Biotechnology Laboratory Notebook Protocol (version 4.0; Biotech Series)

Students in the Biotechnology pathway and the Research courses will be required to maintain laboratory notebooks. Documenting work in a laboratory notebook is an important skill to master and is often mandatory in college research and biotechnological careers. The lab notebook is used to document the experiment being performed so that the work can be reproduced by following the information in the book. During your research and lab investigations you should "commit nothing to memory" and write everything down. Please review pages 25-26 in your Biotechnology textbook and be sure to read the "Biotech in the Real World" story on page 26 to understand the importance of these notebook procedures and expectations. This protocol contains 1). Standard Operating Procedure (SOP), 2). Exemplar notebook entries and, 3). A detailed rubric for notebook assessment.

1). Standard Operating Procedure (SOP)

Academy of Science, Research and Medicine	**Standard Operating Procedure (SOP)**
SOP .004	**Laboratory Notebook Entries**
Department: **Biotechnology**	**Page 1 of 2**
Version: **1**	Date Created: **08/04/2014**
Author: **Marc Pedersen/Tricia Pedersen**	Authorization: **NA**

Purpose:
This SOP describes how to enter laboratory activities, research and investigations. In a laboratory notebook.

Scope:
This SOP applies to all students and course instructors in the Biotechnology pathway within the Academy of Science, Research and Medicine at Paulding County High School. It is the responsibility of the students to follow the procedures described in the SOP. It is the responsibility of the course instructor to ensure that students comply with the SOP and to provide adequate training to ensure compliance.

Additional Documentation:
Laboratory notebooks will be permanently bound with sequentially numbered pages. Each page will have a space for a title. Each page will have "To" and "From" page indicators to link experiments that continue on multiple pages. Each page will have a space for the signature of the author and a witness and the date the page was signed.

Definitions:
SOP: Standard Operating Procedure
Laboratory Notebook: Any permanently bound book used to record laboratory experiments.

Procedure:

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1. General Guidelines

a. Make all laboratory notebook entries using black or blue pen. No pencils.

b. Page linking identifiers: All page numbers are on the top right. When an entry continues onto an additional page, write the page number on which the entry is continued in the **To Page** field at the bottom right of the page. Write the page number where the entry originated in the **From Page** field at the top left of the new page. If it is the start of new lab/protocol, the **From page** number should match the page number on the top right. At the end of lab/protocol, the bottom right should read **To Page** X.

c. Witnessing: When labs/protocols are started and completed, sign and date the page in the author/researcher field at the bottom of the page. Have a witness sign and date the entry.

d. Cross out any errors with a single line so that the incorrect entry can still be read.

e. Cross out any empty space with a single diagonal line.

f. Always start a new experiment on the next clean page.

g. Leave one pages (front and back) blank for a **Table of Contents**; otherwise never leave blank pages to be completed later.

h. Table of contents lists the date, experiment title, and page numbers

i. The date format is day month full year (e.g., 01 Aug 2016)

2. Procedure for the laboratory notebook entry

a. Write a title that clearly identifies the experiment.

b. Under the **Purpose** heading, state the purpose of the experiment.

c. Under the Introduction heading, write any background information pertinent to the experiment. Reference any previous experiments/labs that relate to this experiment/lab.

d. State the hypothesis of the experiment (if any) under the **Hypothesis** heading.

e. Under the **Materials** heading, list all specialized equipment, reagents, and materials required to perform the experiment.

   i. For equipment, note the model and serial number.

   ii. For chemicals and other materials, note the full name, the concentration, the lot or batch number, catalog number and the expiration date (if available).

f. Under the **Methods** heading, document each step of the procedure that is being carried out.

   i. Record all reagent quantities and volumes.

   ii. Record concentrations of all reagents.

   iii. Record all incubation times and temperatures.

   iv. Write out all calculations used to deduce quantities.

g. Under the **Results** heading, record all raw data that resulted from the experiment and any data analysis that was performed. This includes detailed observations, sketches, graphs and tables. Include error analysis (qualitative and quantitative)

   i. Label each sketch and graph as a figure with a figure number and a caption. Figure numbers should be sequential.

   ii. Label each table with a table number and a caption. Table numbers should be sequential.

h. Under the **Conclusions** heading record how the results relate to the purpose or hypothesis of the experiment. Record ideas for future investigations and sources of error (qualitative and quantitative).

i. Under the **References** heading, add any relevant references.

