

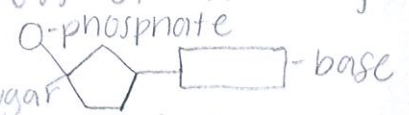
DNA - deoxyribonucleic acid ^{DNA} → double helix
↓ DNA controls all the chemical changes in the cell
The chemical substance is present in the nucleus of all living things
The build block for DNA are nucleotides →

Ribose - sugar in RNA

deoxyribose - sugar in DNA

100

↓ pentose sugar
they are composed of pentose sugar phosphate, and a nitrogen base

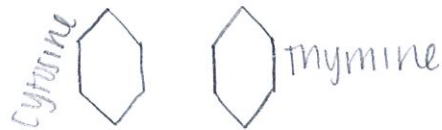
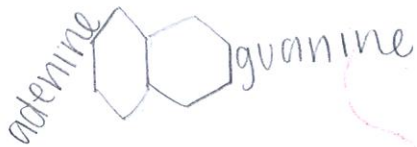


THE MOST COMMON ORGANIC BASES

Adenine, Thymine, Cytosine, Guanine = DNA

Adenine, Uracil, Cytosine, Guanine = RNA

Purines have two rings Pyrimidines have one ring



DNA is composed of two complimentary strands of nucleotides joined by hydrogen bonds

- Adenine + Thymine = joined with 2 hydrogen bonds
- Cytosine + Guanine = joined by 3 hydrogen bonds

Functions of DNA

1. DNA directs the machinery of a cell to make a specific protein, and therefore DNA indirectly controls all the functions of all living things
2. DNA stores all hereditary information of all individual
3. DNA has the ability to mutate
4. Self replication - DNA has the ability to make copies of itself

Chromosome - thread like structure within the nucleus containing genetic information that is passed from one generation of the cell to the next

How each strand of DNA is used to make new DNA copies.

1. Helicase unzips the DNA
2. Primase + polymerase match up base pairs
3. Form the new sugar phosphate base
4. Ligase seals it up and polymerase proof reads it

Sickle Cell Anemia

Most common disease among black people
Caused by an abnormal gene on chromosome 11
Causes hemoglobin to clump within red blood cells, which distorts their shape.

People with sickle cell anemia are immune to malaria.

Symptoms

- Fatigue
- Dizziness
- Headaches
- Chronic pain
- Reduced immune responses
- Strokes
- Autoimmune
- Dominant

Treatment

- Blood Transfusions
- Antibiotics
- Drugs that increase oxygen-carrying capacity of RBC's

Huntington Disease

Affects a person brain cells

Symptoms (40 years old)

- Clumsiness
- Irritability
- Depression
- Memory Loss
- Loss of muscle coordination and ability to speak
- Fatal

Disorders

Some disorders are caused by multiple genes.

- Diabetes
- Heart Disease
- Bipolar Disorder
- Schizophrenia

Some result from chromosomal abnormalities made in meiosis.

Disorders

Caused by meiosis

Nondisjunction - the failure of a pair of chromosome to separate during meiosis. Causes Trisomy (3 copies of a chromosome, Monosomy (1 copy).

Translocation - when a piece of one chromosome breaks off and attaches to another.

A karyotype - taking pictures of an individual's chromosomes and matching them up with their homologous pairs.

Down Syndrome

Caused by adding an extra chromosome to chromosome 21

Symptoms

- mild to severe mental retardation
- short stature
- heart, vision and intestinal problems
- susceptibility to infection

Way to detect disabilities

Genetic counseling - studies family history, creates pedigree charts.

Analysis of fetal cells

Amniocentesis

- a sample of amniotic fluid is taken and cells are grown

Chronic Villus biopsy

- structures that help maximize the surface area between mother and fetus

Echogram - used to detect the position and anatomy of the fetus.

Codominance

When both phenotypes are present

Roan Cow → genotype BW = phenotypes = brown and white

Eminette Chicken → genotype BW = phenotypes, black and white

Cross an white chicken with a black chicken

	B	B
W	BW	BW
W	BW	BW

1. Put the genotypes in the right place
2. Cross the two parents

Blood Type

There are more than two alleles (multiple)

Phenotypes	Genotypes	Allels on ABC surface	Can donate blood to	can receive blood from
A	$I^A, I^A I^A$	A	A, AB	A, O
B	$I^B, I^B I^B$	B	B, AB	B, O
AB	$I^A I^B$	AB	AB	B, O
O	ii	O	A, B, AB, O	O

Polygenic traits produced by multiple genes

Sex-linked Traits

Normal trait is usually dominant and sex linked trait is recessive.

