

DNA Mutations Practice Worksheet

DIRECTIONS: Transcribe and translate the original DNA sequence. Then, do the same for each mutated DNA sequence. Then, determine the consequence, if any, for each mutation, by circling your choice for each question. **You will need a Genetic Code Chart.**

Original DNA sequence:	TAC ACC TTG GCG ACG ACT
mRNA transcript:	AUG UGG AAC CGC UGC UGA
amino acids:	Met - Trp - Asn - Arg - Cys - STOP

Mutated DNA sequence #1:		TAC ATC TTG GCG ACG ACT					
mRNA transcript: (Circle any changes)		AUG UAG AAC CGC UGC UGA					
amino acids:		Met - STOP					
Type of mutation (Circle one.)	Point ⇒	Substitution			Frameshift ⇒	Insertion or Deletion	
How did the mutation affect the amino acid sequence (protein)? (Circle one.)	No change	1 amino acid changed	Premature stop signal		No stop signal	1 amino acid added/ deleted	All the amino acids changed after the point of mutation

Nonsense mutation

Mutated DNA sequence #2:		TAC GAC CTT GGC GAC GAC T				
mRNA transcript: (Circle any changes)		AUG CUG GAA CCG CUG CUG A				
amino acids:		Met - Leu - Glu - Pro - Leu - Leu				
Type of mutation (Circle one.)	Point ⇒ Substitution		Frameshift ⇒ Insertion or Deletion			
How did the mutation affect the amino acid sequence (protein)? (Circle one.)	No change	1 amino acid changed	Premature stop signal	No stop signal	1 amino acid added/ deleted	All the amino acids changed after the point of mutation

Extensive missense

Mutated DNA sequence #3:		TAC ACC TTA GCG ACG ACT				
mRNA transcript: (Circle any changes)		AUG UGG AAU CGC UGC UGA				
amino acids:		Met - Trp - Asn - Arg - Cys - STOP				
Type of mutation (Circle one.)	Point ⇒	Substitution		Frameshift ⇒	Insertion or Deletion	
How did the mutation affect the amino acid sequence (protein)? (Circle one.)	No change	1 amino acid changed	Premature stop signal	No stop signal	1 amino acid added/deleted	All the amino acids changed after the point of mutation

Silent mutation

Mutated DNA sequence #4:		TAC ACC TTG GCG ACT ACT				
mRNA transcript: (Circle any changes)		AUG UGG AAC CGC UGA UGA				
amino acids:		Met - Trp - Asn - Arg - STOP				
Type of mutation (Circle one.)	Point ⇒	Substitution		Frameshift ⇒	Insertion or Deletion	
How did the mutation affect the amino acid sequence (protein)? (Circle one.)	No change	1 amino acid changed	Premature stop signal	No stop signal	1 amino acid added/deleted	All the amino acids changed after the point of mutation

Nonsense mutation

Mutated DNA sequence #5:		TAC ACC TTG GGA CGA CT				
mRNA transcript: (Circle any changes)		AUG UGG AAC CCU GCU GA				
amino acids:		Met - Trp - Asn - Pro - Ala				
Type of mutation (Circle one.)	Point ⇒	Substitution		Frameshift ⇒	Insertion or Deletion	
How did the mutation affect the amino acid sequence (protein)? (Circle one.)	No change	1 amino acid changed	Premature stop signal	No stop signal	1 amino acid added/deleted	All the amino acids changed after the point of mutation

Missense mutation

CONCLUSIONS

1. Which type of mutation is responsible for new variations (alleles) of a trait?

Both point & substitution mutations can results in different amino acids.

2. Which type of mutation results in abnormal amino acid sequence?

Frameshift mutations (insertion & deletions)

3. Which type of mutation stops the translation of the mRNA?

2. A geneticist found that a particular mutation had no effect on the protein coded by a gene. What do you think is the most likely type of mutation in this gene? Why?

- Substitution of the 3rd base in a codon

- Wobble hypothesis: multiple codons code for amino acids, having differences in the 3rd base pair

4. Examine your genetic code chart. Name one amino acid that has more than one codon. Name an amino acid that has only one codon.

All but Met & Trp have more than one codon

5. Look at the following sequence: THE FAT CAT ATE THE RAT. Delete the first H and regroup the letters in groups of three- write out the new groups of three. Does the sentence still make sense? What type of mutation is this an example of?

TEF ATC ATA TET HER AT

No - this is a missense mutation caused by a deletion resulting in a frameshift

6. Given the following three mRNA sequences, determine which two code for the same protein. Circle them.

	mRNA #1	mRNA #2	mRNA #3
Transcript	AGU UUA GCA ACG AGA UCA	UCG CUA GCG ACC AGU UCA	AGC CUC GCC ACU CGU AGU
Translate	Ser - Leu - Ala - Thr - Arg - Ser	Ser - Leu - Ala - Thr - Ser - Ser	Ser - Leu - Ala - Thr - Arg - Ser

BONUS: You have a DNA sequence that codes for a protein and is 105 nucleotides long. A frameshift mutation occurs at the 85th base - how many amino acids will be correct in this protein? **SHOW YOUR WORK.**

105 nucleotides = 35.3 codons
85th base pair is 28.3 codons in, so in 28th amino acid