

## ***Lemna* Project Guidelines**

This handout should serve as a manual to aid in completion of the *Lemna* project. The specific components described below include:

- 1) Project proposal (prepared as a **group**, due in lab the week of Oct. 3<sup>rd</sup>),
- 2) Annotated bibliography (prepared **individually**, due in lab the week of Oct. 3<sup>rd</sup>), and
- 3) Oral presentation (presented as a **group** in lab the week of Dec. 5<sup>th</sup>).
- 4) Formal Laboratory Report (prepared **individually**, due in lab the week of Dec. 5<sup>th</sup>)

### **A. Proposal guidelines**

The proposal is a written rationale and description of the experiment that you will eventually present at the end of the semester. Proposals should be typed and a maximum of 2 double-spaced pages.

Required elements of the proposal:

- **Background:** Write approximately ½ page describing the basic ideas you are interested in. Why is this an interesting problem? What has already been done related to this question? You should have some background information and citations. You may use information from books or journal articles but not websites (you can use the web to find references to books and articles). You should have had your basic topic approved by your instructor in lab during the week of Sept. 27<sup>th</sup>.
- **Hypothesis:** Clearly state your hypothesis. Make sure you are asking an ecological question. Purely physiological questions (e.g., How does *Lemna* respond to different pH?) are not acceptable.
- **Experimental design:** Describe the treatments you will use in the experiment. All treatments need at least 3 replicates for appropriate statistical analysis. Indicate what you will measure during the experiment, and why. Describe the particular results that would support or not support your hypothesis.
- **Materials needed:** List all of the materials you will need to set up the experiment. This section is very important because we will need to gather materials for you. Limit the number of cups you use to 20 or so, a number we've found to be manageable.
- **Literature cited.** All cited materials will be listed alphabetically at the end of the proposal in the format described in Appendix A: Scientific Writing.

Your lab instructor will suggest modifications after reading all of the proposals to make sure that there is a diversity of questions being tested in each lab section. Your lab instructor will also suggest modifications to help each experiment succeed.

## **B. Annotated bibliography guidelines**

Each member of the group will provide an individual annotated bibliography along with the group proposal (i.e., annotated bibliographies are not done as a group).

- The bibliography will consist of the article citation and a summary of three scientific papers that were found in your literature review (these same scientific papers should be appropriate references in your project proposal and final presentation). Each student in a group will be expected to summarize three different papers so check with your group members to make sure there is no overlap.
- Each bibliographic entry begins with a full citation in the format described in the lab manual. A summary of the article will follow the citation. The summary should be organized to provide the information from the article that is relevant to your proposal and experiment (other extraneous material can be ignored).
- To compile the summary read and outline the scientific paper, paying particular attention to points that are relevant to your project. The summary should be no more than ½ page double spaced and should not quote any part of original scientific paper.

---

### **How do I start a Literature Search?**

You will need to do some library research as you write your proposals so don't procrastinate. The general process of finding these resources will be to search a database (described below) for information using keywords (such as "Lemna" or "duckweed") and then refining the search with more specific keywords to narrow the search to articles that are appropriate to your questions.

- **Databases.** In your presentations you are required to present information from at least 5 peer-reviewed papers. "Web of Science" is the absolutely best resource for finding articles in the biological sciences, and we have access to the past several years. **Web of Science** should be your go-to resource, especially for recent articles (note: access occasionally can be difficult if there are too many users on at a given time. If you can't log on, try again in a few minutes, late at night, or early in the morning). Try **Basic BIOSIS** if you are looking for older articles. For access to full-text articles, use **JSTOR**. Although JSTOR lists a number of excellent journals and has the convenience of offering the articles in full-text, relying on just the articles available through this single resource will severely limit your ability to search the literature.
  - **Interlibrary loan requests.** Many journal articles will have to be acquired using the interlibrary loan service that is provided by the library. Interlibrary loan allows you to request an article or book that we do not have in the library. Before making a request make sure you check with the library to see if they have the article on the shelves using the "journal locator". Interlibrary loan takes 1-2 weeks, so plan ahead to request the articles you need.
  - **Citation style.** All information presented from a source (i.e., a journal, book, or website) must be cited. Cite your references and compile a bibliography (presented at the end of your proposal and presentation) using the style described in Appendix A: "Scientific Writing". Make sure "in text" citations are presented as described in the appendix. Journals used by "Web of Science", "BIOSIS" and "JSTOR" are peer reviewed, however, many books and references found on the web are not. Generally, information from general websites is not appropriate in a presentation of this type. Some websites may be useful, however, such as those of university, state or federal researchers. If you have a question about the reliability and accuracy of information on the web, ask.
-

