

AS Related Topics

Dr. Nihal Gabr

Double membrane bound organelles

Nucleus
Mitochondrion
Chloroplast
Amyloplast

Single membrane bound organelles

Large vacuole
Golgi body
Vesicle
Lysosomes
Endoplasmic reticulum

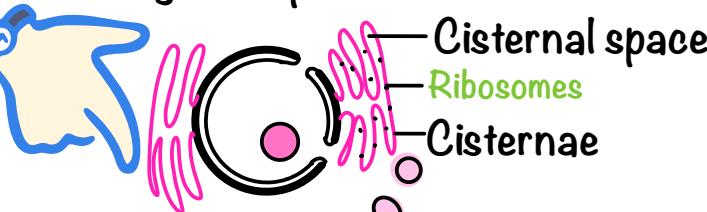
Non membrane bound organelles

Ribosomes
Centrioles
Nucleolus

I. Endoplasmic reticulum

Single membrane bound organelle
Called cisternae
Membrane connected

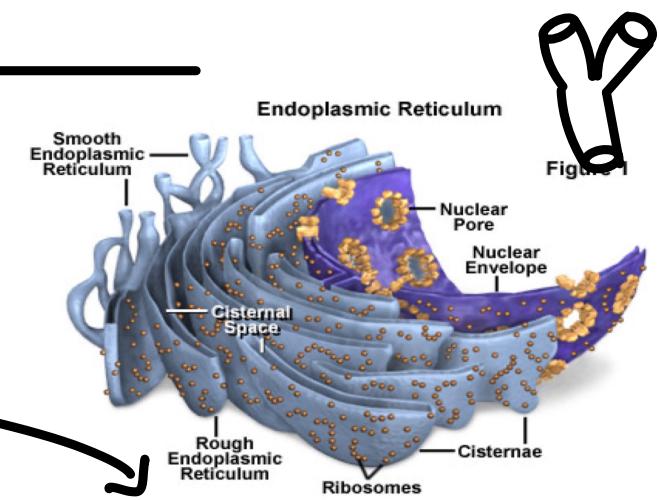
Rough endoplasmic reticulum



Structure : flattened sacs called Cisternae

Ribosomes attached to the RER (rough endoplasmic reticulum)

Function : ribosomes where proteins synthesis takes place (translation), polypeptide enter cisternal space of RER ...to allow modification and packed into a vesicle to be transported to the Golgi body

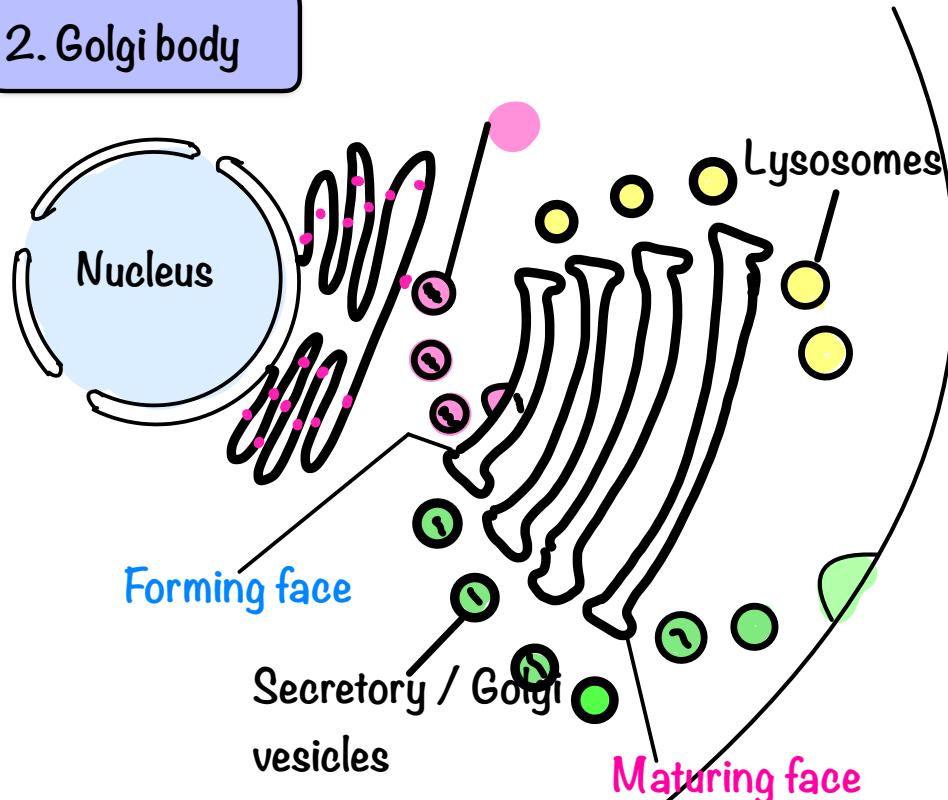


Smooth endoplasmic reticulum



Tubular sacs with no ribosomes attached ...synthesis of lipid and steroid hormones
Such as testosterone / oestrogen

2. Golgi body

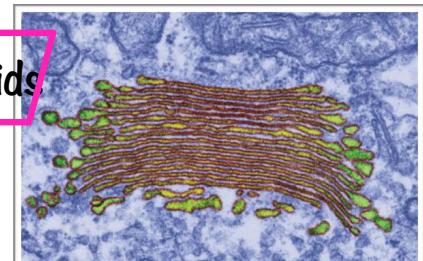


Golgi body
Both are single membrane bound organelle

Interconnected sacs

No connection between
membrane (stacks of sacs)

+ Process and pack the lipids



Ex:
3
pr
EM showing a Golgi body.
A central stack of saucer shaped sacs can be seen budding off small Golgi vesicles(green).
These can form secretory vesicles whose contents can be released at the cell surface by exocytosis.

Prokaryotes

Non membrane bound organelles

70 S ribosomes

Cell wall made from peptidoglycan/ murein

Plasmids

Mesosomes

Pili

Circular DNA (naked with no histone proteins)not enclosed inside a nucleus

Eukaryotes

Membrane bound organelles

Double : nucleus , mitochondrion, chloroplast and amyloplast .

Single : RER, SER, Golgi body , vacuoles, vesicles, lysosomes .

