General Goals of the Genetics Lab

• Students will learn basic molecular techniques, such as PCR, gel electrophoresis, restriction analysis, which are implemented in most research projects.

• Students will explore bioinformatics as an extremely useful tool to study proteins and genomes.

• Students will gain basic knowledge on how to work with model organisms.

• Students will apply the tenets of the scientific method in both descriptive and quantitative analyses to conduct and independent but guided research project.

• Students will learn how to safely dispose of various hazardous and non-hazardous chemicals.

PREREQUISIT
Prerequisites for this course are General Biology I and II with labs (grade C or better) and General Chemistry I and II with labs (grade of C or better).

CO-REQUISITE
Students enrolled in this course must be enrolled in the Genetics Lecture (BIOL3321) or have taken Genetics lecture previously.

TEXTBOOK
This course does not have a required textbook. All handouts will be posted on BlackBoard. It is your responsibility to read the assigned lab material and prepare for your quizzes. Bring a notebook to every lab.

## Tentative Lab Schedule

<table>
<thead>
<tr>
<th>DATE</th>
<th>LAB TOPIC</th>
<th>TO DO BEFORE LAB</th>
<th>TO DO DURING OR AFTER LAB</th>
</tr>
</thead>
<tbody>
<tr>
<td>29-31 Aug</td>
<td><strong>LAB 1</strong>: Pipetting and solution making. Quiz 1 will be on Lab Safety (see syllabus), and your first handout.</td>
<td>HW1 Q1A</td>
<td>Hand in pipetting worksheet (WS1). Pipetting skill test (Q1B).</td>
</tr>
<tr>
<td>5*-7 Sept</td>
<td><strong>LAB 2</strong>: Cheek cell DNA extraction. <strong>Lab starts at 1:15pm.</strong> <em>Students in lab section LA (Monday) will attend lab on Friday, September 11th. Please email Dr. Simmons if you have a schedule conflict.</em></td>
<td>Q2A</td>
<td>Q2B</td>
</tr>
<tr>
<td>12-14 Sept</td>
<td><strong>LAB 3</strong>: Student presentations. Introduction your independent experiment.</td>
<td>Student presentations (P3)</td>
<td>HW3 (group) Due next week.</td>
</tr>
<tr>
<td>19-21 Sept</td>
<td><strong>LAB 4</strong>: Polymorphic regions: how many repeats do you have? <strong>Lab starts at 1:15pm.</strong></td>
<td>Q4A</td>
<td>HW4 (group) Due next week.</td>
</tr>
<tr>
<td>26-28 Sept</td>
<td><strong>LAB 5</strong>: Independent experiment: DNA extraction. <strong>Lab starts at 1:15pm.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-5 Oct</td>
<td><strong>LAB 6</strong>: Independent experiments: PCR reactions. Students will have a 2-hour wait while PCR takes place. <strong>Setup PCR previously. PCR reaction at 12:00pm.</strong> Pre-lab Quiz 6.</td>
<td>Q6A</td>
<td></td>
</tr>
<tr>
<td>10-12 Oct</td>
<td><strong>Fall Break – no labs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17-19 Oct</td>
<td><strong>LAB 7</strong>: Independent experiment: Sample preparation for sequencing. Introduction to phylogenetic analysis with lizards.</td>
<td>HW7 (individual)</td>
<td></td>
</tr>
<tr>
<td>24-26 Oct</td>
<td><strong>LAB 8</strong>: Independent experiment: Phylogeny of orchids.</td>
<td>HW8 (group)</td>
<td>Student presentation (P8)</td>
</tr>
<tr>
<td>31 Oct-2 Nov</td>
<td><strong>LAB 9</strong>: DNA barcoding data analysis. Bring your laptops.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7-9 Nov</td>
<td><strong>LAB 10</strong>: PyMOL</td>
<td>HW10 (individual)</td>
<td>Student presentation (P10)</td>
</tr>
<tr>
<td>14-16 Nov</td>
<td><strong>LAB 11</strong>: Student teams present the findings from their independent experiments</td>
<td>Mini-Report</td>
<td></td>
</tr>
</tbody>
</table>

**Abbreviations:**

Q = Quiz; WS = Worksheet; HW = Homework; P = Student presentations

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Attendance and Assignments

• **You are expected to attend every lab session and arrive on time.** If you have an emergency that requires you to miss class you must notify your instructor immediately in order to plan a potential solution.

