Assessments and Grading
Focus on the Biological Sciences

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"Most teachers waste their time by asking questions that are intended to discover what a pupil does not know whereas the true art of questioning has for its purpose to discover what the pupil knows or is capable of knowing." Einstein

OUTLINE:

1. Purpose of grades and assessment

2. General grading guidelines

3. Practical aspects of grading: Examples of scoring rubrics and grading situations

4. Dealing with dissatisfied students

5. Cheating and plagiarism

1. What is the purpose of grades and assessment?

Assessment: "to sit beside and observe"

Assessment is the systematic and ongoing process of collecting, describing and analyzing information about student progress and achievement in relation to course expectations. The primary purpose of assessment is to improve student learning by having the student practice and demonstrate understanding of content and to develop skills through feedback from the instructor. (Elvira DiGesu)

Typical assessments used include written and oral exams, essays, laboratory reports, projects, and presentations.

Grades: Grades are ideally used to give students feedback about their progress and achievement. They are intended to motivate students. Grades provide information that instructors can use to enhance and adjust their teaching. Grades are also often the only parameter that is used in administrative decisions, such as entrance into universities and graduate programs, retention within academic programs, and for financial gain in the form of scholarships and awards.

Link of grades to assessments

- Ideally, grades should be given in accordance with the performance on evaluative assessments (exams, lab reports, assignments). These evaluations should be clearly linked to the course objectives.

- Because grades carry an important emotional and practical weight for students, it is imperative that the instructor is thoughtful and conscientious when designing assessments and when attributing grades to student work.

- To be a grader, you also need to understand the theories and concepts being tested. When you grade, you must be able to follow a student's thinking to interpret incomplete or partially incorrect answers. If you do not have an in-depth knowledge of the subject, you will not be able to grade an assignment that deviates from an answer key.

2. General grading guidelines

Instructors have variable and personal philosophies and methodologies regarding teaching, learning, and grading. Despite this variability, there are general guidelines that should apply in most grading situations.

A. Be fair to all students

When in doubt, ask yourself 'Would this be fair to the other students in my section? Would this be fair to students in other laboratory sections?'

B. Be consistent

When marking many papers at once, you may find that your criteria become more or less lenient over time. If your grading scheme changes, you must go back and modify all the affected assignments. If marking assignments that consist of numerous questions, it is helpful to mark all the assignments for question one, then all the assignments for question two, etc. Also, shuffle the order of assignments when you start each new question.

C. Be flexible

Although you will have a marking guide, it is important to realize that students may give correct answers that are not expressed exactly as shown on the guide. Similarly, some students may interpret the question or task differently than what was intended by the instructor. A good marker is flexible and should have the knowledge base to understand if a student's response or interpretation is correct. Problems in interpretation can be avoided by taking care with the initial wording of assignments and by clearly outlining expectations.

D. Make expectations and guidelines clear to students prior to assignment deadlines

Students should understand grading policies and procedures as well as assignment parameters (length, format, due date, penalties for late assignments, etc.). A responsible instructor will also provide students with examples of excellent work and with grading guides. Once they are established, it is unfair to change grading policies unless agreed upon by all members of the course.

E. Explain the 'type' of grading that is being used

In many courses, absolute grading is used on assignments. Grades are assigned by comparing the student work with specified absolute standards. There are no quotas in each grade category, so all students may receive an "A" on an assignment. Each assignment is usually given a specific weight, with those requiring more work or of more importance carrying the higher weight. For example: midterm exam 20%, final exam 40%, lab report 15%, etc.

Many students will be confused with the way final grades are determined in a class. Instructors may continue to use absolute grading. For example, if a student achieves 90% or better on all assignments in the course, he or she receives an "A". With this method, there are not quotas in each grade category.

More commonly, the instructor may use comparison grading. In this method, a student's performance is compared with that of the rest of the class and the grade is not an absolute reflection of skill and knowledge. Instead, the grade indicates how the student did in comparison to a group of his or her peers. Typically, in a large class, there will be a distribution of student marks that follow a bell curve and grades are given based on clear breaks in the overall student performance.

3. Practical Grading

A. Assigning and Explaining the Assignment

- Discuss the policies regarding all aspects of the assignment with the laboratory coordinator, course coordinator, or instructor well in advance of the first assignment.

- Clear explanations of the expectations of the assignments are necessary to prevent student confusion and anger. For example, does the assignment need to be typed, is there a page limit, how many references are needed?

- Explain the course policy on missed and late assignments.

- Outline when and where assignments are to be handed in.

- Once the procedures for evaluation have been set and explained to students, you must strictly adhere to them.

B. Marking the assignment

- Scoring guides should describe the essential and most salient points of answers on exams.
  - A correct answer may be judged solely on factual content, or they might require clear and well-written explanations of factual content.
  - Lab reports are usually judged based on content, organization, and style.

- Restrict your evaluations to academic performance. Other factors, such as classroom behaviour, effort, classroom participation, attendance, punctuality, attitude, personality traits, or student interest in the course material, must not influence the grade a student achieves on any assignment.

- Before starting to mark, read five or six papers to obtain an idea of the range of quality.
  - If possible, cover or omit student names when grading assignments.

- You are likely to be strict on the first few papers and lenient on papers when you are tired or bored. When marking, stop when you get too tired or bored. When you start again, read over the last couple of papers you graded to make sure you were fair.

- A paper must be marked for the course level, *i.e.,* do not mark a 100 level paper using the criteria of a 400 level course

- There are different methods for constructing marking guides. Two are listed below:
  - Analytic (point-score) Method: In this method, the ideal or model answer is broken down into several specific points regarding context. A specific subtotal point value is assigned to each. When using this model, be sure you fully understand the model (ideal or acceptable) answer BEFORE you begin to mark the papers. You will find that the answers you receive may only be partially correct or only part of the argument has been developed. In this case, you need to decide how much of each maximum subtotal you judge the student's answer to have earned.

- Global (holistic) Method: In this method, the rater reads the entire essay and makes an overall judgment about how successfully the student has covered everything that was expected in the answer and assigns the paper to a category (grade). Ideally, all the papers should be read quickly and sorted into piles, and then each pile is reread to check that every essay has been accurately (fairly) assigned to that pile, which will be given a specific score or letter grade.

- As you mark and come across incomplete answers, make written modifications to the scoring guide to make a note of the number of marks such an answer receives. This is essential for several reasons:
  1. If you are challenged by a student regarding your marking scheme, you will have written documentation to support your reasons for marking as you did.
  2. From the time you marked the papers to the time you handed back the papers, you may have forgotten how each question was assigned part-marks.
  3. As you mark the papers, you may find similar incomplete answers and it is better to refer back to your amended marking guide than to flip through all papers to find the one answer you were looking for.

C. Written Comments

Students are understandably frustrated when assignments are returned with only a grade and superficial or no comments. In large classes, it is often difficult to write comments on examinations. One approach is for the instructor to speak to the class as a whole to discuss common errors. You should follow the instructor's or course coordinator's guidelines on how to mark examinations.

In general, it is expected that written comments will be made on student laboratory reports or lengthy essays. However, it is not your job to edit or rewrite a paper for a student. The goal of written comments is for the student to fully understand the strengths and weaknesses of their assignment so that they can improve.

Keep the following points in mind when writing comments on student papers:

- Write comments judiciously and legibly. Comments students cannot read are a waste of time.

- Do not obliterate the text – use the margins, the back, or append a note.

- Do not make sarcastic comments.

- Good writing includes the reasoned, organized, and logical presentation of ideas as well as correct spelling, punctuation, and sentence structure. However, you are not a copy editor for your students. You are not responsible for correcting their grammatical mistakes, but you should acknowledge when the mechanics of their writing interferes with your understanding of the ideas they are presenting. One approach is to fully edit one paragraph of the lab report or essay as an example for the student, and to advise them to try and do the same for the rest of the paper. If you expect good writing, make your expectations known and offer help to those who need it.

- Your feedback on their work needs to be specific. Try to say enough so that the student has a reasonably good chance of doing better next time. For example, if you write "confusing" beside a paragraph, a student does not know where they went wrong. Instead, if you write "what do you mean by 'state of equilibrium'?" the student will be able to interpret your comments and will have something concrete to improve on.

- Acknowledge what is good and draw attention to what needs work. Give clear suggestions about what students can do to improve their work: Try to select the most insightful passages for praise, and only the most shallow responses or repeated errors for comment.

- Encourage students who are doing poorly.

- If you find yourself repeating the same kinds of criticisms to many students, prepare a handout clarifying how the students can improve, or discuss the problem in class.

D. Administrative Aspects

- Before handing the assignment back, redo the addition. Addition mistakes can happen but are frustrating to students. Your lack of attention to a simple detail such as addition can make your students lose respect for you and will reflect poorly on your dedication to their learning and your teaching.

- Once all papers are marked, record the grades in your grade book or spreadsheet and make a second copy, just in case.

- Return papers in a timely manner. Students need the feedback from one paper in order to make corrections and improvements on the next paper. Usually you should take about the same amount of time to mark the papers as students had to write them.

- Hand back papers individually and confidentially. Do not leave graded papers in an unsecured place for pick up. Place the grade of the paper on the back or on the second page to ensure confidentiality.

- Do not discuss student grades with other students.

- Do not gossip about student papers with other T.A.s. However, contacting other TAs for help with marking, or marking in a group, is acceptable.

- Keep students informed of their progress. Show the range and distribution of scores, and indicate what level of performance is satisfactory. Such information can motivate students to improve if they are doing poorly or to maintain their performance if they are doing well.

4. Dealing with Dissatisfied Students

For some students, grades are a sign of approval or disapproval; they take them very personally. Even though you have done your best to mark fairly and consistently, you may be challenged on your grading. Your best resource will be your marking guide. A detailed marking guide, to which you have added notes as you marked, will help you discuss why an assignment or paper received the mark it did.

- Make your expectations about grading concerns very clear. Ask students to examine the marking guide and compare it with their assignment. Give students a deadline by which they must address any marking concerns

When confronted with an angry and/or dissatisfied student, keep the following points in mind:

- Remain calm and keep an open mind.
- Don't allow yourself to become antagonized, and don't antagonize the student.
- Listen to the student's concern and repeat the concern back to them so that you understand each other.
- If you do not have adequate time to listen to the complaint, ask the student to write down their concerns.
- Ask the student to examine the marking guide and compare it with their assignment
- Above all, do **NOT** remark the paper with the student present. After you have heard the complaint, tell the student that you will re-examine the paper with his/her concerns in mind and will get back to them. Give them a time period of when to expect to hear back from you.

Once you have looked over the paper, meet with the student.

- Before the meeting, make sure you have all the relevant materials at hand: the assignment, expectations of the assignment, marking guide, and examples of good answers.
- Describe the key elements of a good answer and point out how the student's response was incorrect or incomplete.
- Help the student understand your reasons for assigning the grade that you did.

5. Cheating and Plagiarism

All students at the University of Alberta are governed by the Code of Student Behaviour. Extensive explanations of policies and tips for how to help students understand about cheating and plagiarism can be found at http://www.uofaweb.ualberta.ca/tie/

- To prevent academic dishonesty, inform students of academic scholarship and conduct at the beginning of term, during the first lab period. Students are often unclear about how much they can work with other students and under what circumstances. Describe for your students acceptable and unacceptable behaviour, giving examples as appropriate. Explain that cheating and plagiarism will not be tolerated and discuss the university policies, procedures, and penalties for academic violations. The most common breach of the code will be aiding and abetting, plagiarism, and cheating. Below are the descriptions of each of these aspects of the code.

- All cases of academic misconduct must be brought to the attention of the laboratory coordinator or course coordinator in charge of the course you are teaching. You may **NOT** adjust a student's mark. All cases of academic misconduct must be brought to the attention of the Associate Chair of Undergraduate Studies of the Department of Biological Sciences.

PLAGIARISM, CHEATING, MISREPRESENTATION OF FACTS AND PARTICIPATION IN AN OFFENCE

The U of A considers plagiarism, cheating, misrepresentation of facts and participation in an offence to be serious academic offences. Plagiarism, cheating, misrepresentation of facts and participation in an offence can be avoided if students are told what these offences are and if possible sanctions are made clear at the outset. Instructors should understand that the principles embodied in the *Code* are essential to our academic purpose. For this reason, instructors will be fully supported by Departments, Faculties and the University in their endeavours to rightfully discover and pursue cases of academic dishonesty in accordance with the *Code*.

30.3.2(1) Plagiarism

No Student shall submit the words, ideas, images or data of another person as the Student's own in any academic writing, essay, thesis, project, assignment, presentation or poster in a course or program of study.

30.3.2(2) Cheating

30.3.2(2)a No Student shall in the course of an examination or other similar activity, obtain or attempt to obtain information from another Student or other unauthorized source, give or attempt to give information to another Student, or use, attempt to use or possess for the purposes of use any unauthorized material.

30.3.2(2)b No Student shall represent or attempt to represent him or herself as another or have or attempt to have himself or herself represented by another in the taking of an examination, preparation of a paper or other similar activity. See also misrepresentation in 30.3.6(4).

30.3.2(2)c No Student shall represent another's substantial editorial or compositional assistance on an assignment as the Student's own work.

30.3.6(4) Misrepresentation of Facts

No Student shall misrepresent pertinent facts to any member of the University community for the purpose of obtaining academic or other advantage. See also 30.3.2(2) b, c, d and e.

30.3.6(5) Participation in an Offence

No Student shall counsel or encourage or knowingly aid or assist, directly or indirectly, another person in the commission of any offence under this Code.

The Truth In Education (T*I*E) project is a campus wide educational campaign on Academic Honesty. This program was created to let people know the limits and consequences of inappropriate academic behaviour. There are helpful tips for Instructors and Students. Please take the time to visit the website at: http://www.ualberta.ca/tie

Possible Sanctions

One or more of the following sanctions given in 30.4.3 (2) and (3) of the Code are commonly used for plagiarism, cheating, participation in an offence, and misrepresentation of facts.

30.4.3(2) a.i A mark reduction or a mark of 0 on any term work or examination for reason of Inappropriate Academic Behaviour (GFC 24 SEP 2007);
30.4.3(2) a.ii Reduction of a grade in a course
30.4.3(2) a.iii A grade of F for a course.
30.4.3(2) a.iv A remark on a transcript of 8 (or 9 for failing graduate student grades), indicating Inappropriate Academic Behaviour in addition to 30.4.3(2)a.i, 30.4.3(2)a.ii, 30.4.3(2)a.iii
30.4.3(3) b Expulsion
30.4.3(3) c Suspension

30.3.2(2)d No Student shall submit in any course or program of study, without the written approval of the course Instructor, all or a substantial portion of any academic writing, essay, thesis, research report, project, assignment, presentation or poster for which credit has previously been obtained by the Student or which has been or is being submitted by the Student in another course or program of study in the University or elsewhere. 30.3.2(2)e No Student shall submit in any course or program of study any academic writing, essay, thesis, report, project, assignment, presentation or poster containing a statement of fact known by the Student to be false or a reference to a source the Student knows to contain fabricated claims (unless acknowledged by the Student), or a fabricated reference to a source.	The following sanctions may be used in rare cases. 30.4.3(3) e Suspension of a Degree already awarded 30.4.3(3) f Rescission of a Degree already awarded

Typical scenarios that T.A.s may experience regarding cheating and plagiarism

- A student approaches you after an exam and states that he believes the student next to him copied from his paper

- John and Mary, who are lab partners, turn in virtually identical lab reports.
  John and Mary, who are lab partners, turn in lab reports with the same figures.

- A student turns in a lab report that contains verbatim explanations from Wikipedia and other online dictionary sites.

- A student turns in a lab report that contains sentences taken directly from the Biology 107 lab manual or from a scientific paper that was provided as background for the assignment.

- One of your best students has failed to turn in a 50 point assignment. According to the course policies, he should receive a zero, which will put his final grade 10 points below the A cutoff. He asks you if he can still turn in the assignment although the deadline is long past. Do you accept the assignment?

6. Summary

- Grading is an essential part of the learning process. As a TA, your job is to help students learn and to spend the time grading their lab assignments that will help them to improve.

- Be fair and consistent with every assignment. Maintain a detailed marking guide.

- When challenged, stay calm, listen to the student's concerns, and always re-examine the assignment in the absence of the student. When discussing the re-marked assignment with the student, help them understand why or why not changes in the grade were made.

7. References

Significant portions of the following references have been used in this handout:

- Marking Lab Reports for the Biological Sciences by Donna Wakeford, University of Alberta, 25th Annual Orientation for Graduate Teaching Assistants, 2005
- Carla Starchuk Biology 107 Lab Coordinator (Sample lab report scoring guide and lab reports)
- Truth in Education, Academic Integrity Handbook for Instructors and Teaching Assistants, 2008/2009 Academic Year, University of Alberta
- Teaching Resource Manual, University of Alberta
- CartoonStock.com for images used in the overhead presentation
- McMillan, H.H. (ed.) 1988. Assessing student's learning. Jossey-Bass. San Francisco
- Elvira DiGesu http://www.gecdsb.on.ca/d&g/onlinepd/Assessment%20&%20Evaluation/Purpose.htm
- Teaching at Stanford, An Introductory Handbook for Faculty, Academic Staff/Teaching, and Teaching Assistants, The Center for Teaching and Learning, Stanford University
- Teaching at the University of Florida, A Handbook for Teaching Assistants, University of Florida
- Teaching Tips for Graduate Teaching Assistants, Tufts University
- Tips for Teaching, A Handbook for New Teaching Assistants, University of Toronto
- Tools for Teaching, Barbara Gross Davis, University of California – Berkeley

Appendix A: Examples of midterm exam answers Biology 107 Fall 2007

Question 1: Give an example of a carbohydrate found in cells. Briefly, what is the function of this carbohydrate? (1.5 marks)

Answer 1: Cellulose is found in plant cells, specifically the cell wall. It is used for the structure of the cell wall.

Answer 2: Cellulose – a glucose polymer that is used by plant cells to construct the cell wall

Answer 3: An example of a carbohydrate found in cells is glucose. Glucose is known as the fuel for cells. We get our energy through glucose and when there is a short supply of glucose our body is forced to break down amino acids in order to fuel our cells. Insulin is used to lower blood glucose levels, and glucagon is used to raise blood glucose levels. Our brain cells in particular rely on glucose all glucose in the body will be sent to brain cells if brain lacks glucose.

Answer 4: Glucose- synthesize ATP

Answer 5: Sucrose- The function of carbs is to store energy (more available, but less E per weight than fat-quick energy). Sucrose is needed for the reaction that produce certain proteins. Carbs (sugars) store fat because they are macromolecules and therefore release lots of energy during catabolic reaction because they have lots of bonds to break (lots of store E)

Answer 6: Glucose

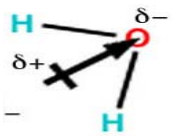
Instructor's Marking Guide for Question 1:
Cellulose: glucose polymer involved in plant cell wall formation
Starch/glycogen: glucose polymer used for energy storage
Peptidoglycan: part is carbohydrate/ used to create bacterial cell walls
Proteoglycan: Carbohydrate/protein combination- found in ECM

Glucose/Sucrose/Galactose/Maltose: simple sugars for energy storage
Ribose: simple sugar found in nucleic acid structures

(0.5 marks for name of carbohydrate, 1.0 marks for correct function)

Question 2. What is the difference in the covalent bonds found in water versus those found in the hydrocarbon tails of lipids? Explain why two different kinds of covalent bonds form in these molecules. (2 marks)

Answer 1: Polar covalent vs. non-polar covalent. Water is polar covalent and will dissolve polar substances (and ionic) (like dissolve like) and not dissolve non-polar substances (like lipids). This attribute is the basis for the cell membrane, the hydrophobic tail tries to avoid water and the hydrophilic head is attached to water so a phospholipid bilayer can be established. (This answer also included a picture of the water molecule and it's charge separation similar to this:



Answer 2: They are saturated fats in the hydrocarbon tails they are longer than those found in covalent bonds.

Answer 3: Statements written haphazardly on the page including: covalent bonds found in water, hydrocarbon tails of lipids are hydrophobic meaning low affinity for water, pictures of water molecule, don't want to be pulled as closely together

Answer 4: The covalent bonds formed in water are formed by a hydrogen bond, a hydrogen atom covalently bonding with another electronegative atom, eg. Oxygen. The bond is not as strong as the covalent bond found in hydrocarbon tails of lipids. Hydrocarbon tails and lipids have covalent bonds which are held together much more strongly and are extremely tight in order to keep the lipid together. (Student had drawn an X over most of the answer)

Answer 5: The covalent bonds in water are hydrogen bonds. They are relatively weak. They form between polar covalent bonds, one being the proton (or hydrogen) and the other an electron (in this case oxygen). Covalent bonds in hydrocarbons are stronger, this is because the molecule is required to stay together, where as for many cellular processes, water must be split.

Answer 6: Covalent bonds found in water will be polar, whereas those found in hydrocarbon tails will be non-polar. Polar bonds form due to a difference in electronegativity between the two atoms involved. The more electronegative atom will attract the electron more strongly and thus be more negative. This separation of charges causes the polar nature of the bond. Non-polar bonds form between two atom of similar electronegativities.

Instructor's Marking Guide for Question 2:

Water has <u>polar</u> covalent bonds. Those found in hydrocarbon tails are <u>non-polar</u>. In water, the oxygen atom is more electronegative than the hydrogen atoms, and pulls the electrons towards its nucleus. This creates a separation of charges and the polar covalent bond. (The water molecule has partial negative and partial positive charges, resulting in its ability to hydrogen bond to other molecules.) In hydrocarbons, the atoms in the covalent bonds are more similar in electronegativity and share electrons equally. (Since a separation of charges does not result, these molecules tend to be hydrophobic and do not dissolve in water.)

Polar vs. non-polar covalent bonds (0.5 mark)
Type of bond created depends on atom electronegativity (0.5 mark)
Water bonds have separation of charges (0.5 mark)

Hydrocarbons share electrons equally (0.5 mark)

Appendix B: Excerpt of scoring guide for lab report in Biology 107 (For the Introduction Section only)

Introduction (15 marks total)

____ Background information (5 marks)

0 No background info
1 Background info only from lab manual
2-3 Background info from manual and textbook, superficial explanations of fluid mosaic model or other relevant background
4 Background info includes good explanations of fluid mosaic model or other relevant background
5 Background info includes good explanation of fluid mosaic model with one extra piece of info on the effect of heat/cold on membranes, information from their journal article, or info on beets, betacyanin or tonoplasts (or exceptional explanation of other relevant background with extra info)

____ Purpose, objectives clearly stated (3 marks)

'We are trying to measure temperature-induced damage to beet membranes by quantifying the betacyanin that leaks from the beet disks.' Full marks given even if the objectives are spread out over a few sentences

____ Organism studied is stated (1 mark)

'Beets or *Beta vulgaris'*

____ Hypothesis is clearly stated (3 marks)

Hypothesis should include what happens in high, low, and intermediate temperatures OR which temperatures will cause the most and the least damage (as long as they include all three 'ranges'). Deduct marks if hypothesis is lacking

____ Relevance of study is indicated (3 marks)

0 No attempt to include relevance
1 Weak relevance, not well explained (trying to determine what temperature beets 'like', eg.)
2 Weak relevance, but it is well explained, or good relevance but not well explained
3 Good or great relevance, well explained (important for food storage and transport, food processing, agriculturally important related crop- in sugar beets, temperature damage to membranes may limit growth range, easier purification as a source of betacyanin for dyes/vitamins, easier purification of sugar from beets, etc.)

Example lab report 1:
Introduction

The **cell membrane** (also called the plasma membrane, plasmalemma or "phospholipid bilayer") is a semipermeable lipid bilayer common to all living cells. It contains a wide variety of biological molecules, primarily proteins and lipids, which are involved in a vast array of cellular processes, and also serves as the attachment point for both the intracellular cytoskeleton and, if present, the cell wall. The membrane is a mosaic of protein molecules bobbing in a fluid bilayer of phospholipids. The cell membrane surrounds the cytoplasm of a cell and, in animal cells, physically separates the intracellular components from the extracellular environment, thereby serving a function similar to that of skin. The barrier is selectively permeable and able to regulate what enters and exits the cell, thus facilitating the transport of materials needed for survival.

The cell membrane consists of a thin layer of amphipathic lipids are arranged so that the hydrophobic "tail" regions are shielded from the surrounding polar fluid, causing the more hydrophilic "head" regions to associate with the cytosolic and extracellular faces of the resulting bilayer. This forms a continuous, spherical lipid bilayer containing the cellular components approximately 7 nm thick.[1] The arrangement of hydrophilic and hydrophobic heads of the lipid bilayer prevents hydrophilic solutes from passively diffusing across the band of hydrophobic tail groups, allowing the cell to control the movement of these substances via transmembrane protein complexes such as pores and gates. According to the fluid mosaic model of S. Jonathan Singer and Nicholson, the biological membranes can be considered as a two-dimensional liquid where all lipid and protein molecules diffuse more or less freely. This molecular arrangement would maximze the contact of hydrophilic regions of proteins and phospholipids with water while providing their hydrophopbic parts with a a nonaquesous environment (Campbell and Reese, 2005).

The purpose of this experiment is to put beet disks into different temperatures and measure the amount of red beetacyanin that leaks out because of membrane damage using a spectrophotometer.

We are also trying to learn how to pipette, to use a spectrophotometer and make a standard curve and use a standard curve.

I hypothesize that beet disks will leak more pigment at high temperatures than all other temperatures. This study is relevant to Russian and Ukrainian soup producers who make red beet soup by boiling beets. Also, red beet colour is gaining importance as an alternative to synthetic red colorants for food and pharmaceutical applications. This study is also relevant to hospitals, because they sometimes have to store tissues for transplantation and it is important to know what temperature to keep the donated kidneys at so they don't get too damaged to be of use to the patients.

Example lab report 2:

Introduction

Beets are a root vegetable that grow in many areas of Canada. Beets are red in colour due to the pigment betacyanin located within the chloroplast. Since beets can grow in many different areas of Canada, they are able to grow in many different temperatures. The purpose of this experiment was to see what temperatures beet can grow in. We hypothesized that high and low temperatures would cause beet membranes to be destroyed. This is what we saw. This should show that beets can not tolerate high and low temperatures for growth.

Example lab report 3: Introduction

Membranes of cells are composed of a phospholipid bilayer, with a hydrophobic and two hydrophyllic regions, in which is embedded a variety of integral and peripheral membrane proteins, used in a variety of functions, including membrane transport, enzymatic activities, etc. Membrane fluidity is an important aspect of membrane structure and function, as demonstrated by Singer and Nicholson in 1972. Singer and Nicholson determined the Fluid Mosaic Model and discredited the Davson and Danielli model proposed in the 1960s. The Fluid Mosaic Model states that the membrane is "fluid" at certain tempertaures and that the phopholipids can move within the membrane, that it is "mosaic" in terms of containing different phospholipids, different intergral membrane proteins, and different peripheral membrane proteins, and "contains a "phospholipid bilayer" containing hydrophobic and hydrophyllic regions that prevents some molecules from crossing the membrane but permits others. The phospholipid bilayer contains some unsaturated and some unsaturated hydrocarbon tails that will affect the fluidity of the membrane. The membrane may also contain cholesterol, which, due to its size, will also affect the membrane's fluidity. All of these factors will affect the membrane's fluidity.

In this lab, we were asked to expose beets to a range of temperatures from -5°C to 70°C, but more specifically to look at -5°C, 4°C, 25°C, 40°C, 55°C, and 70°C. We were also learning the basic principles of spectrophotometry, learning and applying the concept of dilution, and learning how to make and use a standard curve.

We used beets and their scientific name is Beta vulgaris.

Our hypothesis of the study was that as the amount of damage increased, the more betacyanin would be released. The betacyanin would absorb light of a specific wavelength and we would be able to measure absorbance maximally.

This study is relevant as it allows us to disrupt the function of beets and examine the action of temperature on the cell.

Example lab report 4: Introduction

Cells are able to survive at specific temperatures. For example, human cells survive at 37°C and not much deviation from this temperature is tolerated by the cells. Cells have many adaptations with which to survive when exposed to different temperatures. For instance, cells may increase or decrease the proportion of phosopholipids or the percentage of cholesterol in their membranes to help them survive temperature fluctuations. Likewise, many cells contain a special "antifreeze" molecule that will allow them to survive cold weather; this is the reason many amphibians are able to survive freezing temperatures when hibernating over the winter months (Smith and Jones, 1999). This is, of course, different from the hibernating adaptation of reducing calcium stores within the cell proper. With all this background information, it makes sense to conclude that beet cells may also contain special adaptations that can be used to withstand different temperatures.

In this lab, the effect of different temperatures on the ability of beets to withstand these temperatures. Beets contain a phospholipid bilayer that has a hydrophobic and a hydrophyllic region. The hydrophobic region is housed with the two hydrophyllic regions. Also, within the bilayer are membrane proteins, called intepheral and peripheral membrane proteins, that have several vital functions within the cell, such as transport, enzymatic activity, signal transduction, intercellular joining, cell-cell recognition, and attachment to the cytoskeleton and extracellular matrix, to name a few. We wanted to know the effect of temperatures of -5°C, 4°C, 25°C, 40°C, 55°C, and 70°C on beets. We measured the effect using a spectrophotometer and determined how much betacyanin leaked out of the beet cells. Once we determined this, we also made a standard curve of betacyanin using a stock solution of betacyanin at a final concentration of 7 μM; this standard curve is specific for only betacyanin and cannot be used to measure chlorophyll. We used this standard curve to measure membrane damage. We predicted that temperatures around 37°C, body temperature, would not affect the beets but that temperatures over and above this would affect the beets. Our results suggest that we are mostly correct.