What is a Genetic Mutation?

Worksheet

A genetic mutation is a permanent alteration in the DNA sequence of a gene or chromosome, which can change, disrupt, or have no effect on the protein it encodes.

Questions

1. Which type of mutation shifts the reading frame of a gene?

A) Silent mutation
B) Frameshift mutation
C) Synonymous mutation
D) Missense mutation

2. A mutation that changes a codon into a premature stop codon is called a:

A) Missense mutation
B) Nonsense mutation
C) Silent mutation
D) Frameshift mutation

3. Which type of mutation can be inherited by offspring?

A) Somatic mutation
B) Germline mutation
C) Frameshift mutation only
D) None of these

4. Using M = L, if = 210 per bp and L = 110 bp, what is the expected number of mutations?

A) 0.2
B) 2
C) 20
D) 200

5. A single base substitution changes the codon GAA (glutamic acid) to GTA (valine) in the beta-globin gene. What type of mutation is this, and what condition does it cause?

6. Using M = L, estimate the expected mutations per generation in the E. coli genome (about 4.610 bp) with a mutation rate of 110 per bp per generation.

7. A single nucleotide is deleted from the middle of a gene's coding sequence. What kind of mutation results, and what's the likely effect?

8. Define: What is a genetic mutation?

9. Define: What is a point mutation?

10. Define: What is a frameshift mutation?

Answer Key

1. B) Frameshift mutation - Insertions or deletions not divisible by 3 shift every codon downstream - a frameshift.

2. B) Nonsense mutation - Nonsense mutations create a stop codon, truncating the protein.

3. B) Germline mutation - Only mutations in germline (reproductive) cells are passed on to the next generation.

4. B) 2 - M = (210) (110) = 2 mutations.

5. GAA GTA is a single-base substitution: a missense mutation It changes glutamic acid to valine at position 6 of the beta-globin protein This specific mutation causes sickle cell anemia

6. M = L M = (110) (4.610) M = 0.0046 mutations per generation (roughly 1 mutation every 217 generations)

7. Deleting 1 base is not a multiple of 3 This produces a frameshift mutation Every codon after the deletion is misread, usually creating a nonfunctional protein

8. A permanent change in the nucleotide sequence of DNA.

9. A change involving a single nucleotide base - a substitution, insertion, or deletion of one base.

10. An insertion or deletion of a number of bases not divisible by three, which shifts the reading frame downstream.