Genotypes

$X^N X^N$ - dominant non carrier

$X^N X^n$ - carrier

$X^n X^n$ - has trait

$X^N Y$ - non carrier

$X^n Y$ - has trait

Women

Man

Cystic Fibrosis

Most common disease for white people

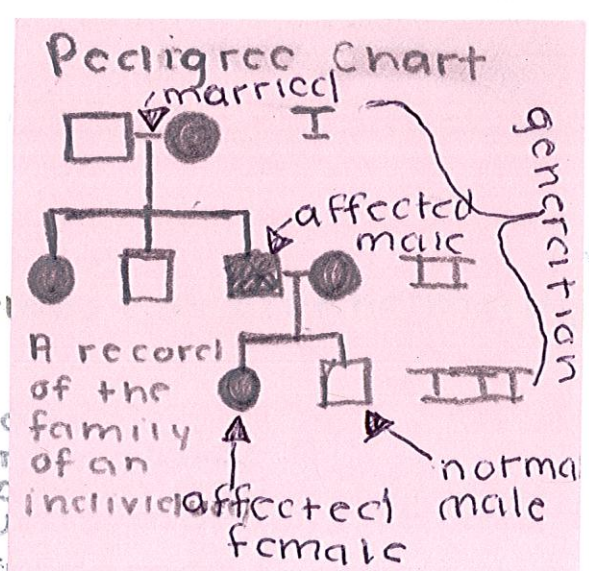
Caused by an abnormal gene on chromosome 7

In healthy individuals mucus is swept away. But diseased individuals

Infections

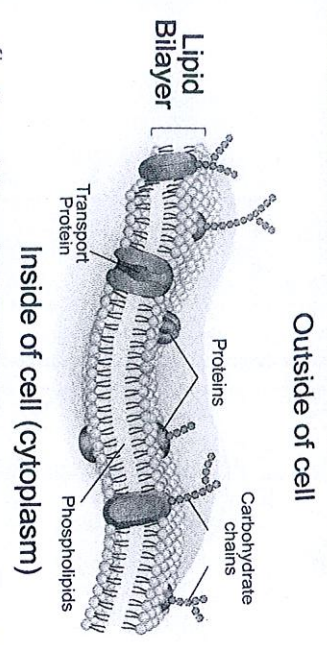
- block digestive enzymes
- malnutrition
- salty sweat

Autosomal dominant



- physical respiration
- breathing exercise
- antipodies
- lung transplant
- capsules containing pancreatic digestive enzymes

Structure of the Cell Membrane



- Cells Membranes work towards homeostasis by controlling what goes in and out.
- Phospholipid Bilayer → a flexible barrier that makes up cell membrane.
- Carbohydrates and proteins are embedded in lipids.
- Small particles pass easily through lipids. Large particles use transport proteins.
- Equilibrium - particles are evenly distributed, but they're still moving!
- Concentration Gradient - difference between concentrations in a space.

Transport

Passive (w/out energy)

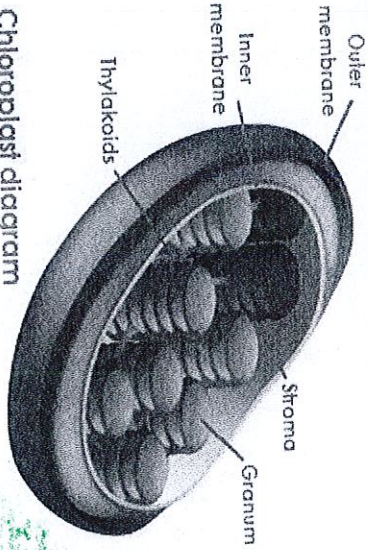
Active (with energy) **ATP**

- Diffusion
- Osmosis
- Facilitated Diffusion

- Protein Pumps
- Endocytosis
- Exocytosis

10/7/14

Chloroplast diagram

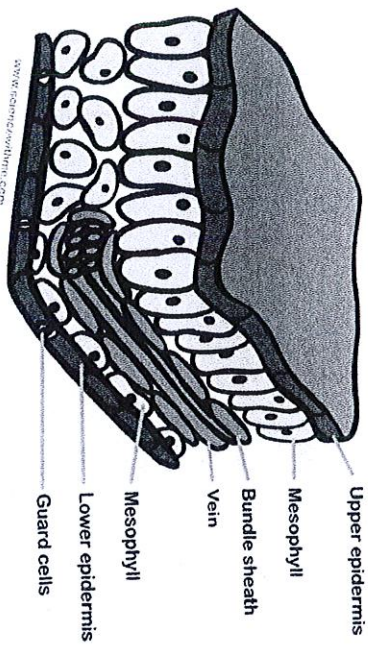


- A process used by autotrophs to convert light energy from sun into chemical energy - or FOOD!
- The purpose is to create oxygen for mammals and glucose that eventually feeds heterotrophs.



