# DNA mutations and their outcome – Reference Summary

## Types of Mutations

A **point mutation** is a change in a single nucleotide.

Point mutations may result in:
- a **missense mutation**, in which the changed nucleotide results in a single amino acid change in the protein product.
- a **silent mutation**, in which the changed nucleotide does not result in any changes to the amino acids in the protein product.
- a **nonsense mutation**, in which the codon that includes the changed nucleotide changes from coding for an amino acid to a stop codon that terminates translation.

An **insertion** is the addition of an extra nucleotide(s) within the sequence. Similarly, a **deletion** is the elimination of a nucleotide(s) from the sequence.

Insertions and deletions frequently result in **frameshift mutations**, by which the extra or missing nucleotide change the reading frame (the grouping of three adjacent nucleotides into codons), thus resulting in a change in the amino acids that are encoded by that nucleotide sequence.

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## Also, remember that...

A **codon** is a set of 3 consecutive nucleotides that together code for an amino acid.

And, a **codon chart** is used to determine which amino acid corresponds to which codon

| 1st letter 5′ | Second Letter: U | Second Letter: C | Second Letter: A | Second Letter: G | 3rd letter 3′ |
|---|---|---|---|---|---|
| U | UUU Phe<br>UUC<br>UUA Leu<br>UUG | UCU<br>UCC<br>UCA Ser<br>UCG | UAU Tyr<br>UAC<br>UAA Stop<br>UAG Stop | UGU Cys<br>UGC<br>UGA Stop<br>UGG Trp | U<br>C<br>A<br>G |
| C | CUU<br>CUC<br>CUA Leu<br>CUG | CCU<br>CCC<br>CCA Pro<br>CCG | CAU His<br>CAC<br>CAA Gln<br>CAG | CGU<br>CGC<br>CGA Arg<br>CGG | U<br>C<br>A<br>G |
| A | AUU<br>AUC<br>AUA Ile<br>AUG Met | ACU<br>ACC<br>ACA Thr<br>ACG | AAU Asn<br>AAC<br>AAA Lys<br>AAG | AGU Ser<br>AGC<br>AGA Arg<br>AGG | U<br>C<br>A<br>G |
| G | GUU<br>GUC<br>GUA Val<br>GUG | GCU<br>GCC<br>GCA Ala<br>GCG | GAU Asp<br>GAC<br>GAA Glu<br>GAG | GGU<br>GGC<br>GGA Gly<br>GGG | U<br>C<br>A<br>G |

(Again, the Codon chart will always be available – no need to waste neurons on this ☺ )