• Some experiments will require you to come to the lab outside the regular schedule and conduct specific procedures or collect data.

• If you have a **cell phone and/or pager**, please be sure to turn it to **silent mode** before lab begins. All other electronic devices **MUST** be turned OFF.

• All assignments must be turned in at the beginning of lab. **LATE ASSIGNMENTS WILL NOT BE ACCEPTED.** Be sure to follow the guidelines provided for each specific assignment.

Guidelines for Notebook

• You must use a bound notebook (no spiral) to keep track of the activities you perform during this lab.

• Leave a few pages at the beginning of the notebook for a Table of Contents, which you will complete as the lab progresses.

• Be thorough. Record the date, concentration of solutions you have used, how long your experiments ran, changes in coloration or smell. Sometimes you will need to repeat the experiment, or report your results, and having this information is very important. Be sure to use the appropriate units (metric). Write down all calculations as well.

• Do not erase anything. If you have made a mistake, or if something does not work, cross it out but do not erase it. It will allow you to keep a record of variables you have already tested, or as a reminder on what not to do.

Scholastic Ethics

The Education System is one **based on trust**: future employers trust that your grades reflect your level of achievement and knowledge, your parents trust that UST will provide you with the best education, and your professors trust you to do your own work and be honest. You must work towards developing your reputation as a student. This way we will trust you to be in our research teams and working in our labs. A professor that trusts you will write you great letters of recommendation and will support you. Once you loose that trust, it is very hard to get it back.

It is your responsibility to read the UST Policy on Academic Dishonesty in the Undergraduate Catalog. Each student must do their own work on exams, quizzes, and all assignments. Academic dishonesty includes (but is not limited to) making one’s work available to other students, copying another student’s work, plagiarizing information from any source, cheating on quizzes or exams, etc. All instances of academic dishonesty will be reported to the Academic Committee and the penalty will be at the discretion of the instructor: a grade of zero on the assignment or an F in the course.
Activities and Grading

<table>
<thead>
<tr>
<th>Activity</th>
<th>Lab</th>
<th>Points</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quizzes (20 pts each x 6)</td>
<td>1A, 1B, 2A, 2B, 4A, 6A</td>
<td>120</td>
<td>Beginning or end of each lab</td>
</tr>
<tr>
<td>Homework / Worksheet (15 pts each x 7)</td>
<td>HW1, WS1, HW3, HW4, HW7, HW8, HW10</td>
<td>105</td>
<td>See schedule</td>
</tr>
<tr>
<td>Graded, in-lab presentation (25 pts each)</td>
<td>P3, P8, P10</td>
<td>75</td>
<td>See schedule</td>
</tr>
<tr>
<td>Student final presentation on Independent Experiment</td>
<td>11</td>
<td>150</td>
<td>16-18 Nov</td>
</tr>
<tr>
<td>2-page Mini-Report on Independent Experiment</td>
<td>11</td>
<td>25</td>
<td>16-18 Nov</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>475</strong></td>
<td></td>
</tr>
</tbody>
</table>

Keep track of all your grades so that you may assess your progress in this course. See table below for percentage/letter grade equivalencies. Please note that your instructor WILL NOT calculate your grade for you.