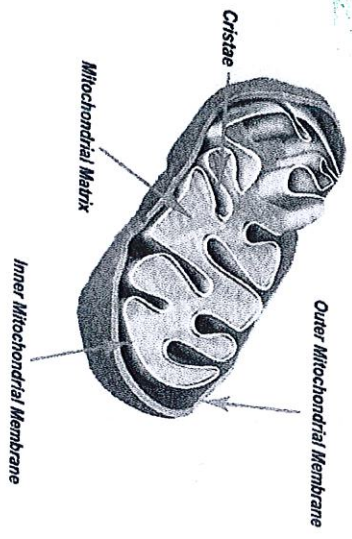
Sunlight enters through upper epidermis. Water enters through the xylem, sugar goes down with the phloem.

CROSS SECTION OF A LEAF



CO₂ enters through guard cells. O₂ and water leave through guard cells.

The Mitochondrion



- The process in which energy is produced through the breakdown of glucose.
- The purpose is to create energy that all things need to survive.

Respiration

Aerobic (w/ oxygen)

Anaerobic (w/out oxygen)

Glycolysis breaks down glucose into pyruvate

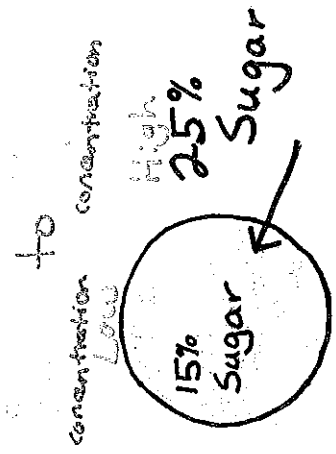
Pyruvate travels to mitochondria and made into ATP.

Pyruvate stays in cytoplasm and does one of two things.

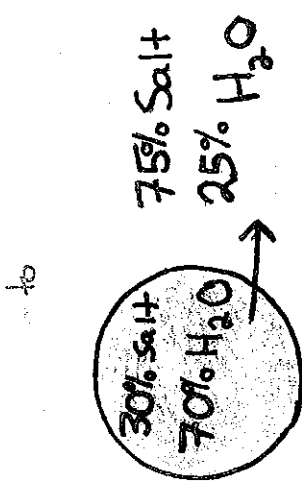
- Alcoholic Fermentation** (in bacteria and yeast) → produces 2 ATP
- Lactic Acid Fermentation** (muscle cells and bacteria)

FACTORS AFFECTING PHOTOSYNTHESIS

Diffusion: ^(no energy needed)
 Moves molecules from



Osmosis: (no energy needed)
 Moves water from

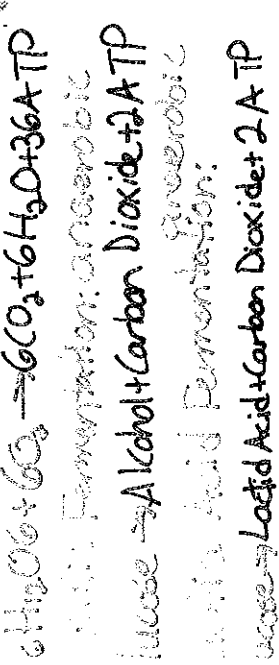


Turgor Pressure: ^{in plants}
 Facilitated Diffusion:

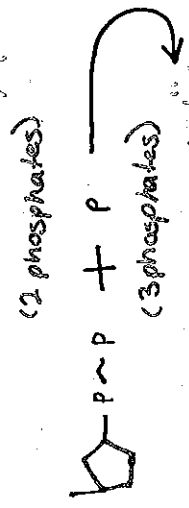
Active Transport:

	Diffusion	Osmosis	Facilitated Diffusion	Active Transport
Moves Molecules	Yes	Yes	Yes	Yes
Moves Water	No	Yes	Yes	No
Needs Energy	No	No	No	Yes

