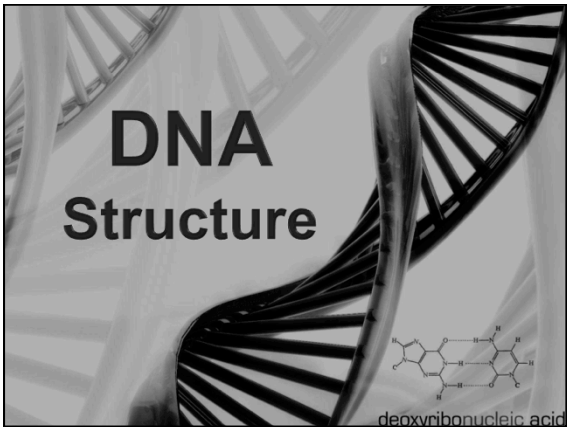


DNA Function

- Main Function: **DNA's major function is to code for proteins.**
  1. Storage of genetic information
  2. Self-duplication & inheritance.
  3. Expression of the genetic message.
- How: Information is encoded in the order of the nitrogenous bases.

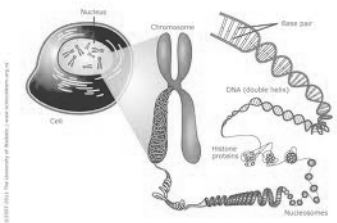
Basic Shape:

Double Helix

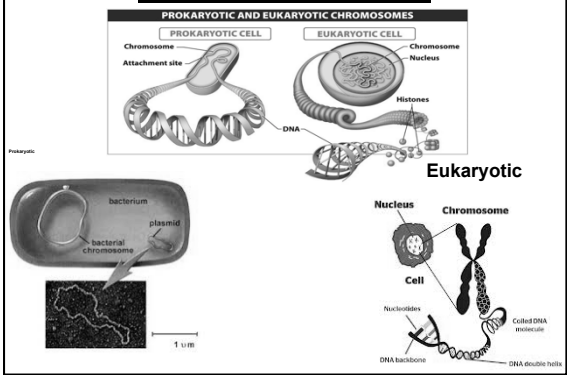
- Compress and store Genetic code

Chromosomes

- Compress and store long term



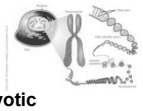
2. Chromosomes



Chromosomes

Prokaryotic

- Circular DNA
- Very small
- 1 chromosome per cell
- **Not** housed in a nucleus.



Eukaryotic

- Linear DNA
- Long
- **Several** chromosomes per cell.
- Housed in a nucleus.
- Histone
  - Protein that---"spools". Same in all eukaryotes
  - Nucleosome—2 loops of DNA wrapped around 8 histone proteins..

Karyotype = Map of your chromosomes, humans have 46

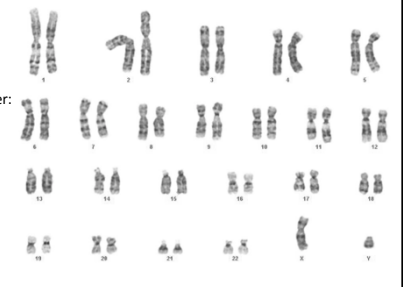
A karyotype from a healthy human has 22 pairs of non-sex chromosomes, and either:

1. One X chromosome, and one Y chromosome

OR

2. Two X Chromosomes

For a total of:
46 chromosomes



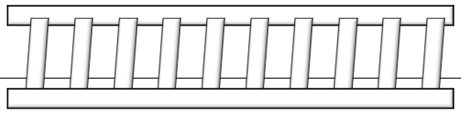
Nucleotides

DNA Structure

I. DNA looks like a twisted ladder = "double helix"

II. The phosphate and sugar form the backbone of the DNA molecule

III. The bases form the "rungs".

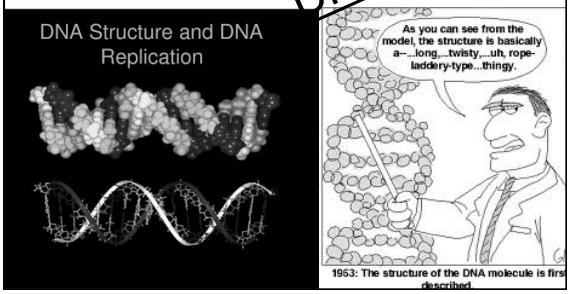


DNA

DNA Structure

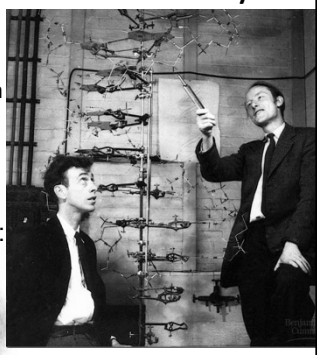
A. Structure:

I. Double helix



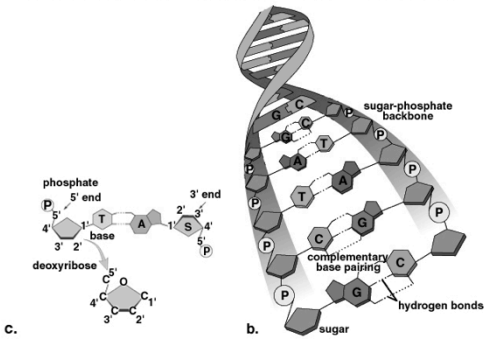
DNA Structure Discovery

III. James Watson & Francis Crick discovered the ***double helix*** structure of DNA in 1953 – they stayed up one night & built themselves a model out of metal



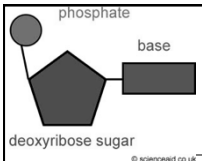
Structure informed by: Rosalind Franklin's DNA image

Watson and Crick model of DNA



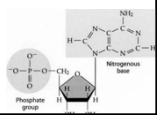
DNA Structure

5. Nucleotides



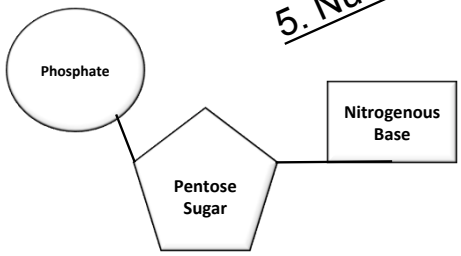
II. A molecule of DNA is made up of millions of tiny subunits called Nucleotides.

1. Each nucleotide consists of:
   a) Phosphate group
   b) Pentose sugar
   c) Nitrogenous base



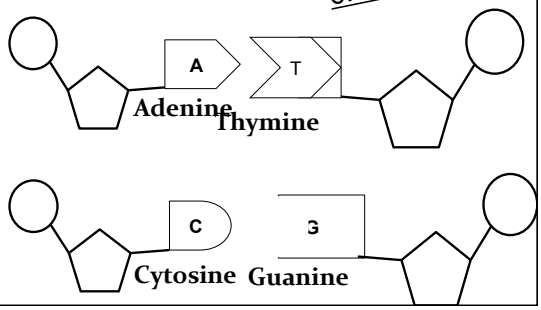
Nucleotides

5. Nucleotides



b) There are four types of nitrogenous bases. (Nucleotides)

5. Nucleotides
6. Base Pairing

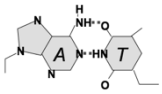


Nucleotides

6. Base Pairing

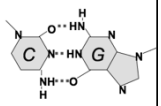
- Each base will only bond with one other specific base.
  - Adenine (A)
  - Thymine (T)

  Form a base pair.



  - Cytosine (C)
  - Guanine (G)

  Form a base pair.

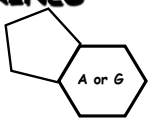


- Because of this complementary base pairing, the order of the bases in one strand determines the order of the bases in the other strand.

