

Supplemental Material for the article:

Assessment of learning gains associated with independent exam analysis in introductory biology

by

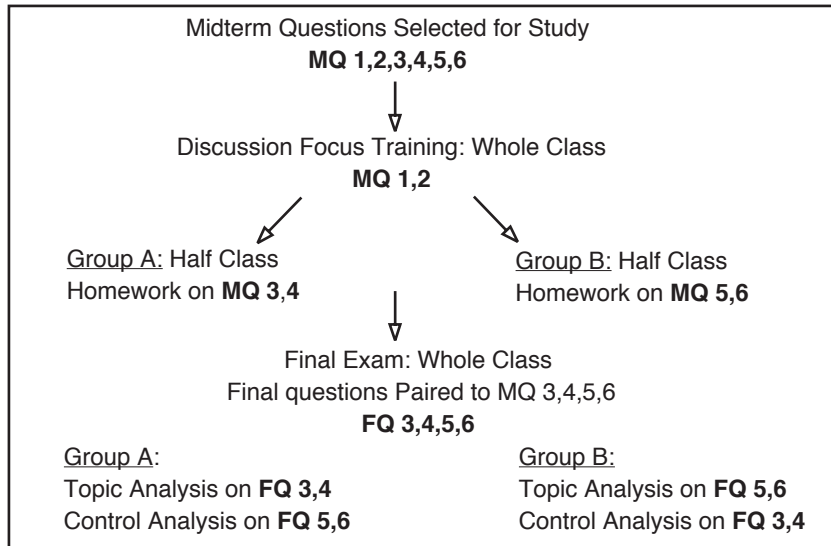
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Corresponding Author:

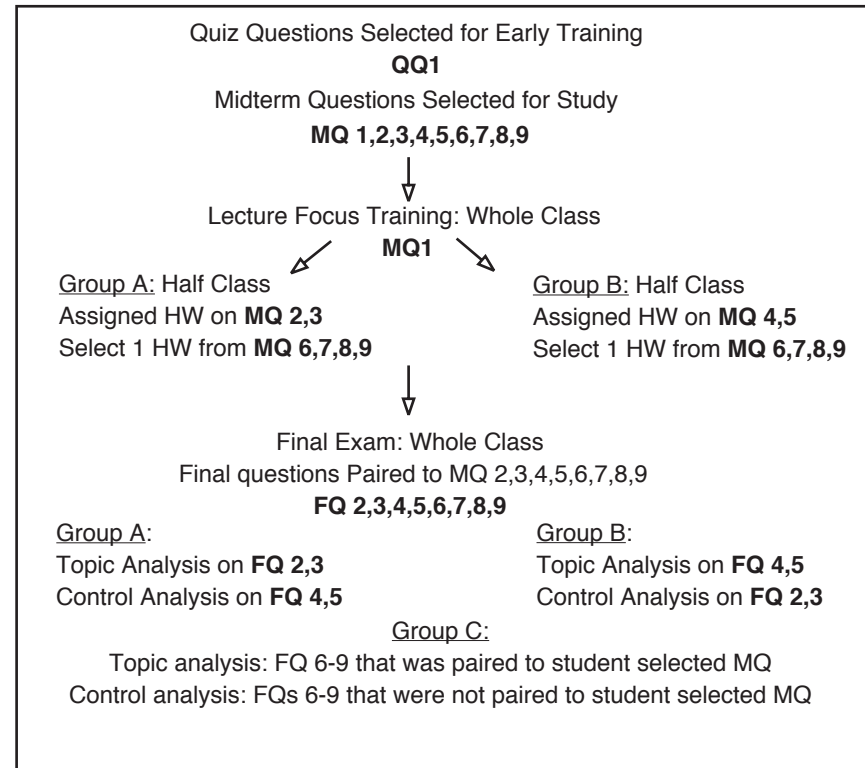
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Supplemental Figure 1

Flow Chart of Discussion Focus Experimental Design
(used for Lecture A: 2008)



Flow Chart of Lecture Focus Experimental Design
(used for Lecture A and B: 2009)



Supplemental Figure 2

Sample Discussion Training Homework: Strong Analysis

24638

Homework for Discussion (worth 1 point)
(Tuesday, Nov. 4)

This homework assignment is due in lecture on Wednesday Nov. 12
Give it to Miles or to Dr. Aguilar-Roca before or after lecture
(either handwritten or typed)

Sample question - Midterm Question #9
Ligand X is a small signaling molecule that is dominated by nonpolar covalent bonds. Which of the following is most likely to be a receptor for ligand X?
A) Ligand gated ion channel
B) Cytoplasmic receptor
C) G-protein receptor
D) Tyrosine kinase receptor
E) Carbohydrate receptor

Answer the following questions: What lectures did info come from? Why is right answer right? Why are wrong answers wrong? Why did you miss this question (or why did other students likely miss it, if you got it right)?

The information about receptors came from lecture 6 and the information about nonpolar covalent bonds came from lectures 7 and 8. Since ligand X is small and has nonpolar covalent bonds it is likely to be hydrophobic. Therefore it will be able to cross the cell membrane and interact with a receptor inside the cell, such as cytoplasmic receptor. All of the other choices are transmembrane receptors that interact with water soluble ligands that bind to the outside of the cell. I answered this question incorrectly because I.....

Homework question #1 - Midterm Question #17
17) The energy released by cleaving the terminal phosphate from ATP is:
A) necessary to drive all exergonic reaction
B) used to increase the rate of facilitated diffusion
C) **necessary for conformation changes in myosin**
D) is important in G-protein receptor signaling
E) both c and d

Answer the following questions: What lectures did the information come from? Why is the right answer right? Why are wrong answers wrong? Why did you miss this question (or why did other students likely miss it, if you got it right)?

This came from lectures 9, 10. The energy released by hydrolysis of ATP ~~causes~~ ^{conformational changes} motor proteins, such as myosin. (Lecture 10, slide 12)

Choice A is wrong because it should be endergonic if it requires energy. Choice B is wrong because facilitated diffusion is not active transport, it's passive transport which requires no ATP. Choice D is incorrect because G-protein receptors require GTP. Students most likely missed this because ATP and GTP only differ by one letter and they must have not known the difference.

You must attach the page from your midterm to receive full credit for the assignment.

Sample Lecture Training Homework: Strong Analysis

Scan (or photograph) and upload to assignment dropbox before 9 am on Mon, Nov 2nd Name: 14884

Learn From Exam 2 - MC#13 and SA#3c

1. Download and print this worksheet, YOUR exam key, and your exam scantron and short answer pdfs.

2. Fill in the answers YOU chose for the following questions. These must MATCH your scantron to receive credit.
#1(version) A #5 D #12 D #13 C

3. Answer the following questions about **Question #13** on the multiple-choice section of the midterm.

a. What lecture or lectures did information for this question come from? 7, 8

b. Why is the following the best answer? Explain the biology.

- Increased levels of carbonic acid.
- When the blood becomes more acidic, a bicarbonate ion will accept a H⁺, turning into carbonic acid (and increasing H₂CO₃ levels)*

c. Why are the following answers incorrect (the order may vary on your key)?

- Carbonic acid releasing OH⁻ ions.
- Carbonic acid would not and does not release OH⁻ ions.
- No change in blood pH.
- If blood becomes more acidic, then the pH decreases*
- Bicarbonate binding fewer H⁺ ions.
- Bicarbonate would bind to more H⁺*
- Carbonic acid releasing H⁺ ions.
- This would cause the pH to further decrease (which is not the purpose of buffers in this case)*
- I missed #13 because (or other students likely missed because): I did not miss this question, but other students may have missed it because they were confused about the relationship between pH and buffer systems*

4. Answer the following about free response **Question #3c** below. If there is no ATP in the extracellular fluid how would this affect Na/K pump function?

a. What lecture or lectures did information for this question come from? 3

b. Why is the following the best answer? Explain the biology.

- No change.
- ATP is needed on the inside of the cell, not the outside; therefore, the concentration of ATP outside the cell is not relevant.*

c. *I missed #3c because (or other students likely missed because): I did not miss this question, but other students may have missed it because they did not know where ATP is used to phosphorylate the Na/K pump*

5. Several other commonly missed questions include multiple choice #3, 4, 14 and 16. Pick one of these that you missed and annotate it below (if you didn't miss any of these, pick the one you were least sure about).

a. Which question did you pick? 14 What lecture did the information come from? 8

b. What is the correct answer (summarize here)? Carbonyl groups increase H-bonding ability

c. Why is this the best answer? Explain the biology.

- Carbonyl groups have a C double-bonded to an O atom (which is highly electronegative), causing increased ability to form H-bonds

d. Why are the other answers incorrect (summarize answers on line)?

- applies to carboxyl group
- H₂O only goes through aquaporins
- increases solubility in H₂O
- decrease ability to pass through membrane
- I missed this because: I completely guessed and had no idea what the correct answer was. I may have confused the carbonyl group with the carboxyl group.*