Non membrane bound organelle : ribosomes , centrioles , nucleolus .

Both 80 S and 70 S ribosomes

Animal X

Plant (cellulose)

Fungi (chitin)

X

Linear DNA(associated with histone proteins and enclosed inside a nucleus)

Cell cycle

- A) interphase ...non dividing phaseincrease number of organelles / DNA replication / checking for errors
- B) mitosis...nuclear division ...equally distribute the genetic material between two cells
- C) cytokinesiscytoplasm division....2 genetically identical daughter cells (diploid).

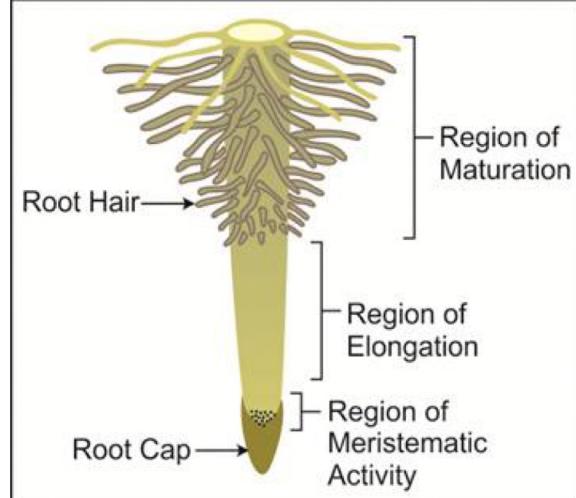
How to observe mitosis in a dividing cells

Get sample / tissue

1. Plant ...use HCL to soften / macerate the tissue
2. Add dye like acetic orcin ...highlight chromosomes.
3. Heat to intensify the stain
4. Place in a slide add cover slip and squash to separate the cells allowing easier view
5. Count number of cells in mitosis under a microscope.

How to prepare a root tip to observe a chromosome

1. Cut the last 5mm of the root (meristematic tissue).
2. Place HCLseparate cells / macerate tissues (soften)
3. Add acetic orcin / toluene bluehigh light the chromosomes.
4. Heat to intensify the stain
5. Place the root tip on microscope slideteasing (using a needle to separate the cells) And squashing the cells underneath the cover slip to separate the cells allowing easier view .
6. Counting number of cells in mitosis , count total number of cells to calculate mitotic index.



Once the cell leaves interphase and enters mitosis, the chromosomes can be seen. You can use this when counting cells to work out the mitotic index.

$$\text{Mitotic index} = \frac{\text{Cells in mitosis}}{\text{Total number of cells}} \times 100$$

Mitotic index ..how active cell are in a dividing tissue

It shows the ratio between the cells in mitosis & the total-number of cells

Use to identify active cells (cancerous cells) so it can measure effectiveness of cancer treatment if it is working so mitotic index should decrease

Why produce gametes by meiosis

Sexual reproduction

To reduce the number of chromosomes from diploid to haploid

Producing cells with one set of chromosomes (haploid)

So upon fertilisation we restore the diploid without doubling in each generation

Allow variation

Mitosis

Involves one division

Gives 2 daughter cells

Genetically identical

No variation

Produce diploid cells

No crossing over

No independent assortment

Meiosis

Involves 2 divisions

Gives 4 daughter cells

Genetically different

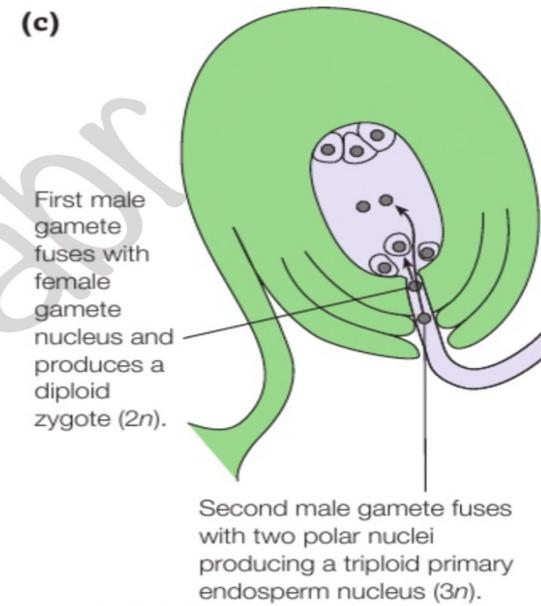
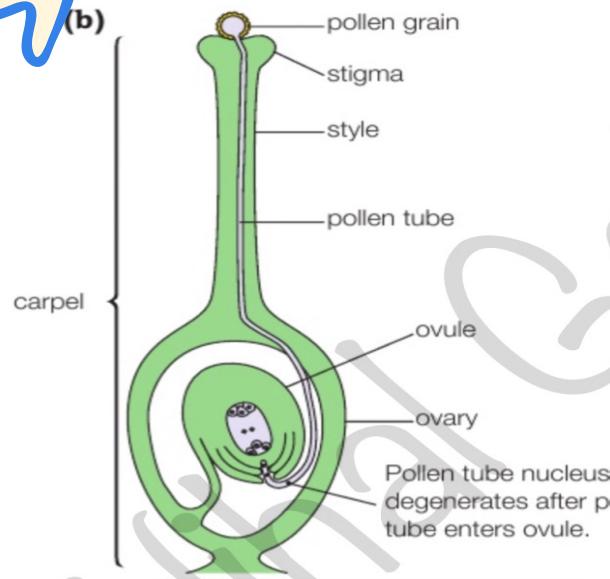
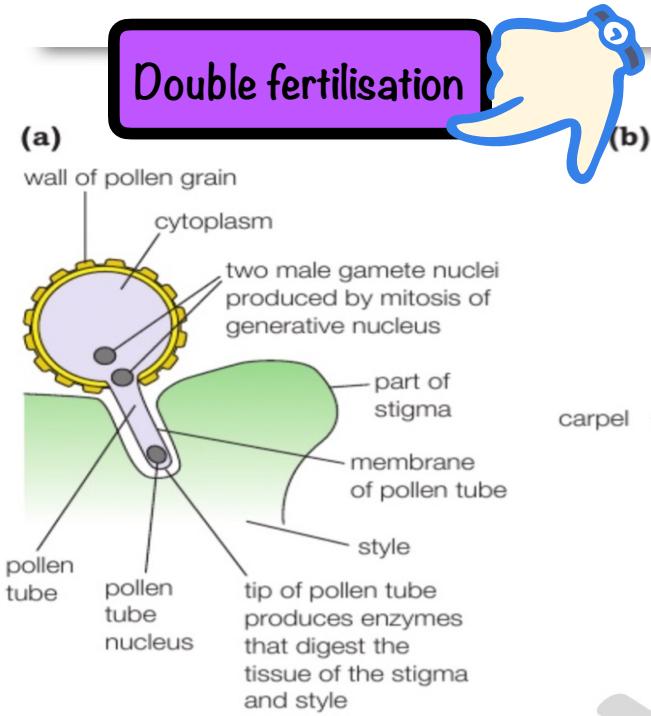
Variation