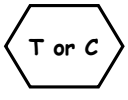
6. Base Pairing
Bonus Knowledge

Nitrogenous Bases

- **Double ring PURINES**
  - **Adenine (A)**
  - **Guanine (G)**



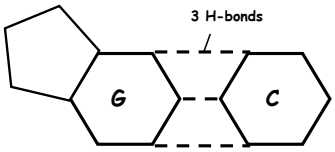
- **Single ring PYRIMIDINES**
  - **Thymine (T)**
  - **Cytosine (C)**



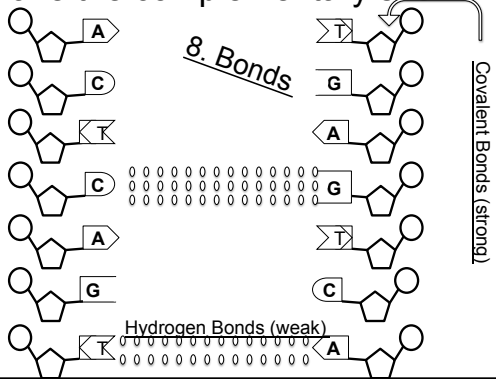
6. Base Pairing
Bonus Knowledge

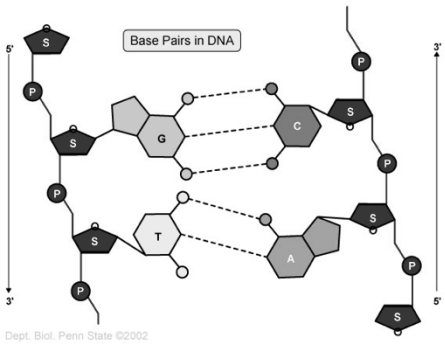
Base-Pairings

- **Purines** only pair with Pyrimidines
- Three hydrogen bonds required to bond Guanine & Cytosine



Make the complementary strand:





Gecko Feet

Gluing **Ungluing**

Reading DNA

- To crack the genetic code found in DNA we need to look at the sequence of bases.
- The bases are arranged in triplets called codons.

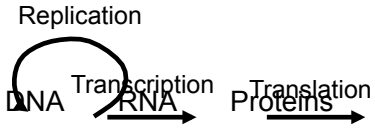
A G G - C T C - A A G - T C C - T A G
T C C - G A G - T T C - A G G - A T C

Genes to Phenotype

- A gene is a section of DNA that codes for a protein.
- Each unique gene has a unique sequence of bases.
- This unique sequence of bases will code for the production of a unique protein.
- It is these proteins and combination of proteins that give us a unique phenotype.

Chloe Emma Estelle

Where are we going with this? The "Central Dogma" of all Biology:



What's so special about proteins?

- "Life" = chemical reactions
- Every chemical reaction in a cell is made millions of times faster by proteins called *enzymes*.

Finish your DNA Model !

Central Dogma of Genetics

- DNA
- mRNA
- Proteins
- Traits

- Replication
- Unzip
- Template
- Floating nucleotides

- Template
- Sense strand
- Semiconservative Replication
- DNA Polymerase
- Proofreading functions
- 5' to 3' only
- Replication fork
- Discontinuous assembly
- Okazaki fragments

You're all mutants! (and so am I)

Our Focus:

1. What are mutations and what causes them
2. Cell reproduction: All your body cells have the same DNA in them, how does that happen? (mitosis)
3. Your sperm or egg have only half as much DNA as your body cells, how does that happen? (meiosis)

Big Picture of Evolution
Think Pair Share

- **What are mutations?**
- **How are they related to evolution?**
- **Are mutations good or bad?**

Big Picture of Evolution

- **What are mutations?**

  Changes to DNA

- **How are they related to evolution?**

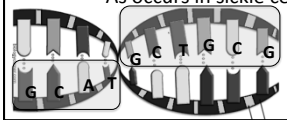
  They are the CAUSE

- **Are mutations good or bad?**

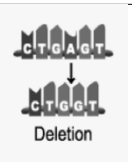
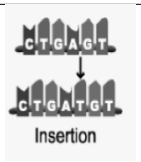
  Mostly Bad
  But once in a blue moon they offer some advantage and if survival of the fittest kicks in, then it gets passed down