Products
 Respiration: Aerobic

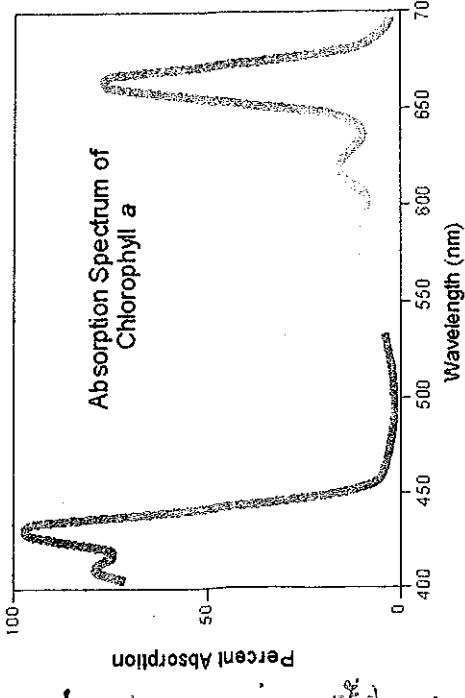
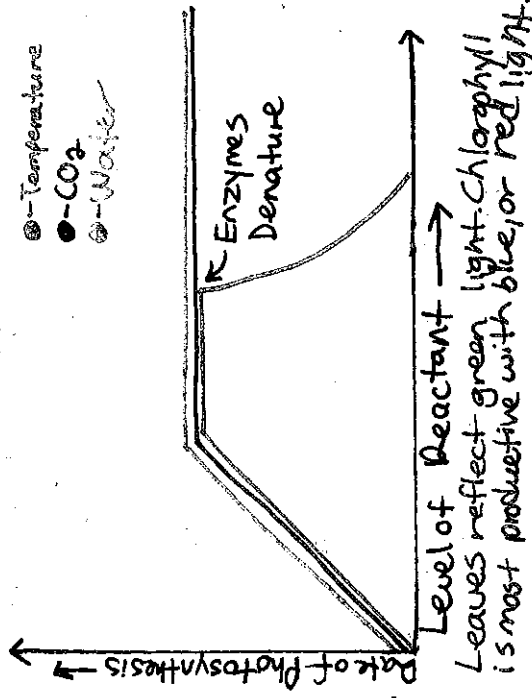
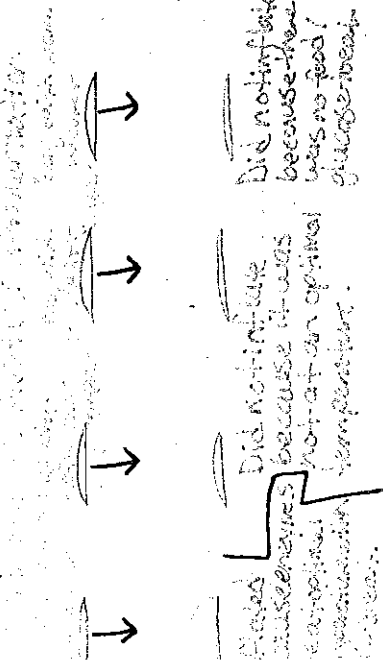


Energy:



Third phosphate is used, and it turns back into an ADP. It can be recharged into an ATP.

Photosynthesis	Respiration
H_2O are reactants CO_2 are products Used in all living organisms Chloroplast	CO_2 are products Glucose are reactants Used in all living organisms In mitochondria or cytoplasm Creates energy



Protein Synthesis

Natalia Luengas
3rd Block

→ Rosalind Franklin:

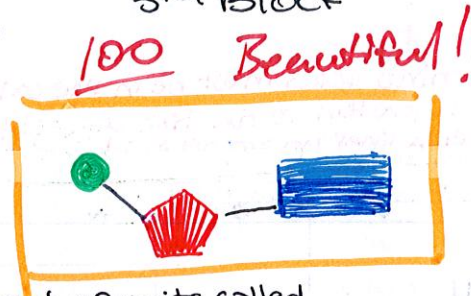
- accepts a job at King's College to work in Maurice Wilkins Lab.
- She is perfecting a technique called x-ray crystallography.
- This lays the groundwork for figuring out the DNA.
- She is given little credit for this accomplishment.
- Watson & Crick came up w/ the structure of DNA, they stole Franklins' work (took all the credit)



DNA: Deoxyribose Nucleic Acid

- The chemical substance is present in the nucleus of all cells in all living organisms.
- DNA controls all the chemical changes which take place in cells.
- The kind of cell which is formed, (muscle, blood, nerve, etc.) is controlled by DNA.
- The kind of organisms which is produced (buttercup, giraffe, herring, human, etc.) is controlled by DNA.