Cells with haploid number of chromosomes.

Crossing over

Independent assortment

Double fertilisation



1. Growth of pollen tube:

- Pollen tube begins to grow out

Growth of the pollen tube:

1. Pollen grain land on the stigma

2. Pollen tube will begin to grow through style ...where tip of the pollen tube release hydrolytic enzymes to digest the tissue ...to be used as a source of nutrients .

3. Generative nucleus transported by pollen tube to ovary / micropyle
Generative nucleus divide by mitosis to produce 2 haploid nuclei

2. Pollen tube will move down through style and pass through micropyle of ovule

3. Fertilisation:

- Once the tube has entered the micropyle the 2 male

3. Fertilisation

A). Male gamete (haploid) fuse with female gamete / female nucleus / egg cell forming zygote .

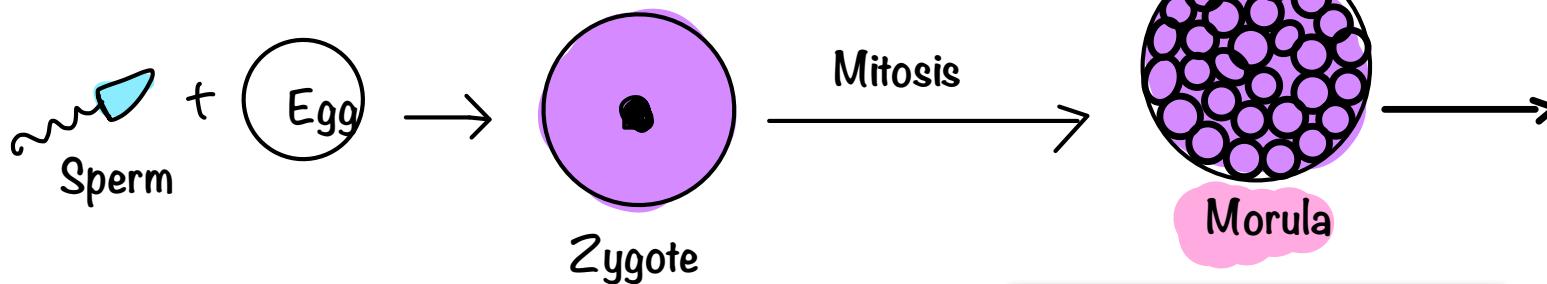
B) other male gamete (haploid) fuse with 2 polar nuclei forming endosperm ... (triploid)

Stem cell

Undifferentiated cells

They have the ability to divide many many times by mitosis

And then become specialised



True totipotent cell
Undifferentiated cells
that can form any type
of cells needed by an
entire new organism
including placenta

An Early stage of embryo
consisting of 16 cells
(blastomeres) ...totipotent
cells

Embryoplac

Pluripotent
Source of
embryonic stem
cells

Trophoblast

Give rise to the
placenta and fetal
membrane

Blastocyst

Embryoblast are
Pluripotent :
undifferentiated cells
that can give rise to
any cell except
PLACENTA AND
FETAL MEMBRANE

Stem cells

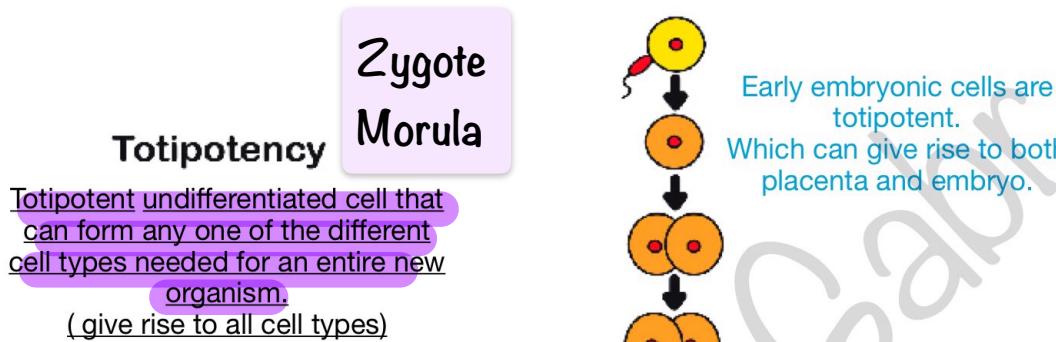
A) totipotent

B) pluripotent : cells that can divide , they are undifferentiated cell
that undergo specialistaion and differentiation ...giving rise to
most of cell types except extra embryonic tissues .

C) multipotent

Read

Embryonic stem cells



Early embryonic cells are totipotent. Which can give rise to both placenta and embryo.

Blastocyst

The **Blastocyst** stage follows the morula. A callout box labeled **Pluripotency** defines it as: "Pluripotent undifferentiated cell that can form most of the different cell types (give rise to many cells) needed for an entire new organism except for extraembryonic tissues".

Blastocyst stage, prior to implantation of the embryo in the mother's uterus lining. Where the inner cells of this ball are pluripotent, that develop into fetal tissue.

