



## Mutations

Changes in DNA



## Mutations

- **Mutation** = a change in the sequence of bases in DNA
- May occur ...
  - Spontaneously due to exposure to chemicals/radiation (**mutagens**)
  - While being paired during DNA replication (**mistakes**)
  - During the process of transcription or translation (**mistakes**)




## Types of Mutations

**2 Categories:**

- 1) Point
- 2) Frameshift

**Point Ex 1: Substitution**

- A pair of bases become incorrectly matched
- Ex: ATCGCA → ATCGⒿA



## Types of Mutations (cont.)

**Frameshift Ex 2: Insertion**

- When 1+ nucleotide pairs are **inserted** into a gene
- Ex: ATCGCA → ATC**A**GCA

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**Frameshift Ex: 3: Deletion**

- When 1+ nucleotide pairs are **removed** from a gene
- Ex: ATCGCA → ATCG**A**

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### Mutation Sentence Examples

- **Original:** THE FAT CAT SAT ONA HAT
- **Substitution:** THE FAT BAT SAT ONA HAT
- **Insertion:** THE KFA TCA TSA TON AHA T
- **Deletion:** THE FAC ATS ATO NAH AT

### Mutation Effects on Proteins

- **Negative (-):** resulting mutation may alter or change the amino acid sequence & protein
  - Lethal: if a stop codon is create with change
- **Positive (+):** resulting mutation gives the organisms an evolutionary advantage
- **Neutral (∅):** resulting mutation may not effect

### Mutation Examples Explained

**Q:** How can a mutation have neutral effect?

- **Normal:** UCU    **Mutated:** UCC

**A:** They both code for the same amino acid

- The resulting protein wouldn't change

- Sickle cell anemia gives resistance to malaria
  - **Heterozygote Advantage**

### Mutation & Evolution

- Any mutation that occurs in a gamete (sperm or egg) has the potential to become hereditary
- **MUTATIONS IN BODY CELLS WILL NOT AFFECT NEXT GENERATION!**
- Mutations range from about 1 in 100,000 to 1 in 1,000,000
  - **Allows for greater genetic variation**
- Only natural selection will determine if these mutations prove to be beneficial or not