### **C. Presentation guidelines**

The presentation is the culmination of the process that started with an idea, evolved into a proposal, outlined in an experiment that was eventually conducted. The presentation is a **group presentation** that requires participation of all group members in its planning and execution. Participation will be evaluated by your peers, and the instructor.

You must use PowerPoint for your presentation. Each presentation should be 10-12 minutes, with the remaining time (to a total of 15 min) for questions from the audience.

#### **Format for the presentation.**

Title: Concise title that summarizes the study. List the group participants on the title graphic.

Introduction: One way to organize this section is to cover some of the following questions: What is known about how your factor affects plant growth? What is known about *Lemna* in relation to the factors you studied in your experiment? *Lemna* is a very well studied plant – you will be able to easily find information about this taxon in the library. What hypothesis did you address in your experiment? You may want to use graphs from other studies in your introduction.

Methods: What is your experimental design? What methods did you use to manipulate the factor of interest? What response variable did you measure? You may want to use diagrams or charts to illustrate your experimental design or methods.

Results: You should present your results both verbally and graphically. You should discuss with your instructor the most appropriate way to graph your results. Were there any unusual points?

Discussion: Did your results support the previous research done on *Lemna* that you discovered in your literature search? Were there factors that you didn't control which may have affected your results? What did you learn from this project? Did any of the results surprise you? If you were going to continue work on this topic, what would you do next?

Literature cited: List any sources that you gathered information from. You should use and cite **at least 5 peer-reviewed articles** from the primary literature. Use the format for citations listed under proposal guidelines.

Literature research will be very important for the introduction and discussion parts of your presentation. Comparing your results with the results of previous studies is the only way to put your research in context. In addition, the literature can help you interpret surprising or unexpected results.

This is the grading sheet that we will use to evaluate your presentation.

### **Biology 172 - Group project presentation evaluation**

**Title**

Concise summary of the study (2%) \_\_\_\_\_

**Introduction: 18%**

Sufficient background/appropriate use of literature (10%) \_\_\_\_\_

Clear rationale (4%) \_\_\_\_\_

Objective/hypothesis clear (4%) \_\_\_\_\_

**Methods: 15%**

Clarity of description of experimental design (5%) \_\_\_\_\_

Clarity of description of experimental methods (5%) \_\_\_\_\_

Clarity of description of experimental analysis (5%) \_\_\_\_\_

**Results: 15%**

General results/sufficient explanation of figures (10%) \_\_\_\_\_

Effective use of figures (5%) \_\_\_\_\_

**Discussion: 30%**

Appropriate reference to objectives/hypothesis (5%) \_\_\_\_\_

Appropriate reference to your results (5%) \_\_\_\_\_

Appropriate reference to background/previous studies (5%) \_\_\_\_\_

Appropriate discussion of surprising data and experimental problems (5%) \_\_\_\_\_

Appropriate discussion of possible future research avenues (5%) \_\_\_\_\_

Sufficient detail (5%) \_\_\_\_\_

**Overall clarity and effectiveness of presentation: 10%**

Logical development related to objectives/hypotheses in introduction (5%) \_\_\_\_\_

Clarity of ideas throughout (5%) \_\_\_\_\_

Appropriate use and citation of literature (10%) \_\_\_\_\_