

# *Bio 220: Introduction to the Biology of Cells*

*Laboratory Manual  
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## Preface

Bio 220 Introduction to the Biology of Cells, together with Bio 210 and Bio 230, launches you on a journey of intellectual discovery in Biology designed to develop a set of knowledge and abilities necessary for Independent Study and a lifetime of learning (see “Objectives of the Biology Major” in the Appendix). While the classroom component of Bio 220 focuses on developing the basic factual and conceptual framework that you will need for further study in Biology and related fields, the laboratory component provides the opportunity to gain experience in really “doing science” (albeit at a limited scale and in a restricted time frame). In the laboratory component, we will begin to address some of the Department’s objectives for the Biology major related to Independent Study and a liberal arts education, including being able to apply the logic and methods of empirical investigation, understanding the role of creativity in science, and being able to communicate scientific information effectively.

When revising our introductory curriculum, the Biology Department paid particular attention to making the laboratory experience more investigatory and open-ended. As a consequence, these laboratory investigations are not always straightforward. You will often need to think hard – about how to start, about what your data means, about what to do next – just like a real scientist. Although you will no doubt find many of these laboratory activities quite challenging, we hope that you will also find them intellectually stimulating and maybe even enjoyable.

Best wishes for a successful semester of biological investigation,  
Dr. Dean Fraga  
Dr. William Morgan

# Laboratory Evaluations

In the laboratory component of the course, you will be evaluated based on your participation in the laboratory, your responses to the assigned “content questions”, and your preparations of a scientific poster and one high-quality laboratory report.

## Participation

Your active participation in the laboratory is expected. You will be evaluated by your peers, as well as the lab instructors.

## Content Questions

Accompanying the instructions for each laboratory investigation, you will find a set of pre-lab and post-lab “content” questions. Your responses to these questions will be used to evaluate your understanding of each laboratory exercise and to provide feedback for preparing your laboratory report(s) (see below).

In addition to written answers, you will also present data in properly constructed tables and figures. It is imperative that you consult the lab manual and Pechenik’s *A Short Guide to Writing about Biology* for instructions on preparing tables and figures.

Your *type-written* responses to the pre-lab questions are due at the start of the lab period and your *type-written* responses to the post-lab questions are due at the start of the next Friday class (see Table 1 below).

## Poster

In addition to the usual content questions for Enzymes 2 and 3, you are also to present your findings in a scientific poster prepared jointly with your lab partner. This will serve as a warm-up for preparing a full-fledged laboratory report in the second half of the course (see below). In particular, it will allow you to showcase your skills in constructing figures and tables -- the “heart” of a scientific paper.

To gain experience in presenting your work to your classmates (your scientific colleagues, if you will), you will present your poster during a subsequent laboratory session. Your classmates will be responsible for returning an evaluative critique (details to follow).

Instructions for preparing a poster presentation can be found in Chapter 12, “Writing a Poster Presentation,” of *A Short Guide to Writing about Biology*, 3rd ed. by Jan Pechenik. In addition, we will be providing more advice about presenting data in a poster later in the semester.

## Laboratory Report

Your goal is to write one laboratory report in the form of a scientific paper that is of “A” quality. Once you have successfully achieved this, you will not need to

complete any more lab reports for the course (just the content questions). If you turn in a lab report that is not “A” quality, it will be returned with a critique (see below) and you must prepare another report on a subsequent lab investigation. You should read such critiques carefully and then apply the lessons learned to your next lab report.

Based on past experience, it is clear that to write a good lab report, you must have a solid understanding of the lab investigation that you undertook. Your responses to the content questions (see above) will allow you to assess how well you understood the lab exercise. After you submit your responses, they will be evaluated and returned to you at the next laboratory period. You will receive one of three scores which will indicate how well prepared you are to proceed with a lab report:

Green (G): *Go for it!* You understand the content of the lab and are fully capable of writing an excellent lab report

Yellow (Y): *Proceed with caution.* You understand some portions of the lab investigation, but are deficient in others. You may write a lab report but should go over the key concepts of the lab with a course professor or TA to be sure that you fully understand the lab investigation. If you turn in a lab report you must submit corrected responses to the content questions. These should be attached to your report.

Red (R): *We do not recommend that you write a lab report for this investigation.* There are serious deficits in your understanding of the content. You may choose to prepare a lab report, but you are unlikely to succeed if you do not first fully comprehend the major concepts of the lab exercise. If you turn in a lab report, you must also submit corrected responses to the content questions. These should be attached to your report.

