

Tuesday January 17th

Make sure you have a wood cube!

4.7 Genetic Mutations Quiz Thurs/Fri!

Lab 13 Wed - Thurs/Fri!

Unit 4 Test next Tuesday January 24th

Starter:

Wild-Type DNA: T A C A A A T A G C C G A T G

Mutated DNA: T A C A A A T A C C C G A T G

What type of mutation is this? What might the affect be?

4.7 Genetic Mutations

Standard Objectives:

- I can describe the different types of genetic mutations and how they affect gene expression.
- I can give examples of mutagens that may cause the different types of genetic mutations.
- Given a mutated DNA sequence, transcribe and translate the sequence to demonstrate and describe the result of mutation.

4.7 Genetic Mutations

Definition of Mutation

Changes or mistakes in DNA or RNA

nucleotide code



4.7 Genetic Mutations

Three General Causes

1. Spontaneous error during DNA replication
2. Spontaneous error during protein synthesis
3. Environmental factors causing damage to DNA

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Mutagens

Environmental factor that causes a mutation

Usually causes mutation in DNA, not RNA

Examples:

Radiation (X & UV rays)

Benzene (solvent)

Tobacco smoke

Arsenic

Some viruses



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Carcinogen

Mutagen that specifically causes cancer
(Cancer = uncontrolled cell growth/cell division)

Examples:

Radiation

Tobacco smoke

Asbestos

Some food additives



**Chip-Makers
Agree To Cut
Carcinogen**

Calif. settlement would
limit acrylamide, a
byproduct of cooking

Aug 2, 2008 12:08 PM CDT

4.7 Genetic Mutations

Effects of Mutations

Most of the time, no effect! Or not problematic

Can alter a protein preventing it from functioning properly



4.7 Genetic Mutations

Major Types of Mutations

Point Mutation

Frameshift: Insertions & Deletions

Nonsense Mutation

Silent Mutation

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Point Mutation

Single base is changed for another in the DNA or RNA

May or may not code for diff. amino acid

THE FAT CAT SAT

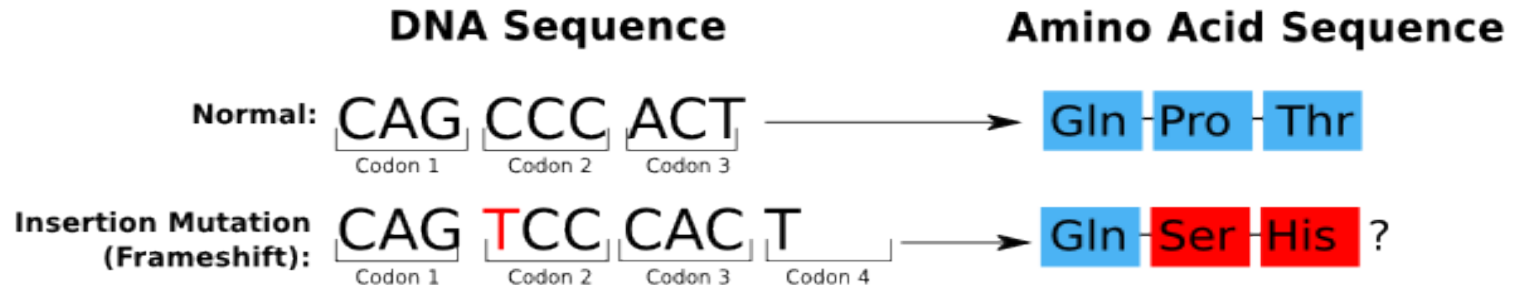
THE FAT BAT SAT

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Frameshift Mutations

Mutations that cause a “shift” in how codons are read

Add or remove a base = diff. codons



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Insertion Mutation

Addition of 1+ nucleotides in DNA or RNA
Causes codons to “shift” altering amino acid code

F
↓
THE FAT CAT SAT
THE FFA TCA TSA T

4.7 Genetic Mutations

Deletion Mutation

Deletion of 1+ nucleotides in DNA or RNA
Also causes codons to “shift” altering
amino acid code

THE ~~F~~X T CAT SAT

THE FTC ATS AT

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Nonsense Mutation

One or more bases are changed resulting in an early STOP codon ending polypeptide early

