How to Write Better Multiple-Choice Questions

Flip the sheet over to see examples of weak multiple-choice questions turned into better questions

Fixing the Five Most Common Mistakes

1. All incorrect options (known as distractors) should be homogenous and logically compatible.
   ⇒ All options should be of the same category as the correct option. Rewrite double options (e.g. X and Y) to focus on a single point.

2. All options should be of the same length as the correct answer.
   ⇒ The correct option is often longer because of the need to qualify it.

3. Don’t use questions of the form “Which of the following statements is correct?”
   ⇒ Questions of this type are not focused and will have heterogeneous distractors.

4. The question portion (known as the stem) should pose a clear question that can be answered without looking at the options.
   ⇒ If the question can’t be answered without seeing the options, then it should be rewritten.

5. A better question will require application of knowledge rather than recalling an isolated fact.
   ⇒ The stem can be relatively long while options should be short. The questions can provide details on an experimental result (e.g. show a graph), and then ask the students to interpret the data.

Using Shell Questions to Write Better Questions

- If X occurs, which is most the most likely outcome? (Applying knowledge)
- Which is most commonly the cause of X? (Applying knowledge)
- What distinguishes X from Y? (Analyzing knowledge)
- Present a problem. Which approach should be used to solve this problem? (Evaluating knowledge)
- Present a problem. Which is a possible solution? (Applying knowledge)
- Present a problem. Why is X the best solution? (Evaluating knowledge)
### WEAK QUESTION and ANSWERS

1) Which of the following statements is *false* with respect to caspases:

(A) They do not regulate blood clotting
(B) They are synthesized in an inactive form
(C) They are cysteine proteases
(D) They cleave proteins after aspartate residues
(E) They contain Asp-His-Ser in their catalytic site

2) Which of the following statements regarding membrane dynamics is *false*?

(A) The acyl chains in the paracrystalline state are highly-ordered
(B) Sideways movement is possible in the liquid-ordered state
(C) Increased synthesis of unsaturated fatty acids can occur at lower temperatures
(D) Cholesterol reduces fluidity of membranes
(E) Adding heat increases the motion of the acyl chains

3) Hyperparathyroidism is a condition where the parathyroid gland secretes excess parathyroid hormone (PTH). How does a sudden excess of PTH alter calcium (Ca2+) in the body?

(A) Increases [Ca2+] in blood (at bone, gut and kidney)
(B) Activates 1-a-hydroxylase → increases 1,25-OH2-D→ suppresses calcium absorption at gut
(C) Increases Ca2+ excretion at gut
(D) Increases Ca2+ excretion at kidney

4) Which of the following is a *true* statement?

(A) Mitochondrial genomes are relatively constant in content (i.e. types of genes present)
(B) Mitochondrial genomes are relatively constant in organization
(C) Mitochondrial genomes are relatively constant in size
(D) None of the above

5) Which of the following is an example of sexual dimorphism?

(A) Only female mussels have modified mantle tissue that resembles the prey of their fish hosts
(B) Mussels reared in the lab may be less bumpy than ones raised in a flowing river
(C) Male and female mussels both use their siphons for feeding and reproduction
(D) Some species of mussels may reproduce twice per season
(E) More female offspring are produced each year than male offspring

### BETTER QUESTION and ANSWERS

1) What distinguishes caspase 9 from factor Xa?

(A) Caspase 9 regulates blood clotting; Factor Xa regulates apoptosis
(B) Caspase 9 is a cysteine protease; Factor Xa is a serine protease
(C) Caspase 9 is synthesized in the active form; Factor Xa is synthesized in an inactive form
(D) Caspase 9 cleaves after a serine; Factor Xa cleaves after an aspartate
(E) Caspase 9 is an initiator protease; Factor Xa is an effector protease

2) Lower temperatures cause membrane lipids to move less. Explain why the addition of cholesterol in the membrane restores membrane fluidity.

(A) Cholesterol causes increased motion in unsaturated lipids
(B) Cholesterol causes decreased motion in unsaturated lipids
(C) Cholesterol causes increased motion in saturated lipids
(D) Cholesterol causes decreased motion in saturated lipids

3) Hyperparathyroidism is a condition where the parathyroid gland secretes excess parathyroid hormone (PTH). How does a sudden excess of PTH alter calcium (Ca2+) at the level of the bone?

(A) Increases osteoblast activity
(B) Decreases Ca2+ released from bone
(C) Decreases reabsorption
(D) Increases osteoclast activity

4) What characteristic is relatively constant in mitochondrial genomes across species?

(A) Content (i.e. types of genes)
(B) Organization
(C) Size
(D) Number of genes

5) A biologist is making observations about the body morphology of different individuals of freshwater mussels. She observes the following: only female mussels have modified mantle tissue that resembles the prey of their fish hosts. Which of the following concepts is consistent with this observation?

(A) Gene flow
(B) Sexual dimorphism
(C) Phenotypic plasticity
(D) Dioecy

### References

OVG MCQ Workshop 2017
Vanderbilt Center for Teaching

### Coming to a mail slot near you - MCQs, The Sequel!

- Multiple-choice questions harder than your long answer questions - Damn right!
- Item analysis reports – What the hell do those numbers mean anyway?
- Test specification – Stop students whining about tests being unfair.

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