Cell & Molecular Biology Laboratory:

Enzymology (Tyrosinase) Report, Expts. 5 & 6

Due Thurs., Oct. 13, 2011 (5-6 *typed* text pages, MAXimum!!); 60 points total!

Note: *Please write your reports in PAIRS (2-3 students, maximum), but ONLY **use your OWN members' words** and **only tabulate and graph data from your group**. You may refer to other groups' data for comparison. **Both authors must hand-sign the report, and include a statement that you BOTH contributed EQUALLY** (or an estimated percentage contribution each partner made) to performing the experiments, presenting the data, & conducting the analysis and writing of the report.*

- ***Thoughtful analysis, careful explanations, and well-organized and well-explained data are the keys to your grade!!!***
- *The attached grading rubric is a general guideline for grading biology lab reports. Not all standards may apply here.*

1. **Introduction** (0.5-1 page; 14 points): In your own words and from your own point of view, give a thoughtful overview of experiments 5 & 6. Recognizing the *SIGNIFICANCE of your scientific investigations* is always crucial to scientific professions. Therefore, you should include some ***background information on tyrosinase, DOPA and/or melanin*.** Also ***discuss enzymes and why they are important*** to biology, the environment, medicine, and/or our scientific understanding of life in general.
   - **a)** Be sure to cite any outside sources according to the following format (see also the *Cell* journal example with the link below)**: Author - Last, First name(s). (Year published). "Title of Article or chapter." *Title of Journal or Book*. Publisher and Location, if a book.** *Parenthetical In-Text Citations (eg: APA style or CBE/CSE) are preferred.* ***[see Syllabus for more on citations]***
   - **b)** **What** is the Question/**Hypothesis** we are testing in each experiment (from YOUR point of view? – Write the Hypothesis and your Predictions for the Experiment in: *"If____, then ____" format*). What is the overall **purpose** of the experimental investigations? **Why** are we doing these experiments (not only from an educational perspective, but why is it important to understand tyrosinase and how enzymes work in general?). **How** are we performing the investigations? What laboratory techniques, experimental methods (in general), and general strategies are we using? What predictions can we make based on our hypothesis, & how will we make *unambiguous interpretations* of the results *(hint: consider the **control samples** we used, & if there are others we could/should have used)*?

2. **Methods** (0.5-1 page; 6 points): These do not to be as detailed as the examples given in the professional versions below. Mainly, just reference the lab manual, and ***include any special alterations we or you made to the experimental procedures***. Be sure to **include** any important details of conditions, reagents, and control samples used in your Self-Designed Investigation for **Experiment 5.3,** and the **precise conditions we decided to use for in-gel enzyme detection** for Experiment. 6. ***What was the purpose of the different buffers and reagents we used in the experiment (****why do they contain the chemical ingredients that they have****)?***

3. **Results & Discussion** (3-4 pages of text; 30 points): Include **ALL DATA** in the form of Tables, Charts/Graphs, & Image/Photoscan Figures. Be sure to **label each data figure/table with an appropriate Title** (ie: pH data activity all on one line graph & your self-designed experimental data all on one graph). You should also **include a complete Legend, briefly describing the samples in the figure and the conditions that were used. LABEL all lanes and protein bands on your gel.** *[Data does not count towards the limit on the number of text pages.]*

Be sure to ***discuss the implications of the data, what we learn from it, and what it means*** in the **big picture** of how biological systems/cells work. Consider the ***Thought Questions*** included in the Lab Manual for each experiment – these address concepts that you should incorporate into your analysis of your experimentation and results. What conclusions can we make about the pH preferences of tyrosinase & it's mobility in Native PAGE (see data images under Additional Materials on the course website)? *Did the data **prove your/our hypotheses**? If not, how should we alter our hypotheses and retest them?*

- **The Results/Data and Discussion section should have THREE main PARTS:**
  - **a)** [Expt. 5.1-5.2] Enzyme extraction and colorimetric (spectrophotometric) assay -- I want LOTS of explanation on how we do these and WHY we use the buffers, reagents and conditions we use (eg: I even want you to mention why we keep extracts, especially protein extracts, on ICE!). ***I always want you to be THOROUGH but BRIEF in your explanations (ie: explain the main things well, but get to the point!).***
  - **b)** [Expt. 5.3] Student Investigation -- as for all the report, you need not list much of the procedural details from the Manual that were used (just reference the lab manual for basic procedures). However, you MUST give a DETAILED description of your designed experimental conditions -- temperatures, buffers, reagent concentrations, CONTROLS, times for readings, etc. There might have been mistakes or difficulties with your experimental methods, but ***if there were additional CONTROLS you should have done*** in hindsight, or unexpected variables you could not control, these must at least be DISCUSSED in the report.
  - **c)** [Expt. 6] Native PAGE and Activity Staining: Basic explanation of PAGE and how it works, all data and graphical analysis from the gel (with complete legends), why we used the sample, electrophoresis, and activity buffers that we did. What did we do to speed-up the in-gel reaction? You should know precise concentrations and names of reagents.