ESC

Mesoderm

Endoderm



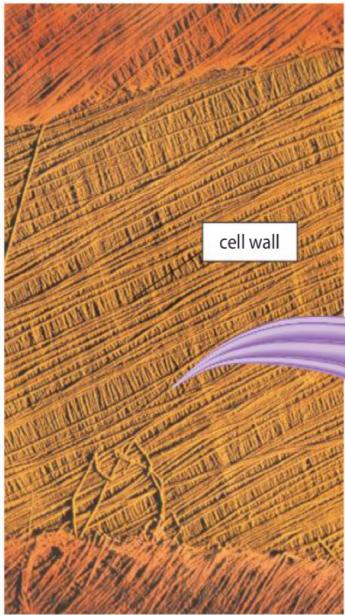
Adult stem cells

Multipotency is a cell that can form a very limited range of differentiated cells within a mature organism.

Somatic Cell

Somatic stem cells (adult stem cells) are undifferentiated cells found among the normal differentiated cells in a tissue or organ that can differentiate when needed to produce any one of the major cell types found in a particular tissue or organ.

By around three months of pregnancy, the cells have become sufficiently specialised, that when they divide they form only one more of the same type of cell.



cell wall

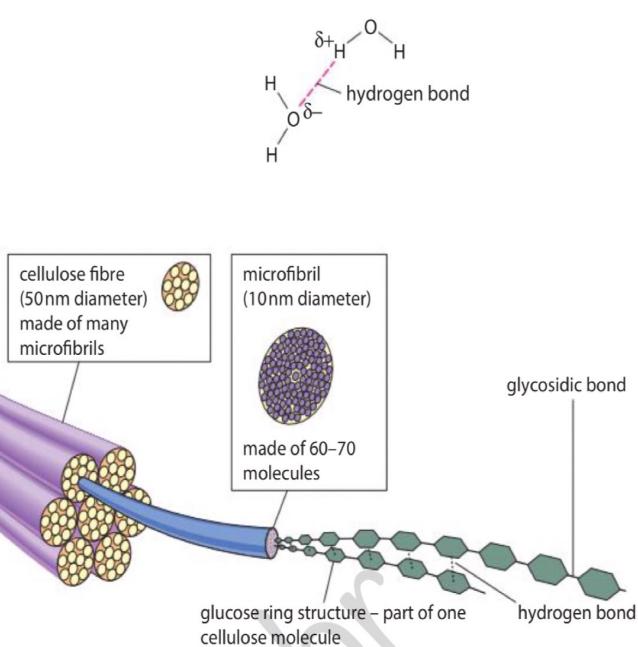
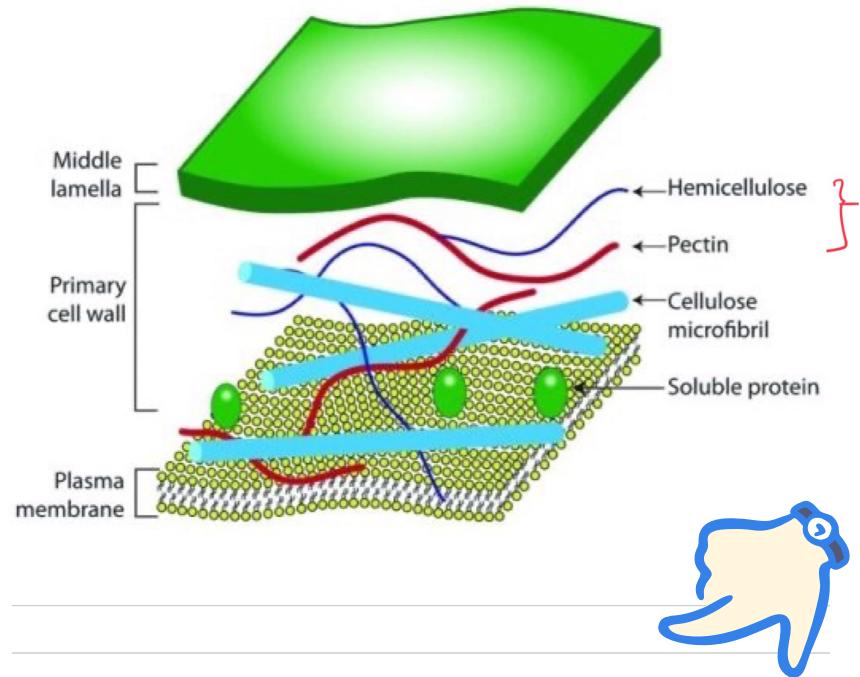


Figure 2.10 Structure of cellulose.



1. Cellulose molecule is a polysaccharide with monomer beta glucose , which are attached by 1, 4 glycosidic bondwhere each monomer is found rotated at 180 relative to the otherforming a flat ribbonwhich is unbranched , straight chain allowing cellulose molecules to lie // to each other .

2. So cellulose molecules are joined together by intermolecular hydrogen bonds .

3. This is called cross linkage and it hold the neighboring chains firmly giving // chains .

4.

A) making layers / sheets of microfibrils

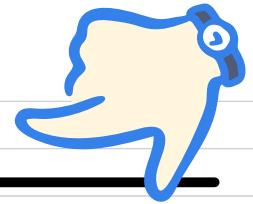
B) microfibrils criss cross together being arranged in different directions (a mesh)

5. Forming fibresincrease tensile strength (unstretchable) , prevent cell wall from bursting and help with stand turgor pressure .

6. Cellulose microfibrils are embedded in a matrix / to be held together by pectin (and hemicellulose) ...which prevent cellulose microfibrils from sliding over each other .

Starch

Cellulose



Both are poly saccharides

Both have glucose monomer

Both have glycosidic bond

Both are formed by condensation reaction

Alpha glucose monomer

All monomers are upright (same orientation)

1, 4 and 1, 6 glycosidic bond

Mixture of 2 polysaccharides

Amylose (spiral and unbranched)

Amylopectin branched .

Compact molecule useful for storage

(metabolic function)

Beta glucose monomer

Each monomer is found at 180 to the other

Only 1, 4 glycosidic bond

Only one polysaccharide

Lie // to each other to form microfibrils

having structural function

1A.5. Proteins

7 There is evidence for a causal relationship between blood cholesterol levels and cardiovascular disease (CVD).

(b) Lipoproteins are composed of phospholipids, cholesterol and proteins.

Direct
Important

(i) Proteins are made up of amino acids.

