**Original multiple-choice:**

Suppose that a single DNA base change of an A to a T occurs and is copied during replication.

Is this change necessarily a mutation?

a) Yes, it is a change in the DNA sequence.

b) Yes, if the base change occurs in a gamete (sperm or egg cell); otherwise no.

c) Yes, if the base change occurs in the coding part of a gene; otherwise no.

d) Yes, if the base change occurs in the coding part of a gene and alters the amino acid sequence of a protein; otherwise no.

e) Yes, if the base change alters the appearance of the organism (phenotype); otherwise no.

**Open-ended**: Suppose a single DNA base change of an A to a C occurs and is copied during replication. Is this a mutation? Yes or No. Explain your answer

**Series of scenarios for open-ended responses**

1. In bacterial cell 1, a single DNA base change of an A to a C occurs and is copied during replication. The base change alters the amino acid and protein function (phenotype)? Is this a mutation? Answer Yes or No. Explain.
   1. In bacterial cell 2, a single DNA base change of an A to a C occurs and is copied during replication. The base change has no effect on the amino acid or protein function (phenotype)? Is this a mutation? Answer Yes or No. Explain.
   2. In bacterial cell 2, a second base change of T to G also occurs next to the first base change. As a result of the combined changes, the amino acid and protein function (phenotype) are altered. Select one of the following and explain.
   3. Is this second base change (T 🡪 G) a mutation?
   4. Is the first base change (A🡪 C) a mutation
   5. Are both changes mutation
   6. In bacterial cell 3, a single DNA base change of an A to a C occurs and is copied during replication. The base change alters the amino acid sequence but the protein function (phenotype) is not affected? Is this a mutation? Answer Yes or No. Explain?
   7. In bacterial cell 3, the base change is passed on for several generations. The environment becomes polluted and more acidic. The base change now has an effect on the protein function (phenotype). Was the original base change (A 🡪 C) a mutation? Answer Yes or No. Explain.

Revisions made at AACR PI

Suggested new question:

In bacterial cell 1, a single DNA base change of an A to a C occurs and is copied during replication. Under what circumstances is this a mutation?

Maybe keep #3

Short answer and then some additional data on multiple choice question

Try a new set of questions at MSU- check with John