### **A Tip on Preparing Figures and Tables**

With regard to the mechanics of presenting scientific information, many students have problems preparing a simple table or figure correctly. You should prepare rough examples of each during the first two weeks in lab and get feedback from the professors. This can be accomplished using the software available on the iBooks.

### **Preparing the Lab Reports**

All sections of a laboratory report are to be prepared according to the general instructions in Chapter 3, “Writing Laboratory Reports,” of *A Short Guide to Writing about Biology* by Jan Peckenik (see Syllabus). For convenience, a summary of this chapter is included in the Appendix of this lab manual, and a checklist is available in

Pechenik (pp. 138-140). We strongly recommend using these resources to review your lab report before turning it in for evaluation.

*Additional Instructions:*

- All assignments are to be type-written.
- Each assignment is to be prepared according to the specified format (see Table).
- The **maximum length** of a lab report is **five** pages, including figures and tables. Material beyond this page limit will be ignored and will be considered 'not included' for purposes of grading.
- You may place figures and tables at the end of your lab report.

### **Our Philosophy with Regard to Lab Reports**

The process of scientific investigation and communication is governed by rules. These rules are designed to help others understand what was done, how reliable the study was, and where to find specific pieces of information. Thus, the scientific community has agreed that a  $p$  value of 0.05 is significant and that a complete description of how the experiment was done will be found in the Materials and Methods section. Our goal in having you write Lab Reports is to introduce you to this set of rules and to have you master them to the point where they are second nature for you. As a consequence, we will be assigning a significant amount of points to the mechanics of a lab report. These mechanics are straight forward, clearly explained in Pechenik's *A Short Guide to Writing about Biology*, this lab manual, and in class. So, by simply following directions you will gain an easy 25 points towards your final lab report score.

Scientific journals often have slightly different rules with respect to some of the mechanics. Before one submits a paper to a journal for publication, it is therefore essential that the journal's guidelines are carefully read and followed. If you don't follow the instructions, the paper may be rejected immediately without further review. In this course, and for biology courses in general, we have chosen to follow the guidelines described in Pechenik's *A Short Guide to Writing about Biology*. If you have any questions concerning the format of the lab report, consult this manual. This is an excellent resource for writing papers in Biology and we encourage its constant use.

### **Lab Report Critiques**

The standardized checklist that we will use to evaluate lab reports is provided in this manual (see Appendix). As you revise your laboratory report in preparation of the final draft, you may wish to review this checklist.

**Table 1. Assignment Deadlines\***

Lab investigation	Dates	Evaluation type	Due date	Returned
Scientific Investigation	Jan 14/15	Content questions	January 18	January 21/22
Enzymes 1	Jan 21/22	Content questions	January 25	January 28/29
Enzymes 2	Jan 28/29	Content questions Pre-lab questions	February 1	February 4/5
Enzymes 3	Feb 4/5	Content questions Pre-lab questions	February 8	February 11/12
		<b>Poster of E2&amp;3</b>	February 15	February 18/19
Mendel's paper	Feb 11/12	Pre-lab assignment	February 11/12	not applicable
GCK 1	Feb 18/19	Content questions	February 22	February 25/26
GCK 2	Feb. 25/26	Content questions	March 1	March 4/5
		<b>Lab report of GCK 2</b>	March 29	April 8/9
Molecular Gene Mapping 1	Mar. 25/26 Apr. 1/2	Content questions	April 5	April 8/9
Molecular Gene Mapping 2	Apr. 1/2 Apr. 8/9	Content questions	April 12	April 15/16
		<b>Lab report of MGM</b>	April 19	April 29/30
Photosynthesis 1	Apr. 15/16	Content questions	April 19	April 22/23
Photosynthesis 2	Apr. 22/23	Content questions	April 26	April 29/30
		<b>Lab report of PS1&amp;2</b>	May 3	May 10

**Regarding content questions:** You must do all content questions for each lab exercise. You will receive an evaluation that will tell you if you are ready to do a lab report (see above).

**Regarding the lab reports:** The due dates listed above are only valid if you decide to turn in a lab report for that exercise. You must turn them in by the due date or they will not be accepted. Once you have successfully completed a lab report, you are not required to do another one (see above). You must successfully complete one lab report before the semester ends. Failure to do so will significantly harm your course grade.