Describe how amino acids join together to form the three-dimensional structure of a protein.



(4)

In the primary structure ,

Which involves the linear sequence of amino acids joined by peptide bonds (between carboxyl group of one amino acid and amine group of another amino acid)

Which is formed by condensation reaction , involves the removal of water

Secondary structure

Folding of the polypeptide forming secondary structure , forming beta pleated sheets (flat sheets) and alpha helix , held by hydrogen bond (between o of the carbonyl group pf one amino acid and the H of amine group of another amino acid) , with no R groups involved

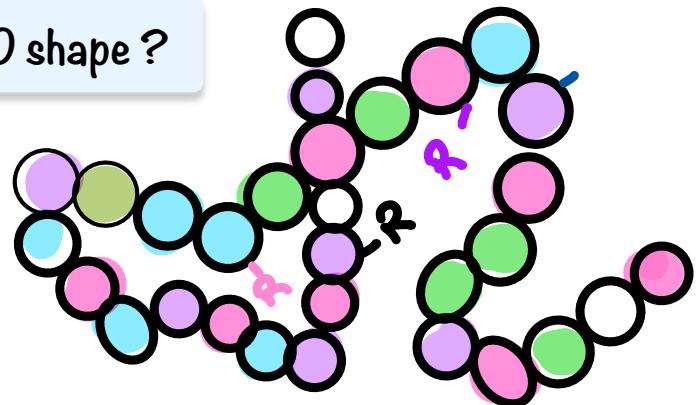
Tertiary structure

Over all folding and coiling of polypeptide chain into a specific 3D shape to form tertiary structure

Which is maintained by R group interaction and bonding such as hydrogen bonds between polar R groups . Ionic bond between ionised R groups , and disulfide bonds between cysteine amino acids

Explain how the primary structure of a protein molecule determines its 3D shape ?

<https://youtu.be/hok2hyED9go>



1. The primary structure of the polypeptide involves the linear sequence of amino acids in the chain
2. Where the amino acids are joined together by peptide bond between Carboxyl group of one amino acid and amine group of another amino acid
3. This determine the arrangement and type of R groups of amino acids
4. Inturn determine the type pf bonds and interactions formed between R groups

Examples ; as hydrogen bonds between polar R groups , ionic bond between ionised R groups

5. These bonds hold / determine the the overall folding and coiling of the poly peptide chain into Tertiary structurewith a specific shape of active site

X Enzymes/ any water soluble protein

- 6.more over , the hydrophilic R groups facing outside and non polar hydrophobic R groups facing inside ... forming GLOBular proteins which are soluble proteins having relatively large number of amino acid with polar R groups with tertiary structure .

B

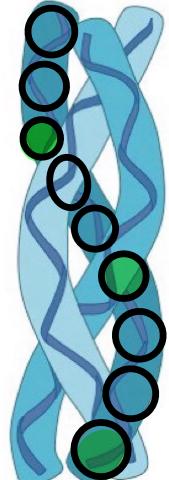
Fibrous protein

Polypeptides lying // to each other

Long strands (has large number of amino acids) with many repeated sequence of amino acids

Structural function

Water insolubleR groups of amino acids facing outside are non polar hydrophobic



Fibrous Protein

Fibrous protein

Globular protein

Both are proteins (polymers)

Monomer is amino acids attached by peptide bond

Long // polypeptide chains with large number of amino acids

Water insoluble with hydrophobic R groups facing outside

Structural function

Less sensitive to changes in pH and temperature

As it has no tertiary structure maintained by bonding between R groups

Spherical / ball shaped with tertiary structure

Water soluble with high number of polar R groups facing outside .

Metabolic function

More sensitive to changes in pH and temperature

Structure of collagen

1. Polypeptide helix ..which is long strand with many amino acids and glycine amino acid found repeated at every third position
2. Three polypeptides (triple helix) attached together by many hydrogen bonds ...between the polypeptides forming collagen molecule.
3. Then collagen molecules lie // to each other and cross linked with covalent bonds (between R groups of amino acids) formingfibrils
4. Many fibrile form fibres giving the high tensile strength .

Staggered ends ...suggest
To avoid any weak points

Correlation

A strong tendency for two sets of data to change together (indirect)

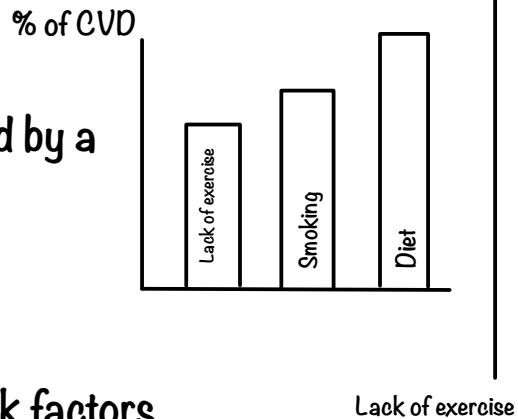
A change in one variable is accompanied by a change in another variable

Proven by statistical analysis.

Example:

Smoking / lack of exercise these are risk factors for CVD

Yet there is no prove that one is a cause of the other



High fat intake Correlation CVD

High blood pressure +

high blood cholesterol level Cause Atheroma Cause Narrowing Cause Increase in blood pressure

Causation

When one factor directly causes a specific effect

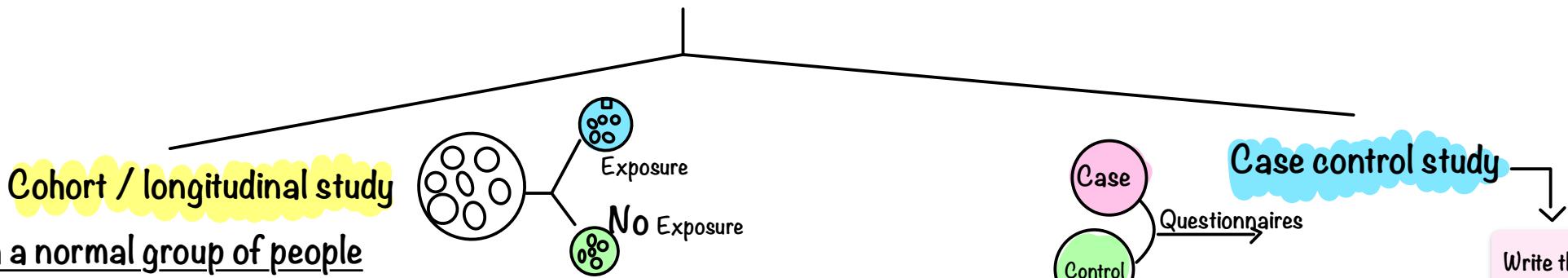
Change in one variable directly results in a change of another variable

Proved by lab test

Increase in blood cholesterol level causes an increased risk of atherosclerosis.