- DNA is composed of units called **Nucleotides**, which are composed of 3 sub-molecules:
1. Pentose sugar (deoxyribose)
 2. Phosphate
 3. Nitrogen base (purine or pyrimidine)



the bases

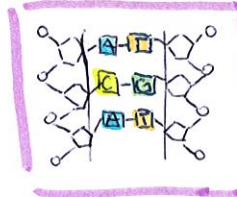
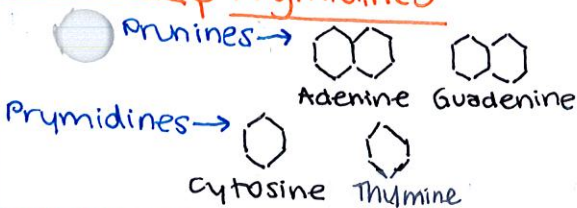
The most common organic bases are

- Adenine (A)
- Thymine (T)
- Cytosine (C)
- Guanine (G)

RIBOSE & DEOXYRIBOSE

- Ribose → RNA
 - Deoxyribose → DNA
- Both represented by **phosphate**.

Purines & Pyrimidines



DNA is composed of two complementary strands of nucleotides joined by hydrogen bonds:

- Adenine w/ Thymine (A-T or T-A) They join w/ 2 hydrogen bonds
- Cytosine w/ Guanine (C-G or G-C) They join w/ 3 hydrogen bonds

DNA twists into a double helix.

FUNCTIONS OF DNA

1. DNA directs the machinery of cell to make specific proteins & therefore, DNA indirectly controls all of the functioning of all living things.
2. DNA stores the hereditary info. of an individual
3. DNA has the ability to mutate (change). This allows for new characteristics & abilities to appear which may help an individual to survive & reproduce (EVOLUTION)
4. Self replication: DNA has the ability to make copies of itself

DNA Replication

DNA replication is called semi-conservative: part of the original strand is conserved in the daughter cells.

2 Steps to Protein Synthesis

Transcription: is the process by which a part of a DNA strand is used to make a strand of RNA, which contains the code for protein synthesis (script for the protein)

Translation: is using that code to actually make the protein (making the protein)



CODONS - coding triplet of mRNA bases.

GENE - a segment of DNA that brings about transcription of a segment of RNA.

Replication:

- Before a cell divides, the DNA strands unwind & separate
- Each strand makes a new partner by adding the appropriate nucleotides
- The result is that there are now 2 double-stranded DNA molecules in the molecules.
- so that when the cell divides, each nucleus contains identical DNA.
- This process is called **replication**.

Steps

1. Helicase unzips DNA
2. Primas & Polymerase match up the base pair
3. Form the new sugar back-bone, done by polymeras.
4. Ligase seals it & polymeras proof reads it.

Transcription

DNA → **Transcription** → **mRNA** - (messenger RNA) type of RNA that encodes info. for synthesis of proteins & carries it to a ribosome from the nucleus.

RNA → **Translation** → **Protein**

Reading the DNA code

- Every 3 DNA bases pairs w/ 3 mRNA bases - these are called **codons**.
- Every group of 3 mRNA bases encodes a single amino acid.

Translation

RIBOSOMES

- 2 subunits, separate in cytoplasm until they join to begin translation
- Large • Small
- contain 3 binding sites.

Functions

- Amino acids must be in the correct order for the protein to function correctly.
- tRNA lines up amino acids using mRNA code.

tRNA (Transfer RNA)

- Bound to one end
- Anticodon on the other end complements mRNA codon - the specific match to specific codons in the mRNA.



Transcription | Translation

- | | |
|---|--|
| <ul style="list-style-type: none"> • Process by which genetic info. encoded in DNA is copied onto mRNA. • Occurs in the nucleus • DNA → mRNA | <ul style="list-style-type: none"> • Process by which info. encoded in mRNA is used to assemble a protein at a ribosome • Occurs on a ribosome • mRNA → Protein |
|---|--|

First Letter	Second Letter				Third Letter
	U	C	A	G	
U	phenylalanine	serine	tyrosine	cysteine	U
	phenylalanine	serine	tyrosine	cysteine	C
	leucine	serine	stop	stop	A
	leucine	serine	stop	tryptophan	G
C	leucine	proline	histidine	arginine	U
	leucine	proline	histidine	arginine	C
	leucine	proline	glutamine	arginine	A
	leucine	proline	glutamine	arginine	G
A	isoleucine	threonine	asparagine	serine	U
	isoleucine	threonine	asparagine	serine	C
	isoleucine	threonine	lysine	arginine	A
	(start) methionine	threonine	lysine	arginine	G
G	valine	alanine	aspartate	glycine	U
	valine	alanine	aspartate	glycine	C
	valine	alanine	glutamate	glycine	A
	valine	alanine	glutamate	glycine	G

Mutations = ERRORS

1. Mutations can occur naturally or through environmental factors. Environmental mutagens include some chemicals (food additives, pesticides, plastics) & radiations (x-rays to UV light)

2. A gene mutation is a change of one or more nucleotides in a single gene (a change in DNA). There are 3 types:

- Insertion
- Deletion
- Substitution.