Your final grade will be calculated using the following percentage scale:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>&lt;59</td>
</tr>
<tr>
<td>D</td>
<td>60 - 65</td>
</tr>
<tr>
<td>D+</td>
<td>66 - 69</td>
</tr>
<tr>
<td>C</td>
<td>70 - 75</td>
</tr>
<tr>
<td>C+</td>
<td>76 - 78</td>
</tr>
<tr>
<td>B-</td>
<td>79 - 81</td>
</tr>
<tr>
<td>B</td>
<td>82 - 85</td>
</tr>
<tr>
<td>B+</td>
<td>86 - 88</td>
</tr>
<tr>
<td>A-</td>
<td>89 - 91</td>
</tr>
<tr>
<td>A</td>
<td>92 - 100</td>
</tr>
</tbody>
</table>

Incompletes (I) are given only in extreme circumstances. For more information see the Student Handbook.

Regarding your final grades: “Course grades are communicated to students by the Registrar's Office. Faculty members may not post course grades, even with a coded listing, or by any other means, whether orally or in writing, communicate them to the students” (UST Faculty Handbook).
In case of emergency, notify your instructor and campus security (713-525-3888). If directed, call 911.

Other contacts to be used only in case of emergency:
Lab Coordinator, Building Safety Captain – Jonathan Newsome (832) 971-5971
Building Safety Captain – Ruth Ann Bagnall (713) 525-3167

General Information:
• Completely read the assigned lab exercise or experiment BEFORE entering the lab.
• Teaching assistants are employees of the University and must be treated with the same level of respect as any other staff or faculty member.
• The consumption of food or drink in lab is PROHIBITED. All food items must remain OUTSIDE of the lab during class time. NO EXCEPTIONS. This includes chewing gum.
• Putting on makeup or contacts is not allowed in lab. Please do this before coming to class.
• Closed-toed shoes must be worn at all times. Open-toed shoes are not permitted. You will be asked to leave the lab if you arrive in sandals, flip flops, or shoes that do not adequately cover your feet. Wear lab-suitable clothing.
• If you are allergic or sensitive to any material used in lab, notify the instructor immediately. The Biology Dept. provides nitrile gloves for laboratory use.
• Never work in the laboratory alone, except with instructor permission. Access to the laboratory is limited at the discretion of the instructor and lab coordinator, especially during non-classroom times.
• No materials, reagents or instruments are to be removed from the lab, except by the instructor.

Lab Safety:
• All accidents, even the most minor, should be reported to the instructor, TA, or lab coordinator IMMEDIATELY.
• In case of fire, there is an evacuation route at both ends of the lab - take the route that takes you away from flames. (See attached floor plan). There is also a fire extinguisher in the lab. Only use if the fire has small risk of spreading and if usage does not put you in danger. Please leave the lab in a prompt but calm manner if a fire occurs, while alerting those around you that there is a fire in the building. Fire alarms are located near the entrances to Anderson Hall.
• There are shower and eye wash stations in all labs (see attached floor plan). If you 'think' you need to use a wash station, especially when your eyes are involved, then you do.
• There is a first aid kit for minor injuries located in the lab (see attached floor plan).
• Be careful not to touch hot glass - glass cools slowly. Use hot pads provided by instructor.
• Never leave a flame or hot plate unattended.
• Eye protection is provided and is to be worn when working with caustic liquids, especially acids or bases.
• Gloves should be worn when working with preserved specimens,
bacteria, buffers, or caustic liquids. Remove gloves BEFORE LEAVING.

• NEVER use your mouth to pipette solutions.
• Keep hands away from face and mouth while in lab.
• Wash your hands after lab, especially if you have been working with bacteria or chemicals.
• Horseplay and practical jokes can be dangerous and are not permitted.
• Keep all extra books and materials such as jackets stored away from your bench top.
• Dumb questions are not nearly as dangerous as dumb mistakes - please ask!!!!