THE FAT CAT SAT
THE FAT CAT **STOP** AT

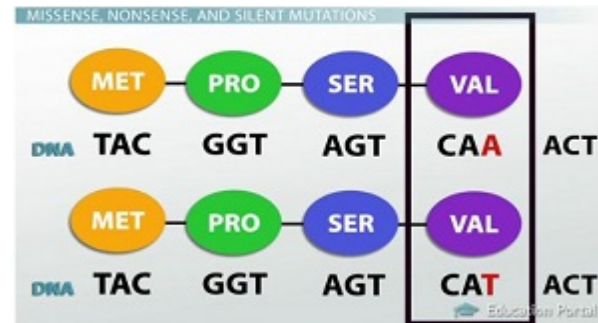
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Silent Mutation

A base is changed but the resulting amino acid is still the same as the normal DNA

THE FAT CAT SAT

THE FAT CAT SaT

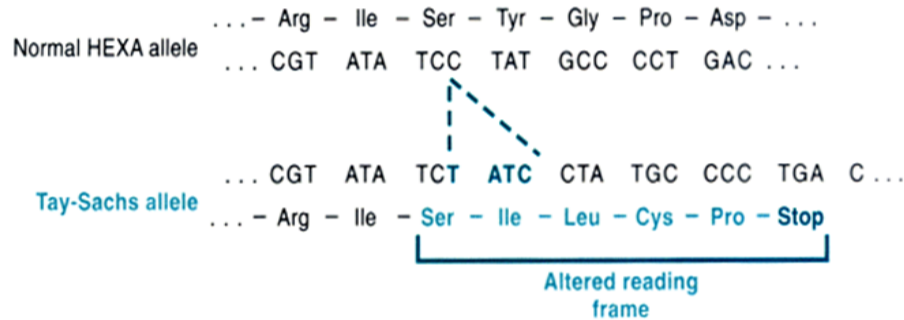


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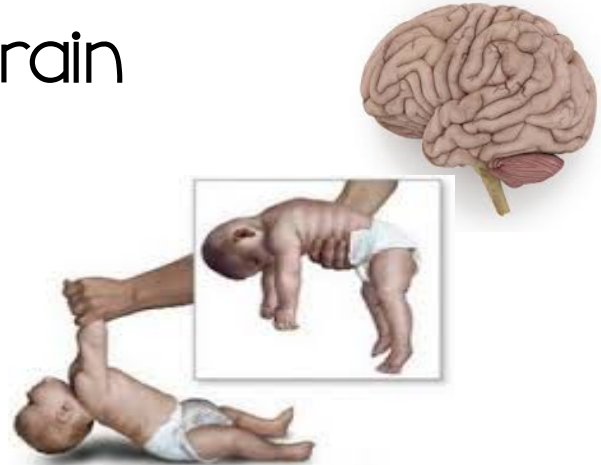
Insertion Example: Tay-Sachs Disease

Addition of 4 bases results in early STOP codon

Malfunctioning protein in the brain



Four-base insertion in the hexosaminidase A gene in Tay-Sachs disease, leading to a frameshift mutation