GENE MUTATION

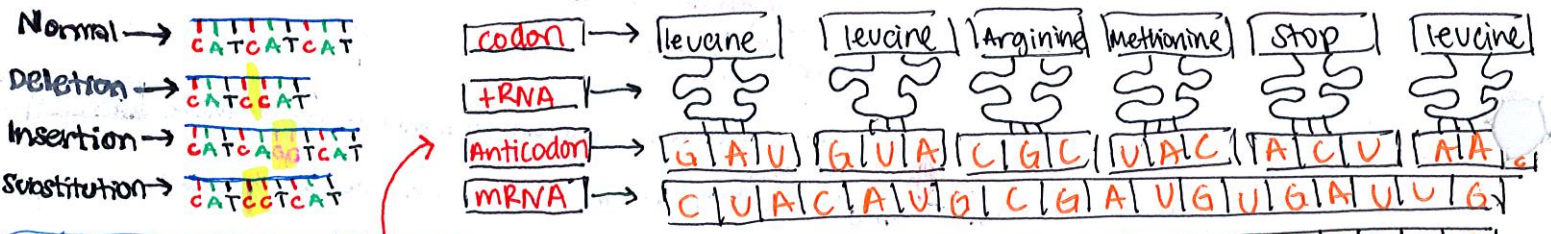
Deletion: one nucleotide base is left out. All of the amino acids after a deletion will be wrong, so SHAPE & FUNCTION of protein are altered. **Serious.**

Insertion: one extra nucleotide base is added. This will also change the entire amino acid sequence of the protein, so SHAPE & FUNCTION of protein are altered. **Serious.**

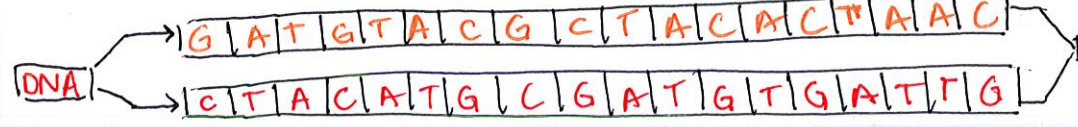
Substitution: when single bases or short pieces are replaced w/ one another.

EX: Sickle-cell Anemia, only one nucleotide base is switched. This causes only 1 amino acid to change, but it is an important one

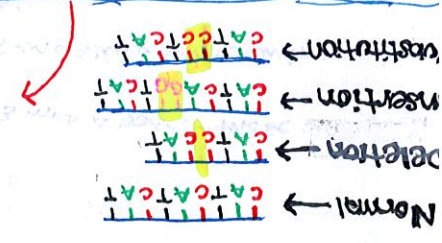
This type of mutation is usually **not as serious** as the 1st two. It just depends on which amino acid is affected.



PROTEIN SYNTHESIS



PROTEIN SYNTHESIS



deletion: one nucleotide base is left out. All of the amino acids after a deletion will be wrong, so SHAPE & FUNCTION of protein are altered. **Serious.**

insertion: one extra nucleotide base is added. This will also change the entire amino acid sequence of the protein, so SHAPE & FUNCTION of protein are altered. **Serious.**

substitution: when single bases or short pieces are replaced w/ one another. EX: sickle-cell anemia, only one nucleotide base is switched. This causes only 1 amino acid to change, but it is an important one which type of mutation is usually **not as serious** as the 1st two. It just depends on which amino acid is affected.

GENE MUTATION

First letter	Second letter	Third letter	Amino acid
U	U	U	phenylalanine
U	C	U	methionine
U	A	U	isoleucine
U	G	U	isoleucine
U	U	C	isoleucine
U	U	A	isoleucine
U	U	G	isoleucine
U	U	U	isoleucine
U	C	A	isoleucine
U	C	G	isoleucine
U	C	U	isoleucine
U	C	A	isoleucine
U	C	G	isoleucine
U	C	U	isoleucine
U	A	U	isoleucine
U	A	C	isoleucine
U	A	A	isoleucine
U	A	G	isoleucine
U	A	U	isoleucine
U	G	U	isoleucine
U	G	C	isoleucine
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U	U	C	isoleucine
U	U	A	isoleucine
U	U	G	isoleucine
U	U	U	isoleucine
G	U	U	valine
G	U	C	valine
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Protein Synthesis

Natalia Lengas
3rd Block
100
Beautiful!