Waste Disposal:

• You MUST clean your lab bench before leaving the laboratory for the safety of the students in the following labs. This includes washing your glass wear, wiping down your lab bench, and properly disposing of any waste generated.
• Disposable sharp objects such as scalpels, needles, or razor blades must be disposed of in a proper sharps container which will be provided to you if necessary.
• Broken or chipped glassware should be disposed of in the broken glassware disposal boxes. If in doubt, ask a professor or TA what you should do BEFORE you use it.
• Do not dispose of anything down the sink unless you have permission to do so by the instructor. Most chemicals CANNOT go down the sink and must be disposed of in a chemical or biohazard waste container.
• Biohazardous waste must be disposed of in a biohazard bag. DO NOT throw away biohazardous materials in the trashcan.
• Chemical spills should be cleaned according to the nature of the liquid. Notify the instructor of spills, especially if they involve acids, bases or caustic solutions.
• MSDS (material safety data sheets) are provided in an addendum to this safety information. Please reference the MSDS for chemicals you are working with in the lab so that you are aware of any potential hazards.

Please acquaint yourself with the following waste disposal and chemical hazard signs:

Sharps container for proper sharps disposal.

Glass disposal box for broken glassware.
Universal biohazard symbol that indicates biohazardous waste. Do not discard non-hazardous waste in these containers.

NFPA Ratings that you may see on lab chemicals and solutions.
Guidelines for Writing your 2-page Mini-Report

“Educating students on how to write in a specific scientific discipline is equivalent to teaching them how to think critically in that discipline (Nilson, 2003). It is important for students to learn the metacognitive model behind the scientific method; meaning they must comprehend why, when and how one uses specific methodologies to acquire information, record and interpret data, and to convey the results effectively”.

For some labs you will be handing in a **two page** Mini-Report. It must include the following sections: Title, Introduction, Methods, Results, Discussion and Conclusions, Literature Cited. Additional information and hints are provided for each section (see *italicized text*).

1. **Title**: Here you will state the main question: what are you investigating? The title must be specific and allow the reader to know exactly what you are investigating. Underneath the title you should write the last names of all the members of your lab team (followed by the initial of the first name), the name of your instructor (bold text), lab section and date. If you are the author of an individual report your name should be listed first and must be underlined, followed by the names of your group members.

   Example:
   
   **Effect of light with three different wavelengths on photosynthetic rate**
   
   Carrasco, M., Jones, P., Smith, H., Vu, T. Rosell, R. Lab Section LA: 09/15/09

   • Write a descriptive title. Be specific. For example “Choosing the best mouthwash” or “Which concentration kills more bacteria” are vague as they fail to describe what substances you used, what ‘best’ means, how many different solutions or chemicals were tested, or what bacterial strains were used to conduct the experiment. A better title would be “The effects of three different brands of mouthwash on the growth of S. aureus”.

   • The main conclusion of your research can also be used as a title, for example, “Listerine mouthwash inhibits growth of S. aureus more effectively than Scope”.

   • Writing the names of all your group members (and spelling them correctly) shows respect. Whether you are handing in an individual or group mini report, all the names of your research colleagues must be there. This shows good work ethics.

2. **Introduction**: Select the two or three key concepts related to your experiment (usually your dependent and independent variables) and briefly explain them. For example, if your experiment involves enzymatic reactions and temperature, you should describe enzymes, how they work, what can affect their function, then explain the consequences of changing the environmental conditions of the reaction and then focus on the effect of temperature. You have a limit of 6 succinct sentences to convey this information. Cite your information sources within the text by putting the last name of the first author and year of publication in parentheses, for example (Perez, 1996). In the last 2-3 sentences of your introduction, state your rationale and hypothesis, which should portray the relationship you expect to find between the independent and dependent variables.

   • When you are conducting an experiment you will be describing in a report, pick the three or four topics you need to address in your introduction. For example, if your title was “Effect of mouthwash alcohol concentration on E. coli growth”, you should talk about mouthwashes, the effect of alcohol on bacterial growth and you should describe E. coli. You should also make use of relevant primary literature and avoid making your introduction sound like an encyclopedia entry by providing information that is as specific as possible to your subject.

