

Supplemental Material

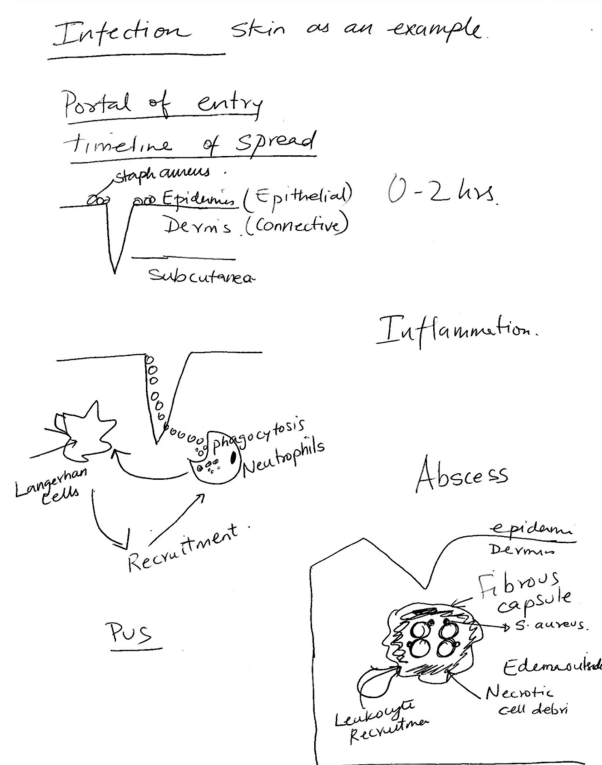
CBE—Life Sciences Education

Vemu *et al.*

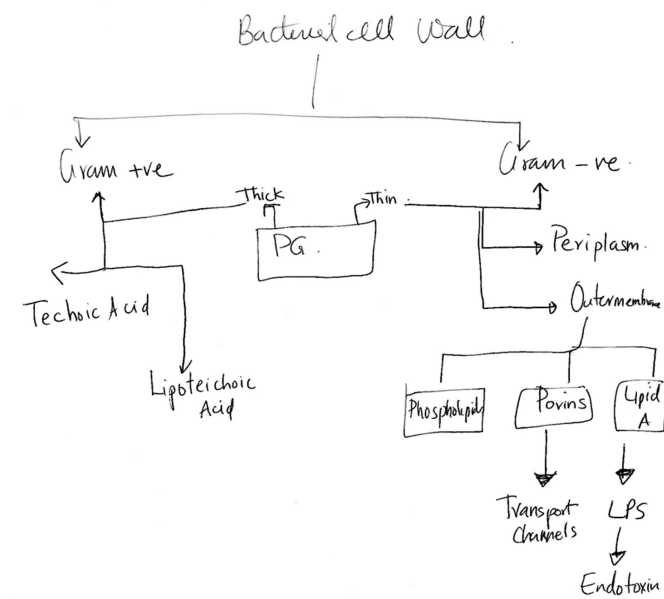
Supplemental Materials 1

Instructor drawings samples:

Microbiology Instructor Example 1:

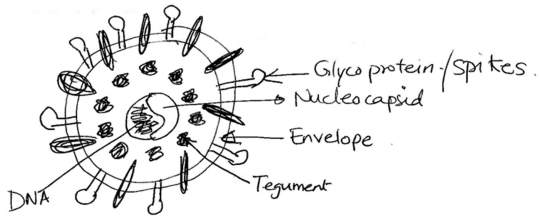


Microbiology Instructor Example 2:

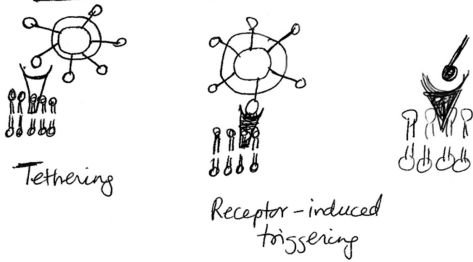


Microbiology Instructor Example 3:

Herpes Simplex

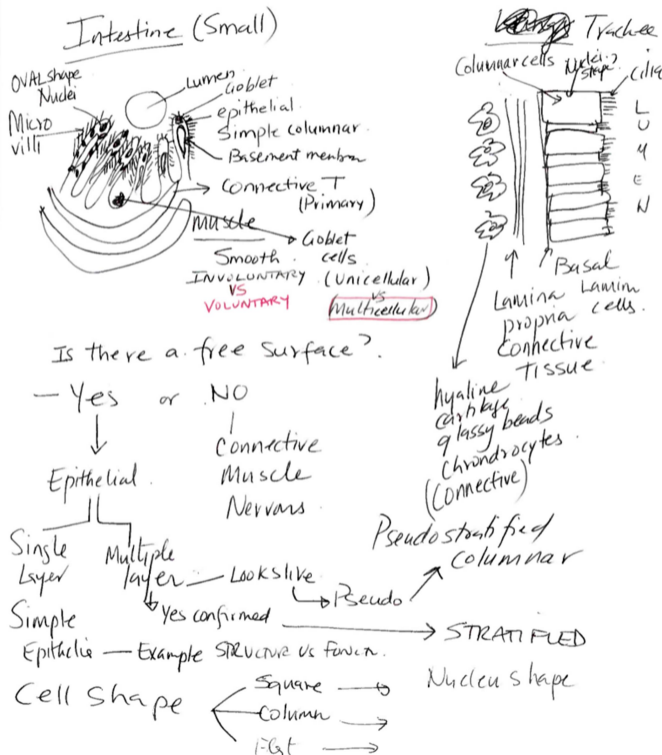


Diffusion method

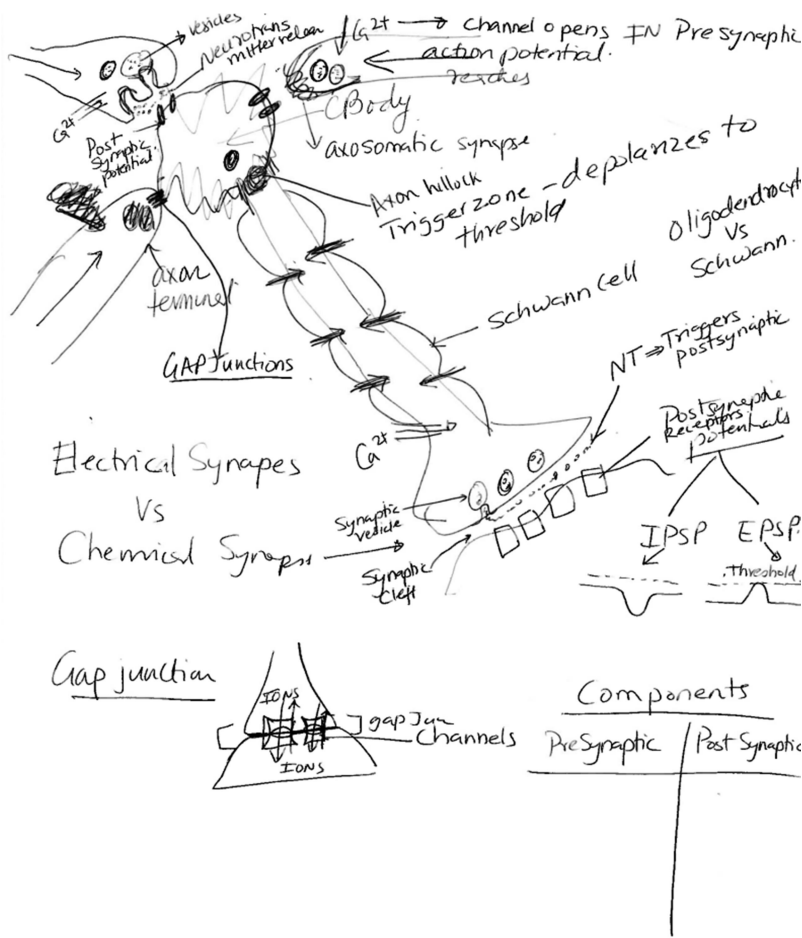


Anatomy and Physiology Instructor Example 1:

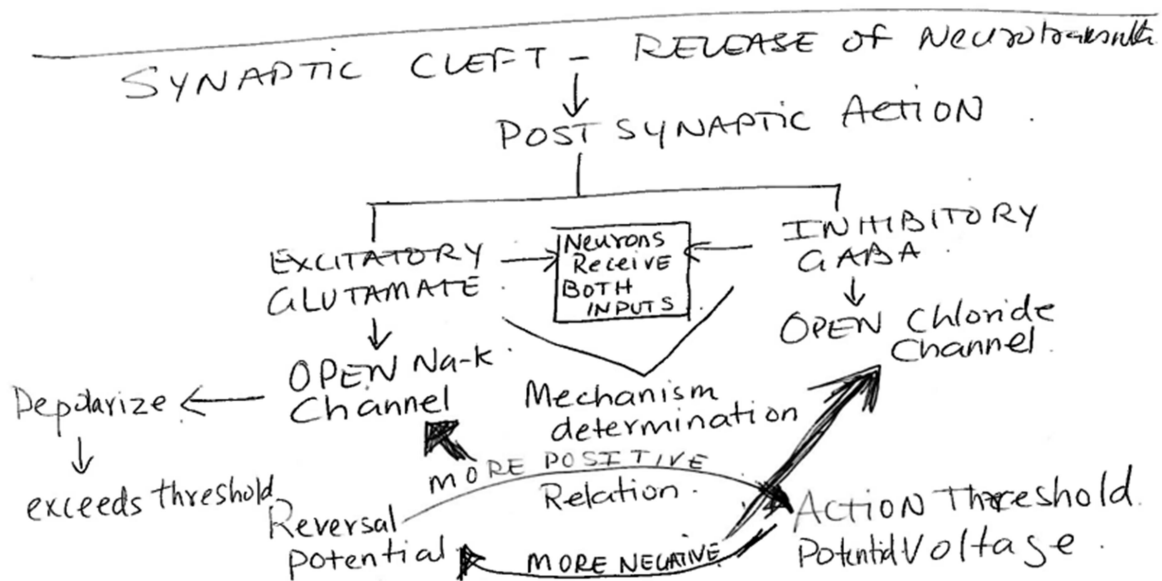
Compare and contrast



Anatomy and Physiology Instructor Example 2:

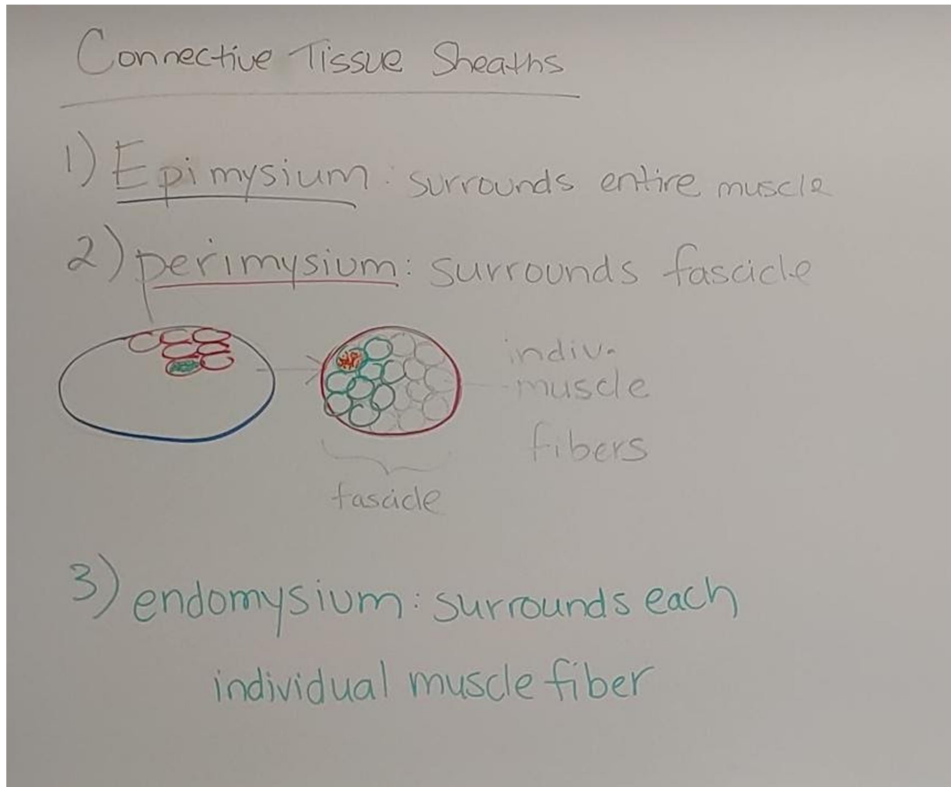


Anatomy and Physiology Instructor Example 3

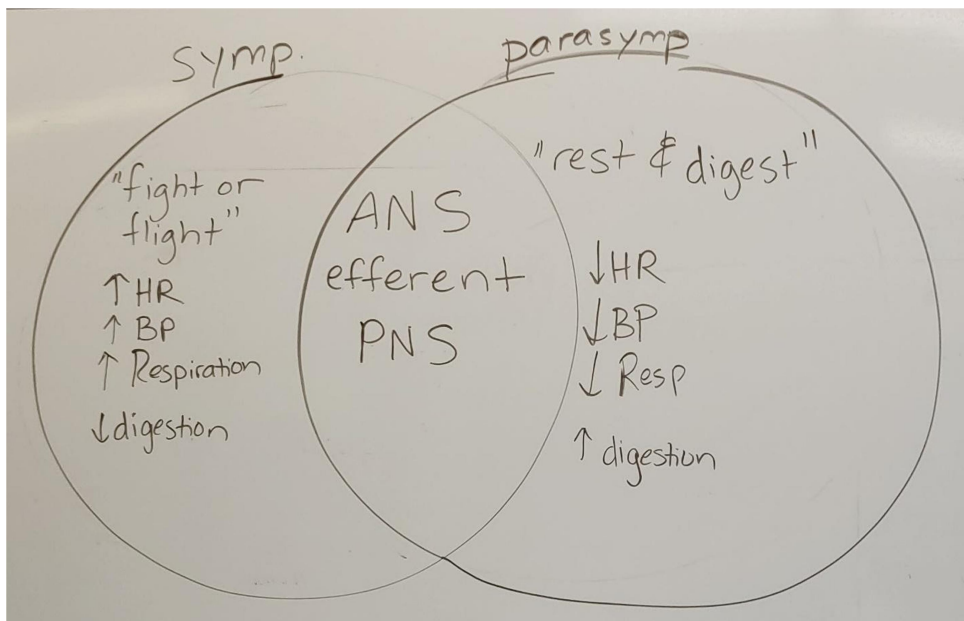


Student drawings (These were collected after an exam review session with the instructor)

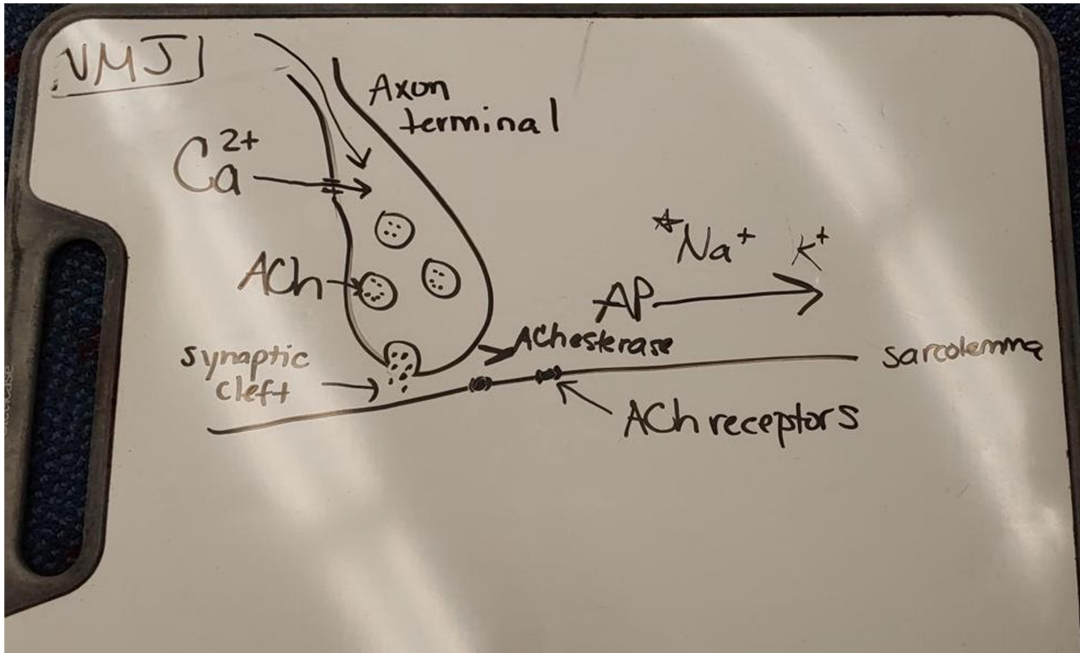
Anatomy and Physiology Student Example 1:



Anatomy and Physiology Student Example 2:



Anatomy and Physiology Student Example 3:



Supplemental Material

S1: The Class Presentation

The presentation that was used in the class followed this outline. The slides were covered in roughly 15 minutes.

Title: Learning to study effectively is very important in our introductory science courses

1. Why is it important to choose the right learning technique while studying?
 - a. It helps with learning difficult concepts and you are able to access the information much more readily during exams.
 - b. Although It is time-consuming initially, it will eventually pay off in the later chapters where there are many overlying concepts.
 - c. It is less stressful because you do not have to rely on memory alone to figure out the answer. It helps you manage your time and responsibilities.
2. Why do we choose some learning strategies?
 - a. They are familiar, easy to use and quick to implement.
 - b. We have heard about these techniques in our previous courses or in high school.
 - c. They were recommended by a classmate or an academic advisor
3. Here is a list of some learning techniques in STEM
 - a. Condensing your chapter notes with your class notes
 - b. Using highlighting and flashcards to study
 - c. Explaining concepts using drawings, images and concept maps
 - d. Practicing questions from the end of the chapter
 - e. Spacing your studying so you are not cramming the night before the exam
4. Condensing your notes is not helpful if you are just verbatim copying from the text or power-point. It can be very time consuming. It is only useful if you are writing notes for one important key learning objective. It does not work for the entire chapter.
5. Highlighting and flashcard usage is one of the most common study strategies. It is easy to use. It is only effective if we are learning some new vocabulary. It is not effective for concepts that have connections and regulatory components.
6. Explaining concepts using drawings, images and concept maps. This is a very STEM specific study strategy. It takes time to implement. You are not just copying the diagrams and memorizing the images. Here, you are creating diagrams that can create a visual with an understanding of how and where the complex concepts are flowing together. This is very useful when you have many feedback loops and regulatory cycles to learn.
7. Using the practice questions from the end of the chapter. Instead of memorizing the answer to the practice questions, it is best to figure out why each of the answers in the multiple choice are wrong. This will help you find the gaps in your understanding while working on the practice questions. This can be very time consuming in the beginning and can also be demoralizing when you start working on the practice questions.
8. Spacing your study is a very important time management skill. It helps you study in small sections and you will have the freedom to start with preliminary key terminology and move into harder concepts later in the chapter. Use this strategy to work on the difficult concept way

ahead of the exam schedule. Stress can be detrimental to test taking and this technique is one of the best ways to minimize it.

9. My suggestion is that you start taking some baby steps to modify your learning strategies and stop using ineffective ones based on your reflection with the exam wrapper. Be ready to ask for help and carve some time to learn the new techniques that may be helpful to you in these courses.

S2: The Exam Wrapper

Students completed the exam wrapper below in class on the day after the exam. After the first exam wrapper was filled out, the presentation on study strategies was given. All further exams had an exam wrapper after the exam, but no significant presentation was given after submission of those wrappers. This wrapper was modified from LaCaille, LaCaille, & Maslowski (2019).

This activity is intended to help you analyze what beliefs and habits might have helped or hurt your quiz performance, and how you might improve for future quizzes and exams. Changing beliefs and habits takes time and effort. This activity is intended to get you moving in the right direction.

Complete the questions below honestly and to the best of your ability. To receive the full two points, your answers should reflect thoughtfulness and reflection.

For questions 1-3, rate your level of agreement of the following statements:

1. I felt I was really prepared for this quiz.
 - a. Strongly disagree
 - b. Disagree
 - c. Neither disagree or agree
 - d. Agree
 - e. Strongly Agree
2. I was surprised by how poorly I did on this quiz.
 - a. Strongly disagree
 - b. Disagree
 - c. Neither disagree or agree
 - d. Agree
 - e. Strongly Agree
3. I read all the assigned reading thoroughly (as well as watched all videos, completed activities, etc.) before the quiz.
 - a. Yes – I did all the reading and completed all activities/videos
 - b. No – I did the reading but not all the activities
 - c. No – I did not complete the assigned reading
4. How many days before the quiz did you complete the reading? _____
5. Did you review the reading after completing the reading the first time?
 - a. Yes

- b. No
6. Did you review your notes and the readings before the quiz?
- a. Yes
- b. No
7. How many days before the quiz did you begin your quiz preparation (this means reviewing materials for the quiz. This does not count reading the material for the first time)? _____
8. List the methods you used to study your notes and the readings before the quiz besides just reading them over.
9. About how many total hours did you spend studying for the last quiz? Do not count reading the material for the first time, but only reviewing of notes, textbooks, and other study activities.
- _____
10. What percentage of your quiz preparation time was spent in each of these activities (This should add up to 100%)?
- | | |
|---|---------|
| Reading textbook section(s) for the first time? | _____ |
| Re-reading textbook section(s)? | + _____ |
| Answering questions for practice? | + _____ |
| Reviewing your own notes? | + _____ |
| Other study strategies (specify)? | + _____ |
| | = 100% |
11. Review your exam performance. List the concepts that you struggled with while taking the exam.
12. For those concepts that you struggled with, try to understand why you missed them. Select each answer that applies.
- a. I thought I had answered the question correctly, but was fooled by a reasonable sounding answer
- b. The information needed to answer the item was not in my notes nor highlighted in the reading.
- c. I didn't know the answer so I guessed.
- d. I didn't understand the concept as well as I thought I did.
- e. I didn't understand the concept that the question was addressing.
13. What, if anything, will you do differently to prepare for your next quiz?