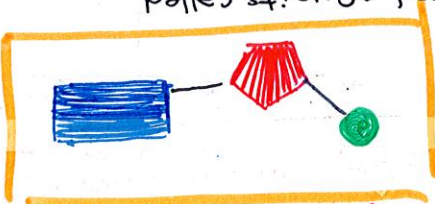
Blind Franklin: accepts a job at King's college to work in Maurice Wilkins lab. she is perfecting a technique called x-ray crystallography. This lays the groundwork for figuring out the DNA. She is given little credit for this accomplishment. Watson & Crick came up w/ the structure of DNA, they stole Franklin's work (took all the credit).

DNA: Deoxyribose Nucleic Acid

The chemical substance is present in the nucleus of all cells in all living organisms. DNA controls all the chemical changes which take place in cells. The kind of cell which is formed, (muscle, blood, nerve, etc.) is controlled by DNA. The kind of organisms which is produced (buttercup, giraffe, merrin, human, etc.) is controlled by DNA.

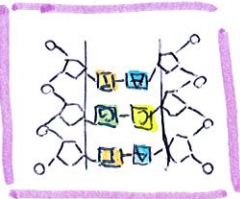
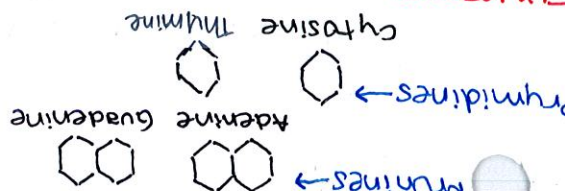


- DNA is composed of units called **nucleotides**, which are composed of 3 sub-molecules:
 1. Pentose sugar (deoxyribose)
 2. phosphate
 3. Nitrogen base (purine or pyrimidine)



RIBOSE & DEOXYRIBOSE
 Ribose → RNA
 Deoxyribose → DNA
 Both represented by phosphate.

Purines & Pyrimidines



DNA is composed of two complementary strands of nucleotides joined by hydrogen bonds. Adenine w/ Thymine (A-T or T-A) they join w/ 2 hydrogen bonds; Cytosine w/ Guanine (C-G or G-C) they join w/ 3 hydrogen bonds. DNA twists into a double helix.

The most common organic bases are:
 • Adenine (A) Thymine (T)
 • Cytosine (C) Guanine (G)

FUNCTIONS OF DNA

- DNA directs the machinery of cell to make specific proteins & therefore, DNA identity controls all of the functioning of all living things.
- DNA stores the hereditary info. of an individual.
- DNA has the ability to mutate (change). This allows for new characteristics & abilities to appear which may help an individual to survive & reproduce (evolution).
- Self replication: DNA has the ability to make copies of itself.



DNA Replication

DNA replication is called semi-conservative: part of the original strand is conserved in the daughter cells.

Steps to Protein Synthesis

Transcription: is the process by which a part of a DNA strand is used to make a strand of RNA, which contains the code for protein synthesis (script for the protein).

Translation: is using that code to actually make the protein (making the protein).
 - coding triplet of mRNA bases.
 - a segment of DNA that brings about transcription of a segment of RNA.



Transcription
 DNA → RNA → Protein

mRNA - (messenger RNA) type of RNA that encodes info. for synthesis of proteins & carries it to a ribosome from the nucleus.

- Steps**
1. Helicase unzips DNA
 2. Primas & polymerase match up the base pair
 3. Form the new sugar back-bone, done by polymerases.
 4. Ligase seals it & polymerase proof reads it.

Before a cell divides, the DNA strands unwind & separate. Each strand makes a new partner by adding the appropriate nucleotides. The results is that there are now 2 double-stranded DNA molecules in the molecules. So that when the cell divides, each nucleus contains identical DNA. This process is called **replication**.

Replication

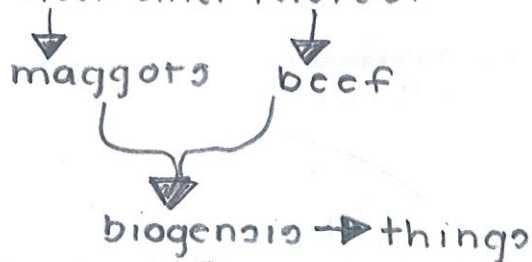
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Evolution



Spontaneous Generation

- Life comes from nonliving matter
- Theory of abiogenesis (abio = nonliving)
- Disapproved by Redi and Pasteur



Antibodies
 - diseases being antibiotic resistance is an example of natural selection
 - antibodies are natural substances secreted by bacteria and fungi to kill other bacteria competing for nutrients

Origin of Life

- the early earth was not livable
- hot and no oxygen in the atmosphere
- Earth's early atmosphere was made up of methane, ammonia, hydrogen chloride, carbon dioxide, carbon monoxide, nitrogen, water. These gases reacted with lightning to produce small organic molecules.