Studies carried to show the correlation between a risk factor and a disease

1. Based on large sample size
2. Investigate one variable with other variables should be kept constant (constant variables)
3. Carry study over a long time at least one year ...longitudinal study
4. Add safety precaution..like excluding people with high risk of CVD / choose people with no risk of CVD)



Start with a normal group of people

Split into

A) group exposed to the risk factor

B) group remain unexposed to the risk factor

Study should be applied for long time , on same group of individuals

Meta data analysis

When data from all available studies in a particular area are analysed ..to give more reliable evidence

You start with two groups

A) group with disease

B) group without disease

Collect data through questionnaires

Age, HDL :LDL , life style , smoking habits , family history , gender , body mass

Advantage : easy , fast , large sample size

Disadvantages : some people don't say the truth , some people may forget

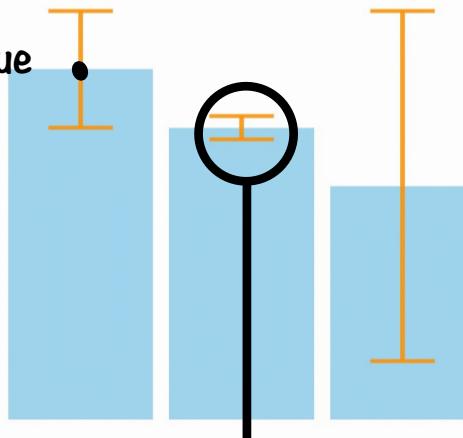
Write this in case he asks u to carry a study

I. Measuring degree of Reliability using SD / error bars.

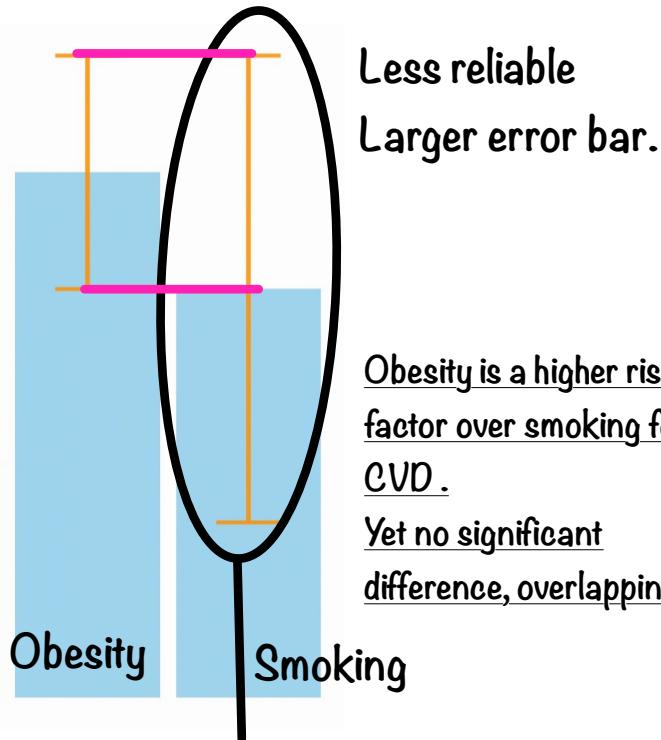
4,,5,6,7,8,11,2,14,18,17,3,1,.....mean value 8

Repeatsthe closer the results the more reliable they are .

Mean value



Most reliable . Shortest error bar . Data is Less deviating from mean value



Least reliable, longer error bar , data is more deviating from the mean value .

Less reliable
Larger error bar.

SD (standard deviation) deviation from mean value

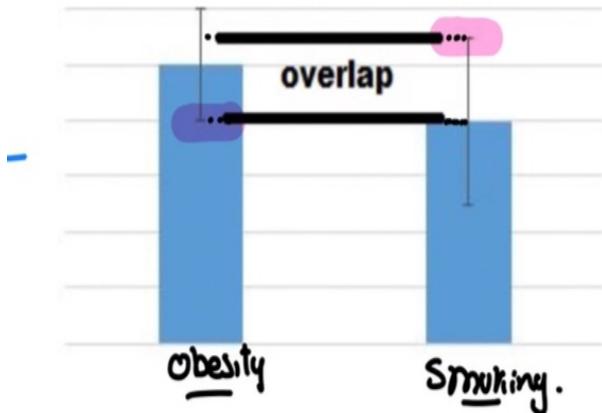
Obesity is a higher risk factor over smoking for CVD.
Yet no significant difference, overlapping.

- 1. Calculate the mean value
So reliable data
- 2. To assess degree of reliability
 - A) size of error bars ..degree of spread out of data from mean value

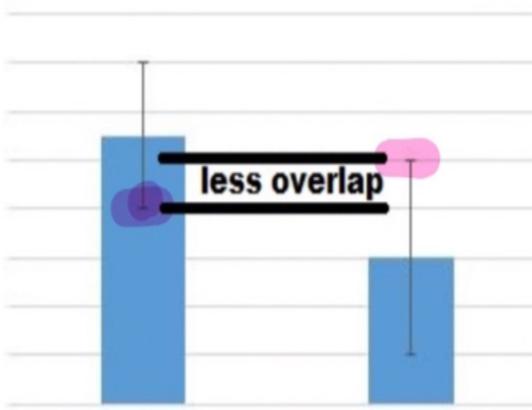
1. detecting significant difference between data

From base

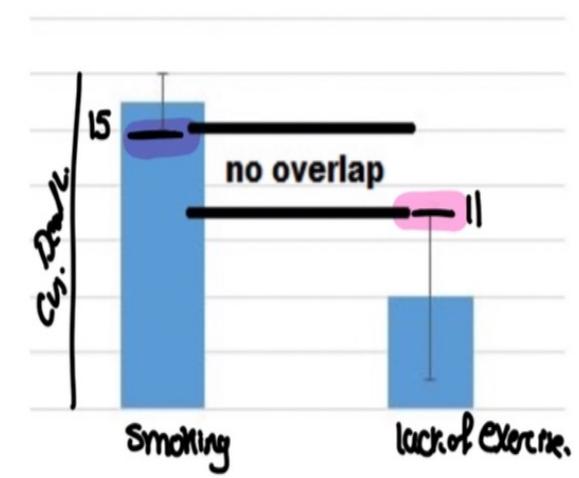
From Top.