4. **Conclusions** (0.5 page; 10 points): Summarize the major "take-home" deductions that we can make from the data, and that are most significant to our understanding of enzymes and biology. *Were you able to form an **unambiguous answer** to your tested questions/hypotheses? If not, **what additional experiments, samples, or controls should we have used**?*

What other investigations could you conduct with our newly-learned lab methods, or what other aspects of tyrosinase, DOPA, or other enzyme activities do you think would be topics of interesting investigations? In other words, try to think outside what we did in our little laboratory experiment. ***Write a hypothesis statement for one of these experiments*** *(Use **"If…, then…"** format).*

Here are some real-life, good examples of professional scientific articles. Three are even related to our lab topic! Don't get overwhelmed by the technical content, just look at the format, organization & Citations, and read the abstracts / summaries.

- **http://www.cell.com/abstract/S0092-8674(09)01043-5**
- **http://www.cell.com/content/article/abstract?uid=PIIS0092867404004118**
  - *Open the PDF file to see a very standard format for biology papers.*
- **http://www.jbc.org/cgi/reprint/191/2/799.pdf#search=%22Dopa%20tyrosinase%22**
- **http://www.jbc.org/cgi/reprint/279/9/7971**

Laboratory Report (60 Points total) Grading Rubric:
Tyrosinase Activity: Spectrophotometry and Native PAGE Labs

Professor Name: **Dr. Nathan Staples**

Student Name(s): _____

CATEGORY	Excellent (6 points)	Good (4-5 points)	Fair (3 points)	Poor (0 - 2 points)
1. Components of the report	All required elements are present and additional elements that add to the report (e.g., thoughtful comments, graphics) have been added.	All required elements are present.	One required element is missing, but additional elements that add to the report (e.g., thoughtful comments, graphics) have been added.	Several required elements are missing.
2. Goals & Hypothesis	The purpose of the lab or the question to be answered during the lab is clearly identified and stated.	The purpose of the lab or the question to be answered during the lab is identified, but is stated in a somewhat unclear manner.	The purpose of the lab or the question to be answered during the lab is partially identified, and is stated in a somewhat unclear manner.	The purpose of the lab or the question to be answered during the lab is erroneous or irrelevant.
3. Materials and Methods	Procedures are listed in clear steps. Each step is a complete sentence.	Procedures are listed in a logical order, but steps are not in complete sentences.	Procedures are listed but are not in a logical order or are difficult to follow.	Procedures do not accurately list the steps of the experiment.
4. Data	Professional looking and accurate representation of the data in tables and/or graphs. Graphs and tables are labeled and titled.	Accurate representation of the data in tables and/or graphs. Graphs and tables are labeled and titled.	Accurate representation of the data in written form, but no graphs or tables are presented.	Data are not shown OR are inaccurate.
5. Analysis	The relationship between the variables is discussed and trends/patterns logically analyzed. Predictions are made about what might happen if part of the lab were changed or how the experimental design could be changed.	The relationship between the variables is discussed and trends/patterns logically analyzed.	The relationship between the variables is discussed but no patterns, trends or predictions are made based on the data.	The relationship between the variables is not discussed.
6. Experimental Design	Experimental design is a well-constructed test of the stated hypothesis.	Experimental design is adequate to test the hypothesis, but leaves some unanswered questions.	Experimental design is relevant to the hypothesis, but is not a complete test.	Experimental design is not relevant to the hypothesis.
7. Conclusion	Conclusion includes whether the findings supported the hypothesis, possible sources of error, and what was learned from the experiment.	Conclusion includes whether the findings supported the hypothesis and what was learned from the experiment.	Conclusion includes what was learned from the experiment.	No conclusion was included in the report OR shows little effort and reflection.
8. Appearance/ Organization	Lab report is typed and uses headings and subheadings to visually organize the material.	Lab report is neatly handwritten and uses headings and subheadings to visually organize the material.	Lab report is neatly written or typed, but formatting does not help visually organize the material.	Lab report is handwritten and looks sloppy with cross-outs, multiple erasures and/or tears and creases.
9. Scientific Concepts	Report illustrates an accurate and thorough understanding of scientific concepts underlying the lab.	Report illustrates an accurate understanding of most scientific concepts underlying the lab.	Report illustrates a limited understanding of scientific concepts underlying the lab.	Report illustrates inaccurate understanding of scientific concepts underlying the lab.
10. Background Sources	Several reputable background sources were used and cited correctly. Material is translated into student's own words.	A few reputable background sources are used and cited correctly. Material is translated into student's own words.	A few background sources are used and cited correctly, but some are not reputable sources. Material is translated into student's own words.	Material is directly copied rather than put into students own words and/or background sources are cited incorrectly.