Revision History

Version	Date of Revision	Author of Revision	Description of Changes
4	**25 July 2016**	**Marc Pedersen**	**page # format; date format**

2). Exemplar Notebook Entries (page 1)

From page #: 24
Book: 1
Project: 1

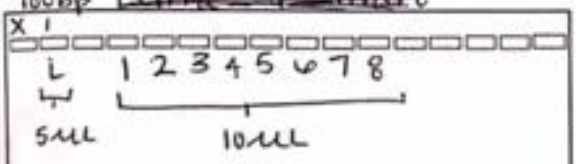
Title: Detection and monitoring of mussel species using Environmental DNA

25

March 14th 2016:
Below is the gel sheet, and the gel image is taped below. All bands shown are for cyt. 8.

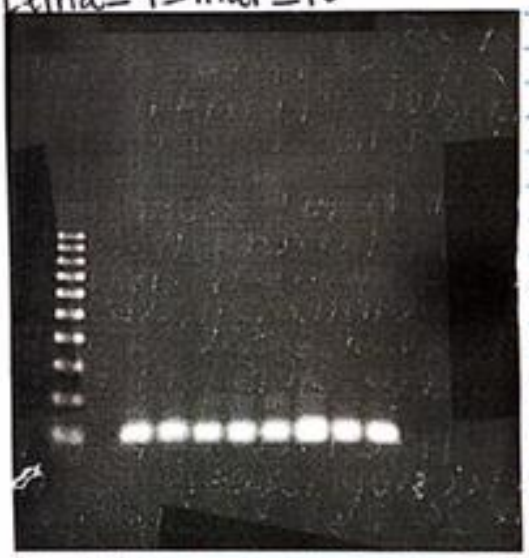
1.5% TBE gel Run on.
90 volts; 1:15 mins. March 10th
Lema-9-mar-16 2016

100bp ~~Lema-9-marc~~



1: Sample 3; 1uL Primer; 2uL DNA
2: Sample 4; 1uL Primer; 2uL DNA
3: Sample 5; 1uL Primer; 2uL DNA
4: Sample 6; 1uL Primer, 2uL DNA
5: Sample 3; 2uL Primer; 2uL DNA
6: Sample 4; 2uL Primer; 2uL DNA
7: Sample 5; 2uL Primer; 2uL DNA
8: Sample 6; 2uL Primer, 2uL DNA

Lema_9_mar_16



- To keep optimizing PCR, we will use the DNA samples from our last extraction (pg. 23). We will be using samples 3, and 5 (chosen randomly) and new DNA samples labeled 7, and 8.
- PCR components and thermocycler conditions are on the next page (pg. 26)

Signature:	Date:	Witness signature:	Date:	To Page #:
Taylor Shadle	03/14 14 Mar 2016		14 MAR 16 3/14/16	26

14 Mar 2016

2). Exemplar Notebook Entries (page 2)

From Page 43 44

Project No. 21

TITLE Bradford Test Book No. 1

③ place your control cuvette into the machine, making sure that the light is passing through the clear part of cuvette -press read blank.
④ add your unknown to the machine and press read sample.
⑤ write down the mg/ml of the sample (*.76 mg/ml)
⑥ multiply times the dilution factor to get original concentration