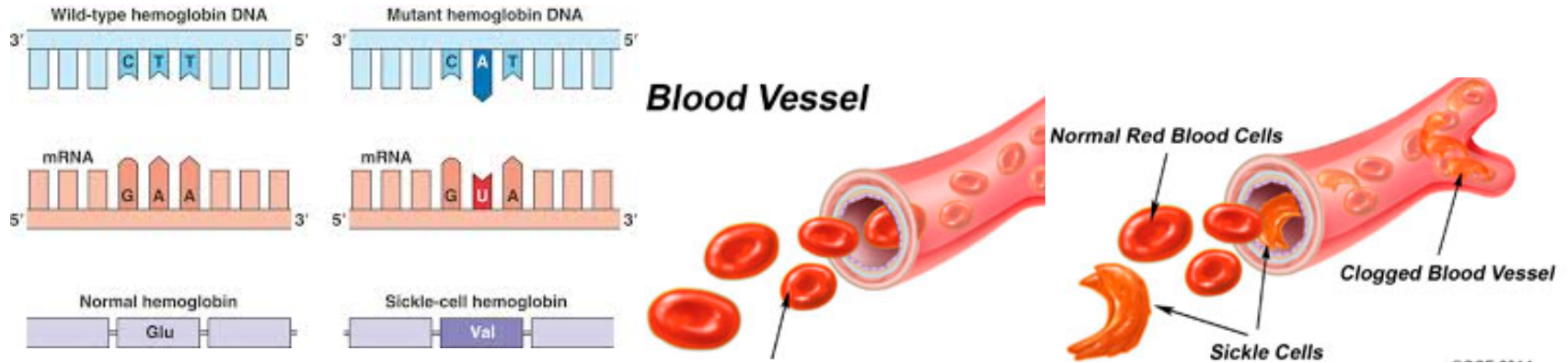


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Point Mutation Example: Sickle-Cell Anemia

Single base change in DNA (A for T)

Codes Valine amino acid instead of Glutamine

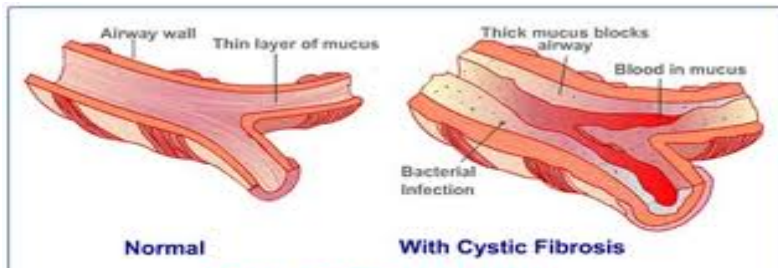


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Deletion Example: Cystic Fibrosis

Deletion of 3 bases

Malfunctioning protein =
mucus building up in lungs

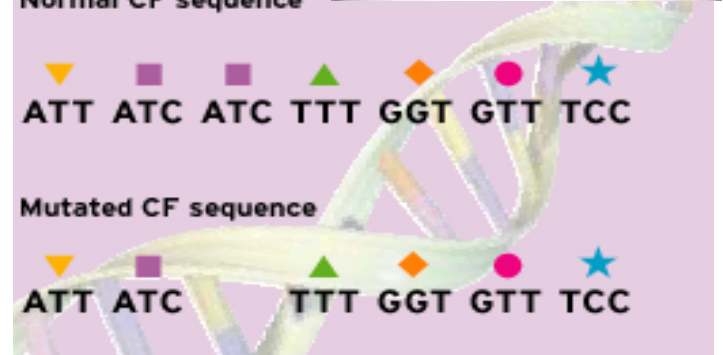


Normal CF sequence

ATT ATC ATC TTT GGT GTT TCC

Mutated CF sequence

ATT ATC TTT GGT GTT TCC



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Deletion Example: Myostatin Hypertrophy

Two base deletion in myostatin gene

Results in hypertrophy
(excessive muscle growth)



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Nonsense Mutation Example:

Duchenne Muscular Dystrophy

Mutation gene for muscle protein

Early stop = no muscle protein

Lack of specific protein =
muscle degrading

Affects only males

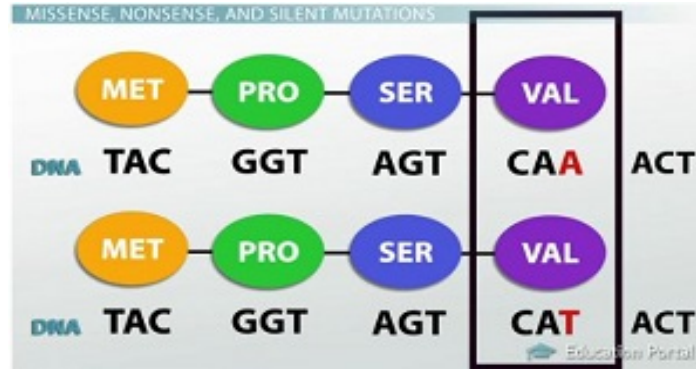


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Silent Mutation Example:

No known effects due to do silent mutations

But does create variations in ATCG code



4.7 Genetic Mutations

Inheriting Mutations

Mutations in DNA of sperm or egg cells can be passed to offspring

Mutations in body cells will not be inherited
(Ex. Cigarette carcinogens in the lungs)

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