

Difference Between Missense and Nonsense Mutation

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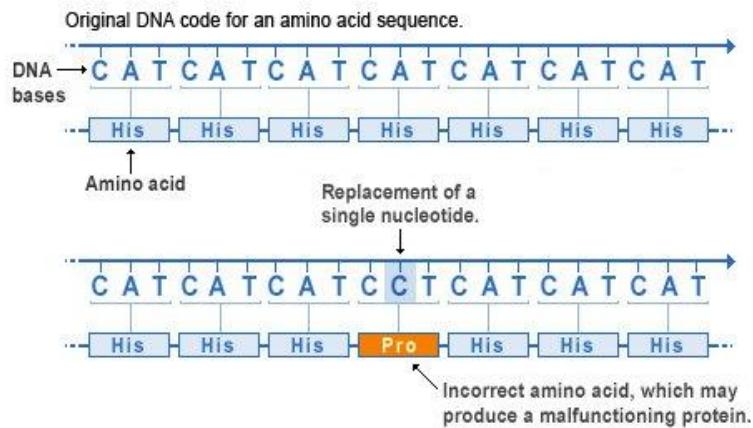
Key Difference – Missense vs Nonsense Mutation

DNA is constantly subjected to changes due to various factors including internal and environmental origin. DNA damages and mutations are two such changes that occur in DNA. Mutation is defined as a base change in the DNA sequence. Mutations cannot be recognized and repaired by enzymes. Mutated genes result in different amino acid sequences which produce wrong protein products. Mutations are caused by insertion of nucleotides, deletion of nucleotides, inversion of nucleotides, duplication of nucleotides and rearrangement of nucleotides in DNA. Mutations are originated during DNA replication or due to different environmental factors such as UV light, cigarette smokes, radiation, etc. There are different types of mutations such as point mutations, frameshift mutations, missense mutation, silent mutations and nonsense mutations. Missense mutation is a point mutation which results in the substitution of a different amino acid in the amino acid sequence due to the change of a single nucleotide in the mRNA sequence. Nonsense mutation is a point mutation which results in a truncated, incomplete, nonfunctional protein product due to the introduction of a premature stop codon in the transcribed mRNA sequence. The key difference between missense and nonsense mutation is that **missense mutation substitutes a different amino acid in the amino acid sequence while nonsense mutation introduces a stop codon to the mRNA sequence.**

What is a Missense Mutation?

Missense mutation is a point mutation where a single nucleotide is changed to cause a substitution of a different amino acid. In missense mutation, stop codon is not generated to terminate amino acid sequence synthesis similar to nonsense mutation.

Missense mutation



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Figure 01: Missense Mutation

When one nucleotide changes in the DNA sequence, it changes the genetic code of the gene. When it transcribes, the resultant mRNA will have a different codon (nucleotide tripled which results in an amino acid). The changed codon results in a different amino acid. The resultant amino acid sequence will differ from the unique amino acid sequence due to the substitution of a different amino acid by the mutation.

What is a Nonsense Mutation?

A stop codon is a nucleotide triplet within the mRNA sequence that signals the termination of translation into proteins. In a standard genetic code, there are three different stop codons. They are UAG (“amber”), UAA (“ochre”) and UGA (“opal”) in RNA. In DNA, these three stop codons occur as TAG (“amber”), TAA (“ochre”) and TGA (“opal”). These stop codons are correctly situated at the end of the genetic code of a gene. Hence, it produces a complete protein without introducing any interruption. Mutations can introduce a premature stop codon to an mRNA sequence. Nonsense mutation is a point mutation which introduces a premature stop codon into the mRNA sequence. A single nucleotide change leads to an introduction of a stop codon. When a stop codon is unnecessarily introduced into the mRNA sequence, it terminates the translation without completing the entire translation. Hence, the resultant protein becomes abnormally shortened.

Each protein has a unique amino acid sequence. Nucleotide changes in the DNA sequence of the gene result in different proteins which are nonfunctional or incomplete.

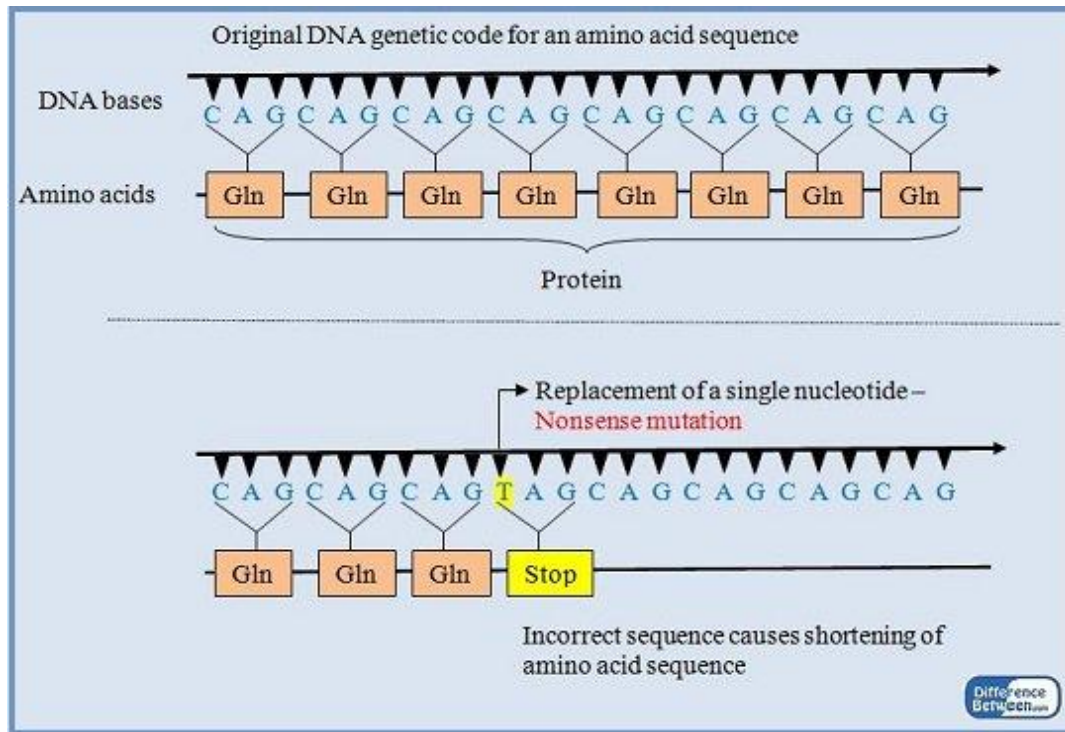


Figure 01: Missense Mutation

Nonsense mutations can cause a genetic disease by damaging a gene responsible for a specific protein. Thalassaemia, Duchenne muscular dystrophy, cystic fibrosis, and Hurler syndrome are several genetic diseases caused by nonsense mutations.

What are the similarities between Missense and Nonsense Mutation?

- Missense and nonsense mutations are point mutations caused due to a single nucleotide change.
- Both mutations result in different proteins.

What is the difference between Missense and Nonsense Mutation?

Microsporogenesis vs Megasporesogenesis	
Missense mutation is a point mutation which causes the substitution of a different amino acid into the amino acid sequence as a result of the nucleotide	Nonsense mutation is a point mutation which introduces a premature stop codon into mRNA sequence as a result of a nucleotide

change.	change.
Introduction of Stop Codon	
Missense mutation does not introduce a stop codon.	Nonsense mutation introduces a stop codon.
Final Product	
Missense mutation results in a different amino acid sequence.	Nonsense mutation results in a shorter and unfinished protein product.
Substitution of a Different Amino Acid	
Missense mutation substitutes a different amino acid.	Nonsense mutation does not substitute a different amino acid.

Summary – Missense vs Nonsense Mutation

Missense and nonsense mutations are two types of point mutations which cause a single nucleotide change in the DNA sequence. Missense mutation leads to a substitution of a different amino acid in the amino acid sequence. Nonsense mutation leads to an introduction of a premature stop codon into the mRNA sequence. This is the difference between missense and nonsense mutation.

References:

- 1."Missense mutation." Wikipedia. Wikimedia Foundation, 14 July 2017. Web. [Available here](#). 27 July 2017.
2. "Nonsense mutation." Study.com, n.d. Web. [Available here](#). 27 July 2017.

Image Courtesy:

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