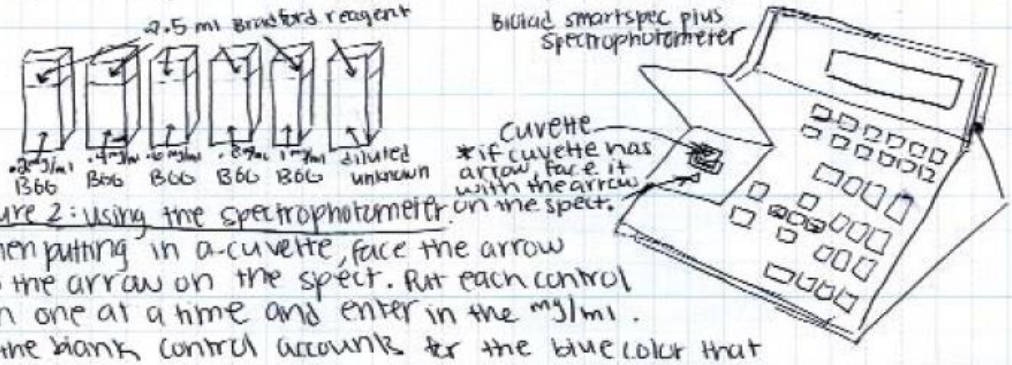


Figure 2: using the spectrophotometer. When putting in a cuvette, face the arrow to the arrow on the spect. Put each control in one at a time and enter in the mg/ml.
* the blank control accounts for the blue color that was left on to the cuvette.

Results

-spectrophotometer result = ~~.76~~ .7599 mg/ml (dilution factor) ×50 = 37.995 mg/ml (convert to grams/100 ml)

want over 100 mL → $\frac{37.995\ mg}{100\ ml} = \frac{3799.5\ mg}{100\ mL}$ 3799.5 mg · $\frac{1\ g}{1{,}000\ mg}$ = $\frac{3.8\ g}{100}$ = 3.8% protein

	qualitative measurement (prediction)	quantitative measurement
concentration	1.2 mg/ml	.7599 mg/ml

Table 1 - Comparing Qualitative and Quantitative measurements

- As shown in Table 1, the qualitative measurement that was made by eye was predicted to have a concentration above the known standards, whereas the Smartspec plus report showed the concentration to be .7599 mg/ml
- the spectrophotometer result was multiplied by the dilution factor, then converted to a precent in grams, which was about 3.8% protein.

To Page x

SIGNATURE [signature] DATE 1 Feb 2010 WITNESSED & UNDERSTOOD BY [signature] DATE 01 Feb 2010

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3). Rubric for Laboratory Notebook (Formative and Summative Grades)

Objective	Emerging 0-10	Developing 10-20	Advanced 20-25	Score
Organization Organize lab notes effectively	1. Pages are not numbered, dated or signed. Few have "from page" and "to page "direction. 2. Few titles or headings 3. Table of contents is missing and/or incomplete. 4. When experiments are on different sections of the notebook, forwarding and previous section information are not provided.	1. Most pages are numbered, dated and some are signed (per SOP). Most have "from page" and "to page "direction. 2. Titles and headings are clearly marked in most experiments. 3. Table of contents is mostly current and complete 4. When experiments are on different sections of the notebook, information on the location is hard to follow.	1. All pages are numbered and have "from page" and "to page "direction. Every section is dated and signed (per SOP). 2. Each experiment has a Title, Purpose, Materials, Procedure, Results and Conclusion 3. Table of contents lists the date, experiment title, and page numbers for each experiment. 4. When experiments are on different sections of the notebook, forwarding and previous section information are clearly provided.	_____
Content Describe materials and methods used and document results	1. Methods are incompletely described. 2. Figures and Tables are not included when appropriate. 3. Observations are not described.	1. Methods and Materials are described in most experiments. 2. Most Figures and Tables are included but not properly labeled. 3. Observations are noted but lack details.	1. One could repeat the experiment from the Methods and Materials described. 2. All Figures and Tables are included and labeled (per SOP). 3. Observations are carefully recorded with details.	_____
Analysis Describe data analysis	1. Data analysis is rarely described or included. Little work shown. 2. Very little error analysis 3. Very few inferential statistics were used.	1. Data is analyzed, but the methods used were not full described and work was partially shown 2. Error analysis is only qualitative. 3. Inferential statistics used infrequently and/or incorrectly	1. Data is analysis is complete with sample calculations written out in full. 2. Error analysis is qualitative and quantitative. 3. Inferential statistics used correctly when applicable	_____
Interpretation Reach a conclusion	1. Conclusions were not documented well.	1. Immediate thoughts are recorded for most experiments, but without reflection or future direction.	1. Results are interpreted in the context of the hypothesis being tested or technique being conducted. Researcher provides reflection into error analysis and future direction for research.	_____