experiment, or your results. This can also be brief.
- Finish with some general conclusions, broader implications, and/or potentially some ideas for interesting follow up experiments. Again, only include information that is relevant, e.g., how would your follow up idea clarify the topic / problem? Why would your follow-up idea be interesting / useful?

**Figures and Tables**

You may make figures and tables in whichever program you prefer. For tips about doing these in JMP, refer to the graphing tips sheet handed out in Lab 1. Figures can be incorporated (“in line”) in the text of the results section or at the end of your report.

- Only include them if they explain your results better than words (don’t include arbitrary figures, such as box plots or diagnostic plots that show (deviations from) normality. In this case, just say “The data significantly deviated / did not deviate from normal”. Also, do not include redundant figures that show the same / similar information (e.g. box plot and histogram and diagnostic plot)
- Every figure/table must be referred to in the text
  - Do not say “Figure 1 shows heights for men and women”, but say “men were taller than women (Fig. 1).
• Figure/Tables should include captions
  o Captions go below a figure, or above a table.
  o Captions should be detailed enough to stand alone. E.g.: “Figure 1. The difference in circumference between cowrie shells measured by groups A&B. Mean = 2mm (+/- SE 0.3 mm)” but should not be overly long.
• Figures and Tables should follow the text that describes them, and be numbered in order.
  o Whichever one is mentioned in the text first should be #1, the next one mentioned in the text should be #2, etc. Be sure to be consistent in your numbering (in the text & captions).
  o Figures / Tables should also appear in numerical order.
  o You can have a Figure and Table with the same number: there can be a Figure 1 and Table 1 in the same report).
  o You can also have several ‘panels’ within the same figure, and number them: Figure 1a, 1b, 1c.
  o See an example published paper to see how this is done.
• Figures must include labeled axes - do this in JMP (see the ‘graphing tips’ hand out) or by hand if necessary, including units or scale.
• If you are having trouble getting your figures from your graphing program to your word processing program, you may ‘screenshot’ them, but it must be neat when it appears in the report. You should not screenshot statistical outputs – copy these into tables or incorporate them into the text.

For some more general instructions, refer to p. 77 of lab manual

**Citations and Bibliography**
If you include citations within your text, they should be in one of these formats:
“Distributional patterns of species across thermal gradients seemed to depend more on interactions among species (Darwin 1959)”
“...among species (Darwin et al 1959)”
“...among species (Darwin and Irwin 1959)”
“Darwin (1959) discovered that...”

A list of References / Bibliography should appear at the end of the paper (if you use them), and they should be formatted like this: