



Double- and Triple-Jump Questions Appearing in the USMLE I

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Medical students completing the USMLE I in recent years have reported the appearance of increasing numbers of multiple-choice questions (MCQs) in the double- and triple-jump format. These are questions which require making not one, but two or three correct decisions before selecting an answer.

In 1984, a blue-ribbon panel of the American Association of Medical Colleges concluded that the present, passive system of medical education in the United States was based largely on memorization and recall. The panel found that in over 70 percent of U.S. medical schools, students were required to take the nationally standardized, multiple-choice examinations provided by the National Board of Medical Examiners. The panel recommended that medical educators design tests that measure the ability of students to gather information, problem-solve, and apply knowledge to clinical situations.¹

Perhaps in response to recommendations such as the one above, questions appearing in recent tests of basic science concepts and principles in the USMLE I have a new format. The question stem is presented in a clinical scenario. The student must first analyze the question stem and decide what the clinical problem is. Having done this, the student must then read the question and make one decision (single-jump), two decisions (double-jump), or three decisions (triple-jump) before selecting from the answer pool.

The following is an example of what might be considered a typical question presented in single-, double-, and triple-jump USMLE I format:

Question stem: A 69-yr-old alcoholic man presents to the emergency department with high fever, chills, and productive cough for the past two days. He says that he has been producing "lots of thick, bloody, gelatinous mucus." Chest x-ray shows consolidation of the upper lobes and culture of the sputum reveals pink colonies on MacConkey agar.

Single-jump MCQ: Given the above information, the most likely causative agent is:

- (A) *Streptococcus pneumoniae*
- (B) *Legionella pneumophila*
- (C) *Hemophilus influenzae*
- (D) *Pseudomonas aeruginosa*
- (E) *Klebsiella pneumoniae*

Double-jump MCQ: Given the above information, which of the structures below is present in all bacteria having a similar Gram-stain as the organism likely to be the causative agent of the pneumonia above?

- (A) capsule
- (B) flagella
- (C) peptidoglycan
- (D) periplasmic space
- (E) conjugation tube

Triple-jump MCQ: All bacteria having the same Gram-stain as the organism likely to be the causative agent of the pneumonia above possess a structure responsible for which of the below?

- (A) inhibition of phagocytosis by PMNs
- (B) motility
- (C) protection against osmotic lysis
- (D) high concentrations of beta-lactamases within the outer membrane
- (E) transfer of antibiotic-resistance genes

Explanation: The correct answer to the single-jump MCQ is (E) *Klebsiella pneumoniae*. This is a Gm (-) rod commonly found in the GI tract and is a common cause of aspiration pneumonia in alcoholics. Furthermore, it produces a thick, gelatinous, bloody sputum commonly referred to as "currant-jelly" like. Of the organisms listed, only *Klebsiella pneumoniae* would grow on MacConkey agar. Moreover, *Klebsiella* is a lactose-fermenter and would grow out pink colonies. All other choices are bacterial causes of pneumonia, but have different clinical presentations. The correct answer to the double-jump MCQ is (D) periplasmic space. The student must make two decisions: (i) what is the causative agent and (ii) what bacterial structure in the list is present only bacteria having the same Gm stain. *Klebsiella pneumoniae* is Gm (-) The bacterial capsule, flagella, peptidoglycan and conjugation tube are present in both Gm (+) and Gm (-) bacteria. Only Gm (-) bacteria possess an outer membrane and therefore contain a periplasmic space. Finally, the correct answer to the triple-jump MCQ is (D). In addition to the two correct decisions above, the student must recognize not only the name, but know the biological function and significance of the structures in the double-jump question. Gram-negative bacteria such as *Klebsiella pneumoniae* all have a periplasmic space. Beta-lactamases released into the periplasmic space are contained in high concentration by the outer membrane and result in increased antibiotic resistance and higher minimal inhibitory concentrations. (A) is incorrect; inhibition of phagocytosis by PMNs is a characteristic of the bacterial capsule, which is present in both Gm (+) and Gm (-) organisms. (B) is incorrect. Motility is a function of bacterial

flagella, which are present in both Gm (+) and Gm (-) bacterial. (C) is incorrect. Peptidoglycan provides protection against osmotic lysis and is present in Gm (+) and Gm (-) bacterial. Finally, (E) is incorrect. The bacterial conjugation tube is responsible for transfer of plasmids and are found in both Gm (+) and Gm (-) bacteria.

While double- and triple-jump questions appear to be more difficult, challenging, and thought-provoking, they are constructed and pilot tested by the NBME to have an overall difficulty averaging about 0.58, according to Dr. Steven Daugherty.² For example, students might make a correct first decision in 90 percent of the time, a correct second decision in 80% of the time, and a correct third decision in 80% of the time. The overall result would be a question difficulty of 0.578. The new format appears to place greater emphasis on the student's ability to gather information, problem-solve, and apply basic science knowledge to clinical situations. Whether double- and triple-jump questions continue to appear and eventually dominate the USMLE I format remains unclear. What is certain is that how students prepare and how basic science faculty teach for the USMLE I must constantly evolve in response to changing formats.

References

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