SD / error bars overlap ...no
significant difference



SD / error bars overlap ...no
significant difference



SD / error bars dont overlap ...so there
is a significant difference

1. Draw error bars ..given SD value.....

Given mean value is 13 , S.D is 0.5cm

2. Comment on size of error barlonger error barsmore data are spread / variable from the mean valueso less reliable results .

3. Compare data / bars

Overlappingso no significant difference

No overlapping ...there is a significant difference

3. Lack of exercise

Energy input > energy output

Excess energy stored as fats

Increase risk of CVD

As exercise is needed to lower blood cholesterol level

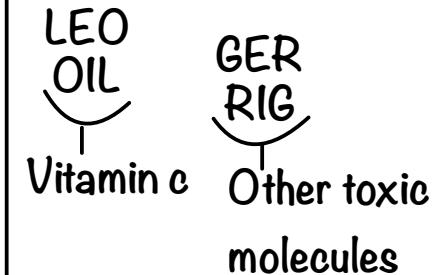
Release stress

Strengthen the heart muscle



Balance lipoprotein (increasing the HDL : LDL ratio) / decreasing LDL to HDL ratio

Thus lowering risk of atherosclerosis.



4. Diet

A) vitamin Cantioxidant(prevent oxidation of other molecules = allow reduction of other molecules) ..by losing electrons / donating electrons

B) saltincrease blood pressure .

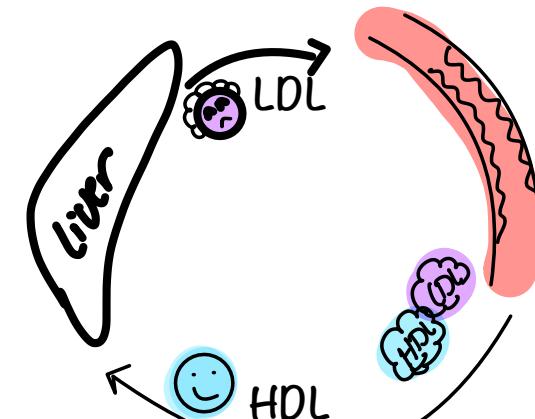
C) alcohol and caffeine consumption

D) saturated fat intake

1) LDL (saturated fat, cholesterol, proteins)

2) HDL (unsaturated fats, cholesterol, more proteins)

Why do we need to take into consideration the total cholesterol level and HDL level ?



Having higher HDL to LDL ratio....lower risk of CVD

Having higher LDL To HDL ratio....higher risk of CVD

5. Stress

Increase adrenalineincrease in heart rateincrease in blood pressure

Fluid mosaic model

Fluid: the phospholipid move about / diffuse within their monolayergives flexible structure to the membrane and making it constantly changing.

Mosaic: different protein molecules are scattered in the cell surface membrane (within phospholipid bilayer).

What affect the fluidity of the membrane: <https://youtu.be/qBCVVszQQNs>

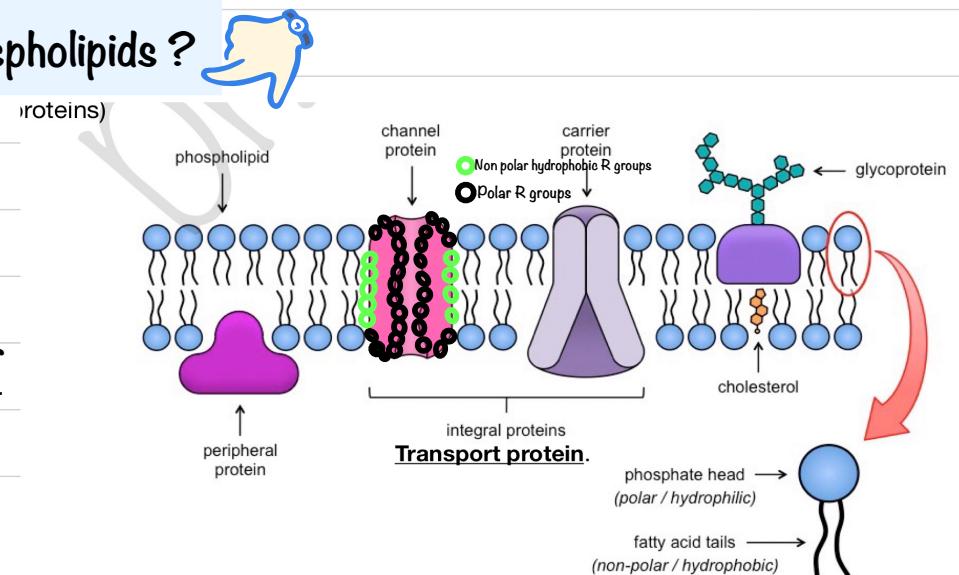
1. Percentage of unsaturated fatty acids (C=C) ..kinks ..increase fluidity
2. Temperature ..increase in temperature ..increase fluidity , increase the movement of phospholipids .
3. Tail length ...longer tail ..decrease in the fluidity
4. Cholesterol

Explain how the intrinsic proteins are embedded between phospholipids ?

A) the region pf the polypeptide with hydrophilic R groups of amino acids are facing / interacting with hydrophilic phosphate head.

B) the region of the polypeptide with hydrophobic R groups of amino acids interact with hydrophobic fatty acid tail .