   • Have a **rationale** for your hypothesis. The rationale (reason you are doing this specific experiment) and hypothesis will state the relationship between your dependent and independent variables. Your rationale must be clearly stated and express the reasons why you pose your hypothesis in the first place. It should
also be grounded on observations or background research using the scientific literature. The rationale is usually written in 1-2 sentences after the background information and before the hypothesis in the introduction section.

3. Methods: In this section you will briefly describe how you conducted your experiment. In paragraph form, describe the experimental procedures performed to obtain your data. Use the past tense. You must be specific (give exact measurements, volumes, times, etc.), but at the same time, be brief and only include details that are necessary if someone else would wish to replicate the experiment. Remember to indicate the number of replicates. You may state that the protocols followed were as in the lab handout (remember to cite your handout) and mention any deviations or changes from the original procedure.

• How you labeled your samples and the number of tubes you used are pieces of information that are not crucial for another researcher to be able to repeat the experiment. Write only what another person would need to know if someone wanted to replicate your experiment. Mention the number of trials conducted (which usually is three). Use your technical vocabulary and avoid using personal pronouns; for example, say “paper discs soaked in the three test solutions were placed on bacterial lawns of E. coli” instead of “we used three paper circles for each solution, wet them and then put them on one of the quadrants of a Petri dish that had E. coli smeared all over”. Describe what you used as your control.

4. Results: This section should contain at least one paragraph (no more than 5 sentences) describing your most significant findings followed by a graph (or table) that shows your data. Always refer to your table or graph in the text by citing it at the end of the sentence, or using parentheses, for example: see Figure 1, or, see Table 3 below, or, (Figure 2). Remember your figures must have descriptive legends below them, and tables are to be identified with titles at the top. Never include raw data. Do not begin your sentences with “Figure 2 shows”. Keep in mind you must describe the data, not the figure.

• Describe all your results in the Results section. If there is anything particular about your standard deviation, mention it here. Mention exact values, as sometimes they cannot be estimated by observing the graph. For example, “Dr. Tichenor’s mouthwash had the highest zone of inhibition (19.5 mm ± 0.5) followed by…” Please remember that all numbers smaller than 1 should have a zero before the decimal point. Always use relevant units when mentioning data points.

• The graph (table or figure) should be presented AFTER the written description of your results. Understanding which are your dependent and independent variables allows you to decide which one goes on each axis, and if you should use a column or line graph. DO NOT graph your raw data. DO graph your averages. Be critical (smart) about your error bars. Remember that tables have a title (above the table), and figures and graphs have a legend (detailed short paragraph under the graph or figure). Your title or legend must be descriptive and should not include the results of your experiment.

5. Discussion and Conclusion: In your first sentence, state if the data supports your hypothesis or not. Then, interpret your results relative to the background information. Do not repeat what you stated in the ‘Results’ section; instead compare your findings to those published in the scientific literature. These may support (or not) your findings. For example, if you were testing salt concentration and its relationship to product formation in an enzymatic reaction, you should search publications where the authors describe the effects of different salt concentrations on the enzymatic activity of similar enzymes. This should be the longest section of your report and you may use up to 12 sentences for your data interpretation.

• Begin this section by stating if your data support your hypothesis (or not). Since it is a short format, you do not need to restate the hypothesis. The main point of your discussion is to explain why you obtained the data you did. What is the underlying mechanism? Why is product A better than product B? Do not repeat your results in this section. Discuss your findings in the light of the findings of others who have conducted similar experiments and remember to cite those primary references correctly. Because of the space limitation, please refrain from explaining what could have gone wrong or where your research could go in the future.
6. Literature Cited: List the references and the sources you cited in your text following the author-year format. Include a list of your references at the end of your document. You must use the proper format for in-text citations and references which is described in detail on pages 10-11 of this syllabus. In the literature cited section of your report, include all authors’ last names and initials, year of publication, and full title of the paper, article or book. For journal articles, you must list the journal name (abbreviated form is fine), volume, issue number if available, and inclusive pages. Books must be identified by publisher, place of publication, and inclusive pages. Please refer to Pechenik’s “A Short Guide to Writing about Biology”, Chapter 5, for more information on how to cite your references correctly.