Mutations

- A **mutation** is any change in the nucleotide sequence of DNA.
- Mutations can change the amino acids in a protein – but many times they don't
- Mutations can involve:
  - Large regions of a chromosome
  - Just a single nucleotide pair
    - As occurs in sickle cell anemia



Types of Mutations

Base ***Substitution***	*Nucleotide* ***Deletion***	*Nucleotide* ***Insertion***
The replacement of one base by another	The loss of a nucleotide	The addition of a nucleotide
	 Deletion	 Insertion

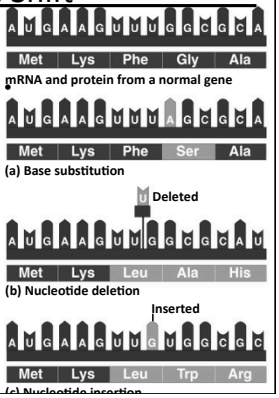
Type of Mutation	Effect
Substitution of one DNA base for another	**Silent** mutations result in no change to amino acids.
	Missense mutations swap one amino acid for another.
	Nonsense mutations change an amino acid codon to a stop codon.
Insertions or **deletions** of DNA nucleotides	These mutations can alter the triplet grouping of codons and greatly change the amino acid sequence.

Base ***Substitution***	*Nucleotide* ***Deletion***	*Nucleotide* ***Insertion***
1. Silent 2. Missense 3. Nonsense	Frame Shift	

Figure 10.UN7

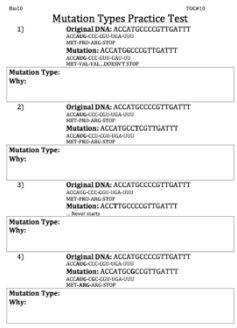
Frame Shift

- Insertions and deletions can:
  - Change the reading frame of the genetic message
  - Lead to disastrous effects



Base ***Substitution***	*Nucleotide* ***Deletion***	*Nucleotide* ***Insertion***
1. Silent: No Change in the amino acid made 1. *What color is that dog?* 2. *What colur is that dog?* 2. Missense: mutation swaps one amino acid for another. 1. *What color is that dog?* 2. *What color are that dog?* 3. Nonsense: Mutation change an amino acid to a stop codon. 1. *What color is that dog?* 2. *What?*	Frame Shift	

Worksheet



Mutation Types Practice Test

1) **Original DNA:** ACCATGCCCCGTTGATTT
ACCAUG-CCC-CGU-UGA-UUU
MET-PRO-ARG-STOP
Mutation: ACCATGGCCCGTTGATTT
ACCAUG-CCC-GCU-GAU-UU
MET-VAL-VAL...DOESN'T STOP
Mutation Type:
Why:

2) **Original DNA:** ACCATGCCCCGTTGATTT
ACCAUG-CCC-CGU-UGA-UUU
MET-PRO-ARG-STOP
Mutation: ACCATGCCTCGTTGATTT
ACCAUG-CCU-CGU-UGA-UUU
MET-PRO-ARG-STOP
Mutation Type:
Why:

3) **Original DNA:** ACCATGCCCCGTTGATTT
ACCAUG-CCC-CGU-UGA-UUU
MET-PRO-ARG-STOP
Mutation: ACCTTGCCCCGTTGATTT
Never starts
Mutation Type:
Why:

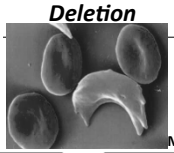
4) **Original DNA:** ACCATGCCCCGTTGATTT
ACCAUG-CCC-CGU-UGA-UUU
Mutation: ACCATGCGCCGTTGATTT
ACCAUG-CGC-CGU-UGA-UUU
MET-ARG-ARG-STOP
Mutation Type:
Why:

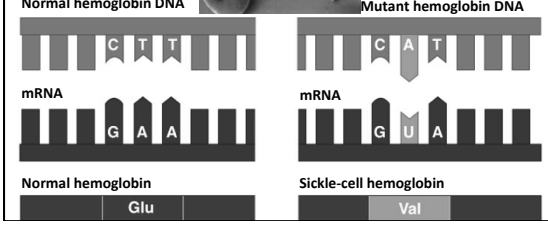
Answers Posted on my webpage

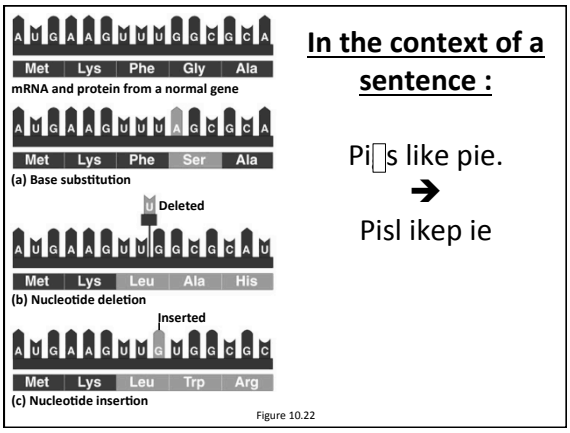
What type of mutation is this?

Base ***Substitution***	*Nucleotide* ***Deletion***	*Nucleotide* ***Insertion***

1. **Silent**
2. **Missense**
3. **Nonsense**





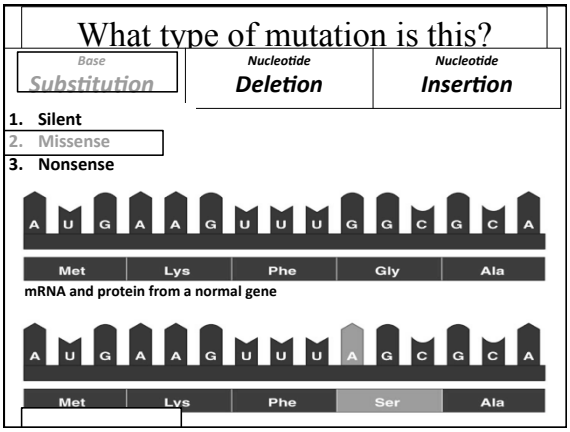


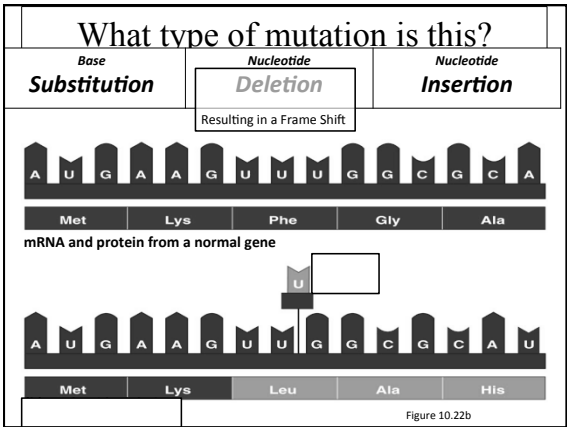
In the context of a sentence :

Pi□s like pie.

➔

Pisl ikep ie





What type of mutation is this?

Base	*Nucleotide*	*Nucleotide*
Substitution	***Deletion***	***Insertion***

Resulting in a Frame Shift

mRNA and protein from a normal gene

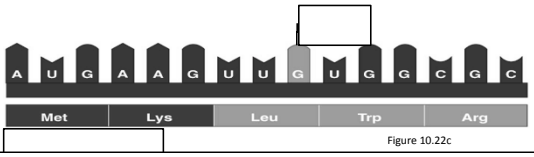


Figure 10.22c