

What can go wrong with the DNA? Why does DNA need to be repaired?

- Errors during DNA synthesis (incorrect base-pairing, insertion of extra nucleotides, etc.)
- Radiation (non-ionizing ultraviolet light, high-energy ionizing radiation)
- Chemical exposure (nitrous acid)
- Spontaneous loss and alteration of bases

Mutations can lead to different kinds of diseases and can also cause abnormalities in the newborn.

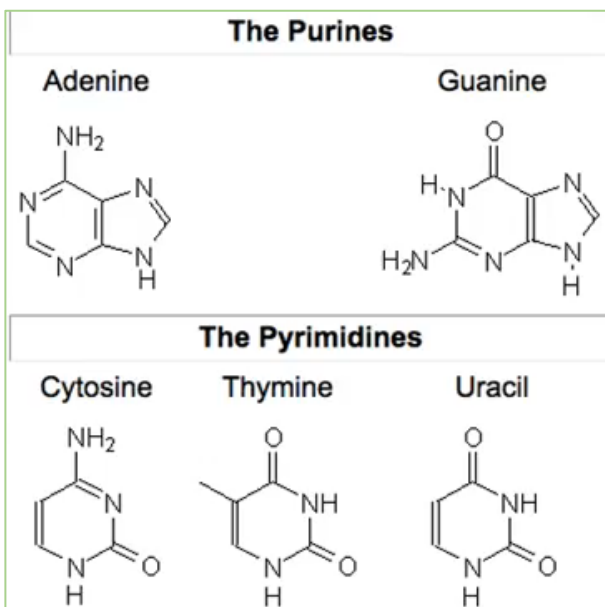
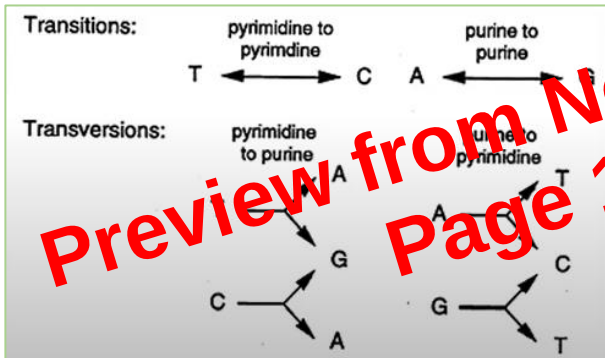
DNA MUTATION

It can be classified:

- **Based on substitution**
 - Transition
 - Transversion
- **Based on size/position**
 - Point mutation
 - Silent
 - Missense
 - Nonsense
 - Deletion
 - Insertion

DNA MUTATION BASED ON SUBSTITUTION

Transition	Change to same kind
Transversion	Change to another kind



DNA MUTATION BASED ON SIZE/POSITION

Point mutation happens when there is only 1 nucleotide that replaces another

- A. **Silent mutation** happens when the mutation has very little to no effect to the body. Despite the point mutation, there is **production of the same protein**

normal	AUG	GCC	TGC	AAA	CGC	TGG
	met	ala	cys	lys	arg	trp
		↓				
silent	AUG	GCT	TGC	AAA	CGC	TGG
	met	ala	cys	lys	arg	trp

- B. **Nonsense mutation** happens when point mutation results in the **production of a stop codon**

DNA STOP CODONS	TAA, TAG, TGA
mRNA STOP CODONS	UAG, UGA, UAA

normal	AUG	GCC	TGC	AAA	CGC	TGG
	met	ala	cys	lys	arg	trp
			↓			
nonsense	AUG	GCC	TGA	AAA	CGC	TGG
	met	ala	---	---	---	---

- C. **Missense mutation** happens when point mutation results in the **production of a different protein**

normal	AUG	GCC	TGC	AAA	CGC	TGG
	met	ala	cys	lys	arg	trp
			↓			
missense	AUG	GCC	GGC	AAA	CGC	TGG
	met	ala	arg	lys	arg	trp

DELETION & INSERTION

Deletion	1 nucleotide is deleted or is gone
Insertion	Addition of an extra nucleotide along the line

normal	AUG	GCC	TGC	AAA	CGC	TGG
	met	ala	cys	lys	arg	trp
			↓			
frameshift (deletion -1)	AUG	GC-	TGC	AAA	CGC	TGG
	met	ala	glu	asn	ala	
			↓			
frameshift (insertion +1)	AUG	GCC	C	TGC	AAA	CGC
	met	ala	leu	gln	thr	leu
			↓		↓	
insertion +1, deletion -1	AUG	GCC	C	TGC	AAA	-GC
	met	ala	leu	gln	thr	trp

In **deletion**, there is a **frameshift to the right** because they keep on borrowing or robbing from their neighbour codons

In **insertion**, there is a **frameshift to the left** because of the addition of an extra nucleotide

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