- At minimum, you should have three references: one for your background information and two for your discussion. At least two of those, typically the ones you use in your discussion, should be primary references from peer-reviewed journals. In many cases, your textbook will be useful for the background information. If you do not include at least two primary references, the highest grade you can make in this section is a D. Keep in mind that opinion articles, encyclopedias and Wikipedia are not considered sources of scientific information.

Miscellaneous Directions for your Mini-report:

- Always follow the verbal and written instructions provided by your instructor. Make notes so you don’t forget.
- Use Arial text (size 11). The Literature cited may be presented in a smaller font if extra space is required (size 9). Margins: 2 cm on every side.
- The maximum length of your mini-report is TWO pages.
- If you are using scientific names of organisms, you must use the appropriate binomial nomenclature and italicize the text. For example, *Caenorhabditis elegans* or *C. elegans*.
- Make sure the font type, font size, margins and maximum extension (2 pages) of your document are correct. If you do not have strong writing skills, take your work to the Writing Center and get help.
- Be cohesive. If your title reads “Effect of mouthwash alcohol concentration on *E. coli* growth”, you are stating which are your dependent (growth) and independent (alcohol concentration) variables. Your hypothesis should reflect that you expect these variables to interact. Your graph must have ‘Diameter of growth inhibition’ on the y-axis and ‘Alcohol concentration’ on the x-axis, along with the corresponding units for these measurements or calculations in parentheses. Since concentration is a continuous variable, you should have a line graph. This is what it means to be cohesive. Your narrative and research of the literature should also relate directly to these general themes.
- Keep in mind that scientific writing is conventional, only uses established abbreviations and should be clear, concise and accurate. In addition, scientific writing uses formal language, avoids quotations, and is objective. Write with your audience in mind (college freshman level). For more information on characteristics of scientific writing, please see following document: <http://skills.library.leeds.ac.uk/uploads/Writing%20for%20Science%20Subjects747.pdf>.

The grading rubric that will be used to grade your mini reports is provided on the next page.
## Mini-Report Grading Rubric

<table>
<thead>
<tr>
<th>Sections</th>
<th>Possible Points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td><strong>B</strong></td>
</tr>
<tr>
<td><strong>1. Title (3 pts)</strong></td>
<td></td>
</tr>
<tr>
<td>Title is descriptive</td>
<td>2</td>
</tr>
<tr>
<td>Names of group members, professor and section</td>
<td>1</td>
</tr>
<tr>
<td><strong>2. Introduction (10 pts)</strong></td>
<td></td>
</tr>
<tr>
<td>Background information (with relevant outside source)</td>
<td>6</td>
</tr>
<tr>
<td>Rationale / Hypothesis</td>
<td>4</td>
</tr>
<tr>
<td><strong>3. Methods (8 pts)</strong></td>
<td></td>
</tr>
<tr>
<td>Experimental design (paragraph)</td>
<td>5</td>
</tr>
<tr>
<td>Correct format (paragraph, past tense, etc)</td>
<td>1</td>
</tr>
<tr>
<td>Variables correctly identified, controls stated</td>
<td>1</td>
</tr>
<tr>
<td>Number of replicates stated</td>
<td>1</td>
</tr>
<tr>
<td><strong>4. Results (12 pts)</strong></td>
<td></td>
</tr>
<tr>
<td>Description of results</td>
<td>5</td>
</tr>
<tr>
<td>Figure pointed out in text</td>
<td>1</td>
</tr>
<tr>
<td>Correct type of figure</td>
<td>2</td>
</tr>
<tr>
<td>Correct labeling of figure/table (descriptive legend/title at top)</td>
<td>2</td>
</tr>
<tr>
<td>Error bars present</td>
<td>1</td>
</tr>
<tr>
<td>Both treated and control groups in figure</td>
<td>1</td>
</tr>
<tr>
<td><strong>5. Discussion and Conclusion (12 pts)</strong></td>
<td></td>
</tr>
<tr>
<td>Does the data support the hypothesis?</td>
<td>2</td>
</tr>
<tr>
<td>Interpretation of results</td>
<td>6</td>
</tr>
<tr>
<td>Comparison of data with previously published information</td>
<td>4</td>
</tr>
<tr>
<td><strong>6. Literature cited (5 pts)</strong></td>
<td></td>
</tr>
<tr>
<td>Literature is cited using the correct format (in text and in this section)</td>
<td>2</td>
</tr>
<tr>
<td>Good quality and relevant citations</td>
<td>2</td>
</tr>
<tr>
<td>Good quantity of citations</td>
<td>1</td>
</tr>
</tbody>
</table>

**TOTAL (over 50 pts)**

### HOW TO LOSE POINTS: AUTOMATIC 5 POINT DEDUCTION FOR EACH OF THE FOLLOWING:

1. Restate results in Discussion
2. Use Wikipedia/online dictionaries in Literature Cited
3. Report is more than two pages
4. Using raw data in Results
5. Using direct quotes from any source (reference material)
Reference Format
(Adapted from Pechenik, 2007*)

All statements of fact and opinion require support. When you write a paper, you do not ‘make things up’. You read about them and collect the relevant information. At the end of your manuscript OR LAB REPORT you must list the books, research articles and web sites you consulted. Here are some basic guidelines:

1. **Cite by author and year of publication**
   It does not matter if your source is a book, a scientific journal or the internet, you must always cite the publication using the authors’ last names, and the year of publication. Example:
   
   A variety of organic molecules are commonly used to maintain or adjust the osmotic concentration of intracellular fluids (Hochachka and Somero, 1984; Schmidt-Nielsen, 1990).

2. **Consider the number of authors**
   When you have two authors write both their names. When more than 3 authors have collaborated on a single publication, use ‘et al’, which is the abbreviation for *et allii*, meaning ‘and others’. Since it is in Latin, it should be italicized. Example:
   
   A mutation is defined as any change occurring in the nitrogenous base sequence of DNA (Tortora *et al*, 1982).

3. **Same author, same year**
   If by chance you have two (or more) papers published by the same person in a single year, you can distinguish them by using a letter (make sure to also use the letters to distinguish these references in your literature cited page). Example:
   
   Asmodeus and Li, 1998a / Asmodeus and Li, 1998b

4. **Cite only those sources you have actually read. Similarly, every reference cited in your text should appear in your reference list at the end of your paper or report.**

5. **Listing references**
   List references in alphabetical order and then chronologically. Spell out only the last names of the authors; initials are used for first and middle names. All authors must be included (if the list of authors is too long you can use the first author followed by *et al*). Journal names are usually abbreviated.

**IN THE ‘LITERATURE CITED’ SECTION OF YOUR REPORT, THIS IS HOW YOU WILL IDENTIFY YOUR REFERENCES:**

**A. Citing Book references:**

Last Name 1, F., Last Name 2, F. Year. *Name of the book (italicized)*, Edition Number. Publisher, City, State, pages (when specific section is used). Examples:


**B. Citing a Laboratory Manual or Handbook:**

Last Name 1, F., Last Name 2, F. Year. *Name of the handbook (italicized)*. Publisher or School, Edition Number,
City, State, pages (when specific section is used). Examples:


C. Citing a Scientific Journal:
Last Name 1, F., Last Name 2, F. Year. Title of the article. *Abbreviated name of Journal*. Volume (number/issue): pages. Examples:


Note: If you are citing an electronic journal you should add ‘e’ before the page number.


D. Citing a Website (NO dictionaries, wikipedia or encyclopedias):
Last Name 1, F. Name of the article [Internet]. City, state: Name of the Website; year of publication [citation date]. Available from <write the full URL>. Examples:
