

How to Keep a Laboratory Notebook

BIOL286: General Microbiology

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Introduction to the Notebook

Summary – Like sterile technique, microscopy, or biochemical analyses, keeping a current and accurate notebook is an essential skill in the microbiology laboratory. Your laboratory notebook will fulfill three primary functions in our course. First, it will give you the opportunity to develop a habit of properly documenting your laboratory activities. In a research lab, your notebook would be a permanent legal record of all your work. As such, it would be used to support grant applications, scientific publications, and patent applications by the members of your laboratory. Second, it will serve as your main study resource for the laboratory portion of our course. Your notebook should contain sufficient information to enable you or someone else to understand and reproduce the results of your work at a later date. This will be of particular importance as you review for our comprehensive laboratory practical exam at the end of this term. Finally, your notebook will help me to accurately evaluate your understanding of the laboratory materials and procedures that we use throughout the semester. By periodically collecting and grading your work, I can provide additional feedback to build upon your strengths and reinforce weaker areas so as to improve your learning this semester.

Supplies – This semester we will be using the hardcover *Student Laboratory Notebook* published by the American Society for Microbiology Press, 2005. (ISBN 1-55581-358-5) I have asked both the Ferris State University bookstore and Great Lakes Books to order copies for our labs. In addition, it can easily be found online at Amazon and other sites for about \$12.00 (shipping is a couple dollars more). The style guide that we will be using in this class is *A Student Handbook for Writing in Biology*, 4th edition by Karin Knisely, Sinauer Associates, 2013. (ISBN 978-1-4641-5076-0) This textbook will also be stocked by our bookstore and Great Lakes Books. Amazon and other online sites sell it for around \$25.00. References to materials in Knisely's text will be abbreviated like this – *WIB* p 8. You are also going to need a solvent-resistant pen to write in your notebook. I find gel pens to be ideal for this purpose. The Pentel EnerGel with black ink is my personal favorite and can be found at our bookstores, Wal-Mart, Staples, and many other places for about \$2.00 each.

Grading – Your completed laboratory notebook will be worth 90 out of the 1,200 total points this semester. I will collect all notebooks on three announced days during the semester (see your laboratory schedule for the exact dates). On each of these occasions, the accuracy, completeness, and format of your entries will be graded out of thirty possible points using the checklist provided in this document. I will also provide some feedback in your notebooks concerning the strengths and weaknesses exhibited in your entries. The point of this work, however, is not the grade. Rather, I am interested in helping you to create an accurate record of your activities and observations during the semester. In addition, completion of your laboratory notebook will give you an opportunity to apply the scientific method in the lab (*WIB* pp. 1-8).

General Instructions

Penmanship – Your laboratory notebook will be of little value to anyone if it is not legible and comprehensible when viewed at a later date. Begin each entry on an odd-numbered page (on the right side of the book). Write using a solvent-resistant ink pen. Write clearly, organize entries, include detailed drawings of observations when appropriate.

Personal information – It will be important for me to be able to identify each of your notebooks when grading. To that end – I ask that you label the cover and spine

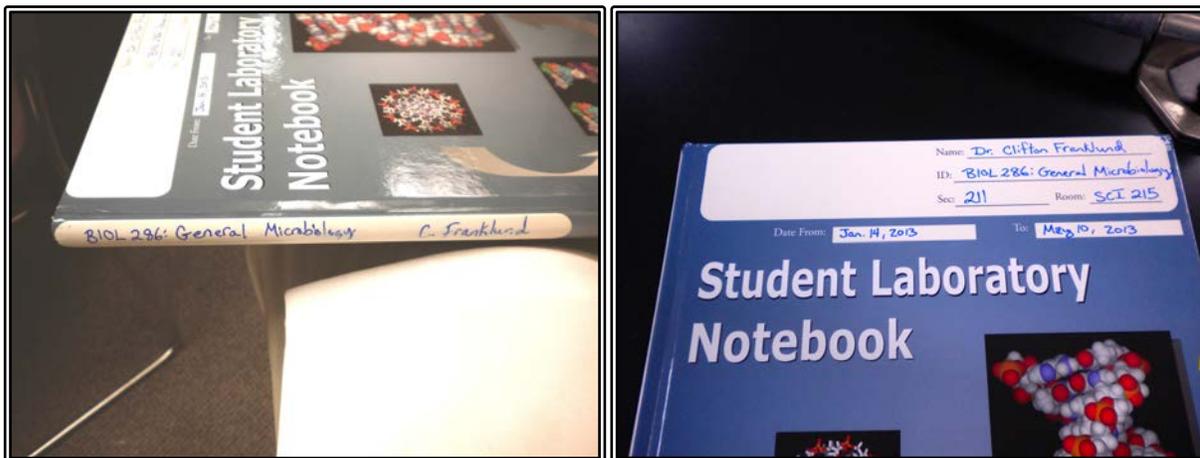


Figure 1 Properly labeled laboratory notebook spine and cover

of your notebook as illustrated in Figure 1. This information should include your full name, course name, lab section number, and lab room number.

Notebook checklist – You should print and cut out an extra copy of the laboratory notebook checklist found on our FerrisConnect site. Securely tape this copy onto the page facing the table of contents in your laboratory notebook. Refer to these guidelines when making your entries to ensure that they meet all of the notebook expectations when I am grading them.

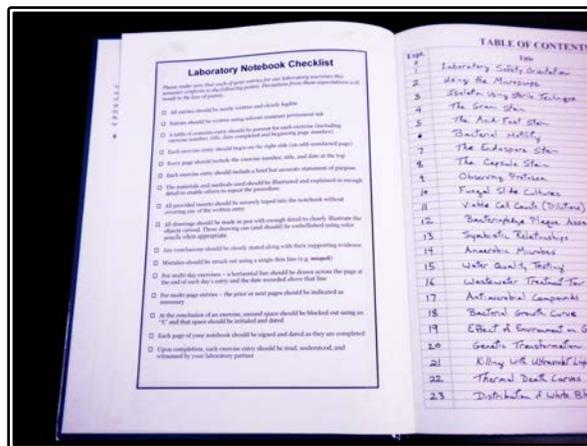


Figure 2 Properly placed checklist

Table of contents – Each laboratory exercise should have its own entry in the table of contents at the front of your notebook. Each entry should include the following information:

- The laboratory exercise number (in ascending numerical order)
- A brief but clear title (the same as on the top of each page for the entry)
- The date that work on the exercise began
- The first page number for the exercise entry

Expt #	Title	Date	Page #
1	Laboratory Safety Orientation	1/15/13	1
2	Using the Microscope	1/17/13	3
3	Isolation Using sterile Technique	1/22/13	7
4	The Gram Stain	1/22/13	11
5	The Acid Fast Stain	1/24/13	15
6	Bacterial Motility	1/29/13	17
7	The Endospore Stain	1/29/13	21
8	The Capsule Stain	1/29/13	23
9	Observing Protozoa	1/31/13	25
10	Fungal Slide Cultures	1/31/13	29
11	Viable Cell Counts (Dilutions)	2/5/13	33
12	Bacteriophage Plaque Assay	2/12/13	37
13	Symbiotic Relationships		

Figure 3 Proper table of contents

Multi-page entries – Most of our laboratory exercises will require more than one page to complete the entire entry. Fortunately, our notebooks provide an easy mechanism to facilitate longer entries. At the bottom of each leaf of your notebook, spaces are provided to indicate continuing pages. If you have filled in page 12 (for example) simply indicate “Continued on page 13” on the bottom of page 12 and “Continued from page 12” on page 13. You can (and

should) use both sides of each notebook leaf. The only exception to this rule is that each new exercise should begin on an odd-numbered page. If this requires leaving the preceding page blank, you should mark it as described later in this document.

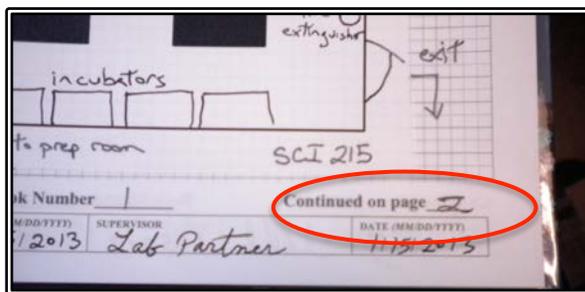


Figure 4 Continuing pages

Multi-day entries – Many of our exercises will require more than one day to complete. In these cases, you will need to indicate where each day's work in lab stopped and when you picked it back up again later. This is accomplished by drawing a horizontal line beneath the point where your current day's entry ends. You should sign and date your notebook above the line. Later, when you return to the exercise, you should indicate the date beneath the line and continue with the entry. Some of our laboratory exercises will span three or more class sessions and will require you to break your entries up into multiple sections in this manner.

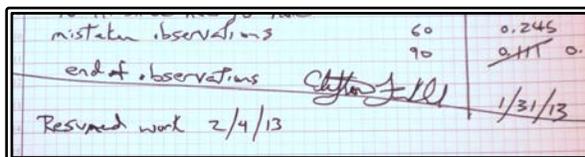


Figure 5 Multi-day entry

Correcting errors – Your laboratory notebook is a working document (like a journal) and mistakes will occur. The presence of errors in your entries will not result in a loss of points as long as they are properly corrected and they do not needlessly detract from the neatness, legibility, and clarity of your work. **NEVER** erase, blot out, or obscure information in your notebook. Neither should you ever remove pages from your notebook. Instead, when you make a mistake in an entry simply strike through the material with a line (the entry should still be legible). You never know – what you thought was a mistake might turn out to

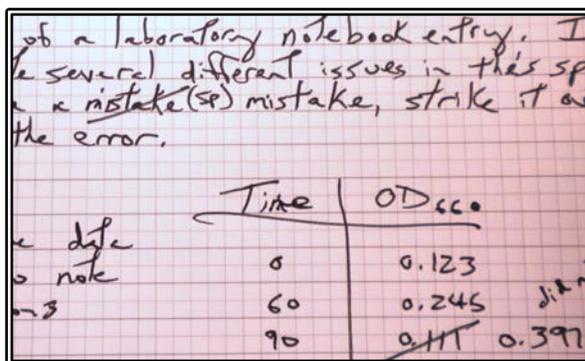


Figure 6 Correcting errors

be of some value later on during your work. It is also good practice to initial strikeouts and provide a brief explanation of the error (miscalculation, wrong sample name, etc.).

Inserting information – To simplify and standardize some portions of your laboratory entries, I will provide handouts to be included in your notebooks. You will cut these out to an appropriate size and permanently affix them to your notebook (scotch tape is preferred). Please indicate that there is nothing hiding beneath your insertions (and there should not be any overlapping materials in your entries). Loose sheets of paper in your notebooks are unacceptable.

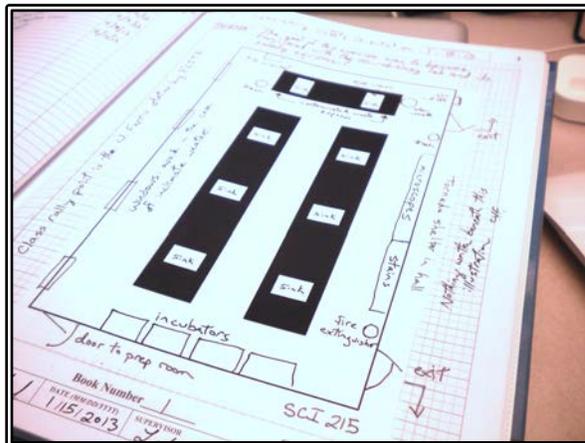


Figure 7 Proper notebook insertion

Unused space – Any unused space in your notebooks (whether a complete page or just a portion of a page) needs to be struck out and initialed. This is to demonstrate that additional data or observations were not added to your notebook at a later date.

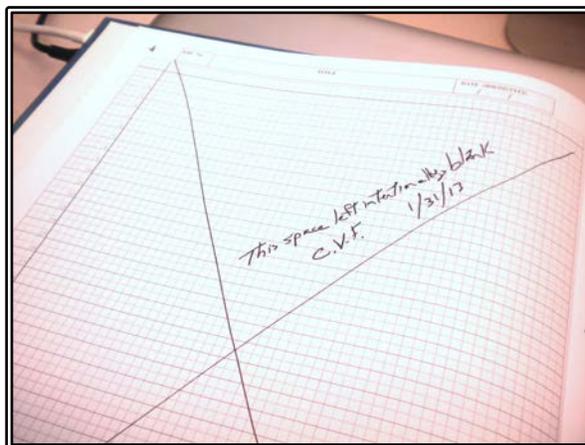


Figure 8 Marking unused space

Laboratory Entry Format

Your notebook entries should all have a common format and appearance. The six critical components of your entries are covered in our ancillary text. A brief description of each of these components is provided on the following page.

Title – (*WIB*, p 80) A short, but descriptive, title should be provided for each laboratory exercise. This title *must* appear at the top of each corresponding page in your notebook and also be present in the table of contents (in chronological order).

Purpose – (*WIB*, p 79) A very brief explanation of the activity's purpose should be present at the beginning of your entry. This only needs to be a few sentences long, but should adequately inform future readers about why you did the exercise and what you expected to find.

Procedure – (*WIB*, pp. 51-55) You should provide enough detail here to enable future readers to replicate your results. Alternatively, this section should have enough detail to remind you of what you did and how you did it when you need to reference it later this semester. You may cut and paste instructions from our lab handouts when applicable.

Observations – (*WIB*, pp. 55-75) Your observations in lab are amongst the most important parts of your notebook entries. Pay special attention to this part and put as much detail into your work as possible. Include tables of data, drawings, graphs, and other illustrations as you see fit. Please make sure to clearly label all illustrations, axes, and tables.

Conclusions – (*WIB*, pp. 75-78) Each laboratory exercise will include a few “critical thinking” questions. You will need to analyze your data and address these questions to complete the conclusion section.

Signatures and dates – One final point. You must sign and date every page of your notebook. In addition, you must have each page read and witnessed by a classmate. You can exchange notebooks with your lab partner to accomplish this. By witnessing your partner's work, you are stating that they did the work themselves, that they safely and correctly performed the exercise (to the best of your knowledge), and that you have read and understood what they have recorded.

Notebook Grading Rubric

Your laboratory notebooks will be collected on three occasions and evaluated using the following scoring guide. You will receive a score out of 30 possible points on each of these occasions. Additional feedback will be provided on the rubric and within your notebooks.

Criteria	4 points	3 points	2 points	1 point	0 points
Table of contents	Table of contents entries containing a number, title, date, and page number are present for each exercise completed.	1 or 2 pieces of the information expected are missing for exercises recorded in the table of contents.	3 or 4 pieces of the information expected are missing for exercises recorded in the table of contents.	5 or 6 pieces of the information expected are missing for exercises recorded in the table of contents.	7 or more pieces of the information expected are missing for exercises recorded in the table of contents.
Entries	All exercises are legibly recorded in the notebook in chronological order beginning on an odd-numbered page.	1 of the lab exercises is out of chronological order or has issues with legibility or does not begin on an odd-numbered page.	2 of the lab exercises are out of chronological order or has issues with legibility or does not begin on an odd-numbered page.	3 of the lab exercises are out of chronological order or has issues with legibility or does not begin on an odd-numbered page.	4 or more of the lab exercises are out of chronological order or has issues with legibility or does not begin on an odd-numbered page.
Format	All entries include appropriate titles, purpose statements, descriptions of methods, observations, and conclusions.	1 entry does not include appropriate titles, purpose statements, descriptions of methods, observations, and conclusions.	2 entries do not include appropriate titles, purpose statements, descriptions of methods, observations, and conclusions.	3 entries do not include appropriate titles, purpose statements, descriptions of methods, observations, and conclusions.	4 or more entries do not include appropriate titles, purpose statements, descriptions of methods, observations, and conclusions.
Clarity	All of the entries have enough detail to enable someone to repeat the work or study the material at a later date.	1 of the entries does not have enough detail to enable someone to repeat the work or study the material at a later date.	2 of the entries do not have enough detail to enable someone to repeat the work or study the material at a later date.	3 of the entries do not have enough detail to enable someone to repeat the work or study the material at a later date.	4 or more of the entries do not have enough detail to enable someone to repeat the work or study the material at a later date.
Observations	All of the entries include detailed observations illustrated in ink with an appropriate sense of scale, color, and accurate labels.	1 of the entries do not include detailed observations illustrated in ink with an appropriate sense of scale, color, and accurate labels.	2 of the entries do not include detailed observations illustrated in ink with an appropriate sense of scale, color, and accurate labels.	3 of the entries do not include detailed observations illustrated in ink with an appropriate sense of scale, color, and accurate labels.	4 or more of the entries do not include detailed observations illustrated in ink with an appropriate sense of scale, color, and accurate labels.
Conclusions	All of the analytic prompts for the exercises have complete and correct responses.	1 to 2 analytic prompts for the exercises have incomplete or incorrect responses.	3 to 4 analytic prompts for the exercises have incomplete or incorrect responses.	5 to 6 analytic prompts for the exercises have incomplete or incorrect responses.	7 or more analytic prompts for the exercises have incomplete or incorrect responses.
Signatures	All completed pages of the notebook are signed by the student, a witness, and are dated.	1 or 2 completed pages of the notebook are not signed by the student, a witness, or are not dated.	3 or 4 completed pages of the notebook are not signed by the student, a witness, or are not dated.	5 or 6 completed pages of the notebook are not signed by the student, a witness, or are not dated.	7 or more completed pages of the notebook are not signed by the student, a witness, or are not dated.
Attachments			No loose papers are present. Any insertions are securely and permanently attached and no pages have been removed from the notebook.	No loose papers are present. Some insertions are not securely attached, but no pages have been removed from the notebook.	Either loose sheets of paper are present or pages have been removed from the notebook.

Laboratory Notebook Checklist

Please make sure that each of your entries for our laboratory exercises this semester conform to the following points. Deviations from these expectations will result in the loss of points.

- All entries should be neatly written and clearly legible
- Entries should be written using solvent-resistant permanent ink
- A table of contents entry should be present for each exercise (including exercise number, title, date work began, and beginning page number)
- Each exercise entry should begin on the right side (an odd-numbered page)
- Every page should include the exercise number, title, and date at the top
- Each exercise entry should include a brief but accurate statement of purpose
- The materials and methods used should be illustrated and explained in enough detail to enable others to repeat the procedure.
- All provided inserts should be securely taped into the notebook without covering any of the written entry
- All drawings should be made in pen with enough detail to clearly illustrate the objects viewed. These drawings can (and should) be embellished using color pencils when appropriate.
- Any conclusions should be clearly stated along with their supporting evidence.
- Mistakes should be struck out using a single thin line (e.g. ~~misspell~~)
- For multi-day exercises – a horizontal line should be drawn across the page at the end of each day's entry and the date recorded above that line
- For multi-page entries – the prior or next pages should be indicated as necessary
- At the conclusion of an exercise, unused space should be blocked out using an "X" and that space should be initialed and dated
- Each page of your notebook should be signed and dated as they are completed
- Upon completion, each exercise entry should be read, understood, and witnessed by your laboratory partner