

Mutations and Cancer Review Sheet Key

1. What is a mutation?
Change in the sequence of the base pairs of DNA.
2. During which of the 4 stage cell cycle do most mutations occur and **why**?
(G₁ S G₂ Cell Division)
S (synthesis) because the DNA is being unzipped and rebuilt during DNA replication.
3. List the 3 types of mutations.
single base substitutions, insertions and deletions, translocations
4. What are the three types of single base substitutions?
i) missense ii) nonsense iii) silent

Before Mutation

DNA = A A T CTC ACC TTA
mRNA = U U A GAG UGG AAU
amino acids = leuc - glut - tryp - asparagine

5. Describe a missense mutation. Rewrite the following strand of DNA to reflect a missense mutation.
Missense Mutation - alters the codon to produce different protein

After Mutation

DNA = A G T CTC ACC TTA
mRNA = U C A GAG UGG AAU
amino acids = seri - glut - tryp - asparagine

6. Describe a nonsense mutation. Rewrite the following strand of DNA to reflect a nonsense mutation.
Nonsense Mutation - alters codon to one of the STOP codons resulting in a shortened protein

After Mutation

DNA = A A T CTC A C T TTA
mRNA = U U A GAG U G A AAU
amino acids = leuc - glut - stop ...

7. Describe a silent mutation. Rewrite the following strand of DNA to reflect a silent mutation.
Silent Mutation - the altered codon happens to code for the same amino acid as the original therefore no change in the protein produced

After Mutation

DNA = A A T C T T A C T TTA
mRNA = U U A G A A U G A AAU
amino acids = leuc - glut - tryp - asparagine

8. Describe an insertion mutation. Rewrite the following strand of DNA to reflect an insertion mutation.
Extra base pairs are added from the DNA of a gene

A A T C T C T A C C T T A G G C A G C T G C

9. Describe a deletion mutation. Rewrite the following strand of DNA to reflect a deletion mutation.
Extra base pairs are deleted from the DNA of a gene

A A T C T A C C T T A G G C A G C T G C

10. Explain why insertions or deletions of 1 base is more harmful than an insertions or deletions of 3 bases.
An insertions or deletions of 1 would result in a frameshift.

11. Create a **single “letter” deletion** mutation in the sentence below.

THE BIG FAT CAT ATE THE RAT
THE IGF ATC ATA TET HER AT

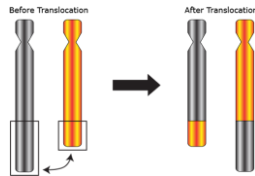
This results in a frame shift. Why would a deletion of 3 letters be less harmful? The rest of the sentence would still make sense.

12. Create an **insertion** mutation in both the sentence and DNA sequences below.

Base Sequence: AGA GCA TAG GAT

Single Insertion Mutation: Answers Vary

13. With a diagram, show what a translocation mutation would look like.



14. What is cancer? Uncontrolled proliferation of cells.
15. Explain the link between mutations and cancer. If a mutation happens by chance to occur in a section of DNA that codes for a protein that controls the cells cycle, the mutation could cause the cell to get stuck in full blown uncontrolled cell division mode.
16. What is the difference between a **malign** (malignant) and **benign** tumor.
malign - cancerous growth (always dividing) benign - stop dividing (like a mole)
17. What does “Metastasis” (ma tast a sis) mean in reference to cancer and why does it make cancer so difficult to treat? When cancer cells move through blood or lymph and establish themselves in other location in body. Difficult to treat because cancer has spread.
18. What is the Ames test? test used to determine if a chemical is a mutagen/carcinogen.
19. The plates below have been prepared for Ames tests. Explain the results. Is either chemical carcinogenic? Chemical A fails the Ames test and is a carcinogen because there are lots of bacterial colonies showing that lots of mutations occurred near Chemical A giving the bacteria lots of chances to mutate back to a viable form. Chemical B passes the Ames test and seems ok, the colonies of bacteria here are referred to as volunteer colonies that mutated back to a viable form on their own.