Miller and Urey

In the 1950's Miller and Urey filled a flask with hydrogen, methane, ammonia and water and then added an electric current. This created organic molecules, proving that life can be made from simple organisms.

Origin of Cells

first cells heterotrophic prokaryotes (evolved the ability to do photosynthesis, → released oxygen into the air)
 eukaryotic cells probably arose through a symbiotic relationship between mitochondria and chloroplast
 this theory is known as endosymbiotic

Charles Darwin

Theory of natural selection

used to be prokaryotes

4 major requirements for evolution

Overproduction - organisms produce more offspring than can survive.

Competition - offsprings compete resources

Variation - organisms show variation and sometimes heritable

Survival - the offsprings that can reproduce and pass on their adaptation.

Types of natural selection

Natural selection is the theory that organisms with favorable traits are most likely to survive.

Adaptation is a beneficial trait that enables an organism to survive.

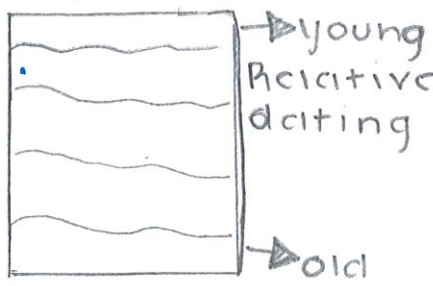
Stabilizing selection - the extremes are selected against

Directional selection - one extreme is selected

Disruptive selection - the extremes are both selected

Evidence of Evolution

Fossil evidence - fossils show that life went from simple to complex, moved from water to land.



Comparative anatomy - comparing body features between organisms looking for evolutionary similarities. (homologous structures - similar structures but different functions)

Comparative biochemistry - comparing DNA and amino acids and DNA sequences

Comparative embryology - looking for similarities during the early stages of life

Mechanism of Evolution

Speciation - the evolutionary process by which new species are caused by

Geographic isolation - population is divided into 2 or smaller populations

Reproduction - a large population split may result in a new species if there is no gene flow

Mutations - the genetics of each population change until they are no longer able to interbreed.

Classification

The arrangement of organisms into orderly groups based on similarities (taxonomy)

Aristotle - first taxonomist, divided them into plants and animals subdivided them by habitats

taxonomist - scientist name organisms

Classification hierarchy process

Carolus Linnaeus - classified organisms by their structure, binomial nomenclature

Dichotomous Key

Look and read the questions

Vocabulary

Fitness - the ability of an organism to survive and reproduce

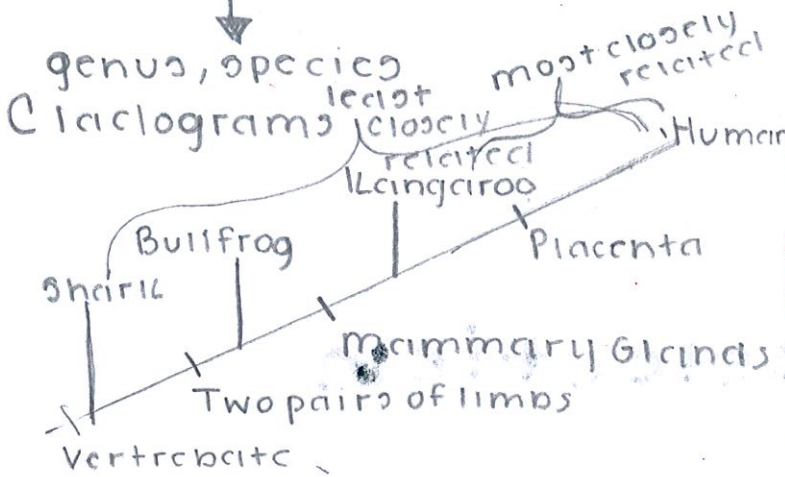
Dumbing - Evolution - the theory that species change over time

Phillip - Vestigial - have no function in present day but useful for ancestor

Over - **For** - **F**

Good - **g** - genus

Soup - **s** - species



Polygenic Tree - diagram showing how organisms are related based on DNA and fossil evidence.