Carrier protein Channel protein



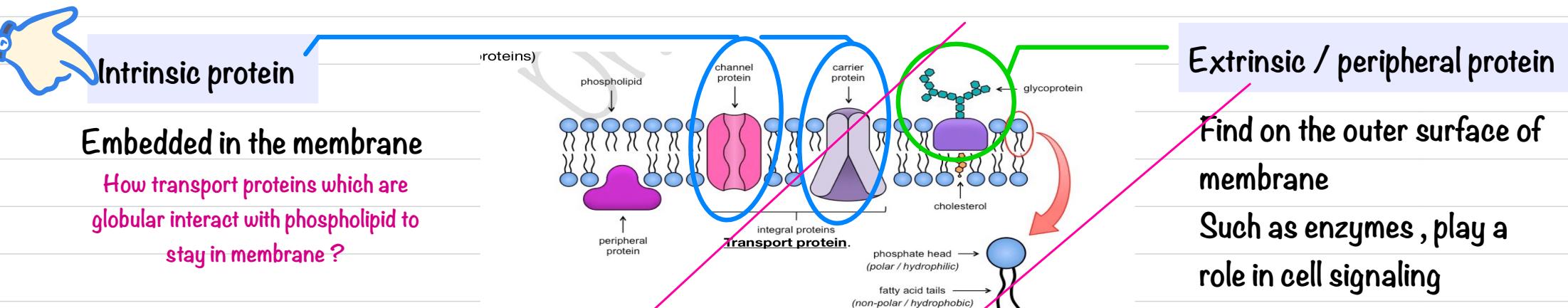
What are the properties of the cell membrane that contributes in the fluid mosaic model ?

Phospholipid bilayer ...with phospholipid each with phosphate hydrophilic heads facing outside (cytosol) and hydrophobic core formed from fatty acid tails facing inside

Phospholipids diffuse within their monolayer

So phospholipid are able to move freely making the membrane fluid

Protein molecules scattered between phospholipids



Transport proteins interact with phospholipid .

A) region with hydrophilic R groups of amino acids , interact with phosphate head of phospholipid

B) region with hydrophobic R groups of amino acids interact with hydrophobic fatty acid tail .

Effect of inhibitors

1. Competitive inhibitor

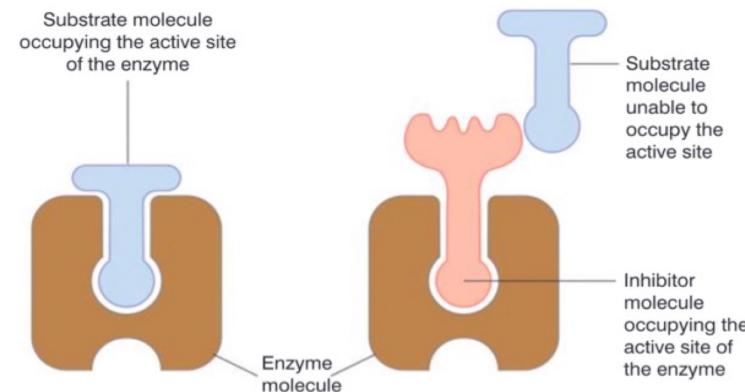
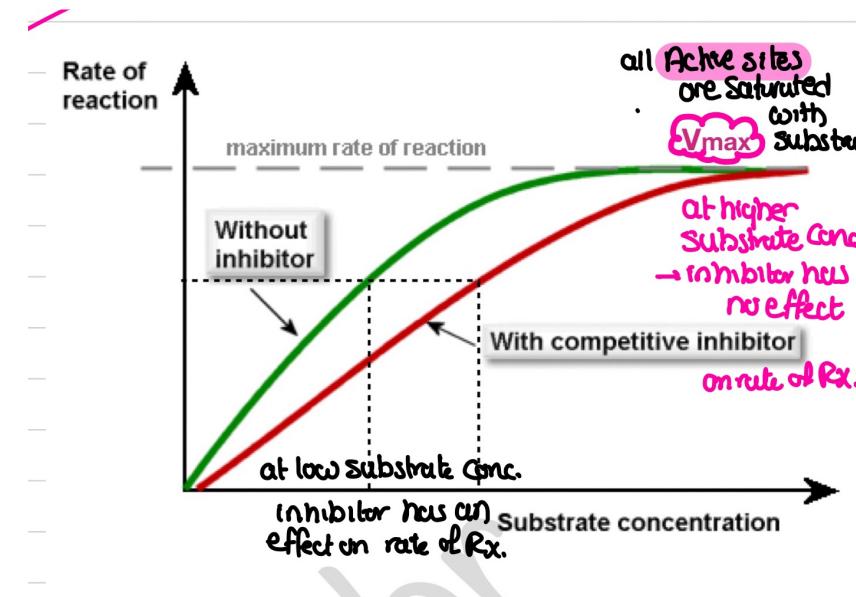
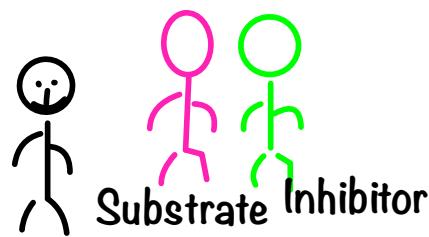


Figure 1 Competitive inhibition



1. Inhibitor has similar shape to substrate
2. Compete on active site with substrate
3. So inhibitor bind to active
4. Reducing frequency of collisions between substrate and the active site
5. So less ESCs so slower rate of reaction at low substrate concentration
6. So increasing substrate concentration , so compete more on active site to reach the V_{max} at higher substrate concentration

V_{max}will remain the same (depends on enzyme concentration)

Affinity of the enzyme to the substrate ...decrease as inhibitor compete on the active site with substrate ..so we need higher substrate concentration to reach the V_{max}

Non competitive inhibitor

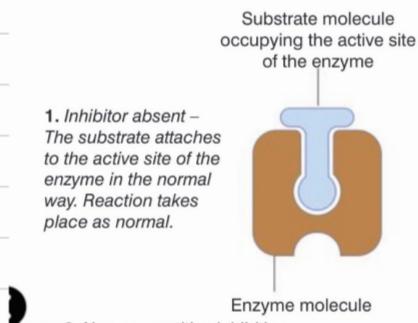
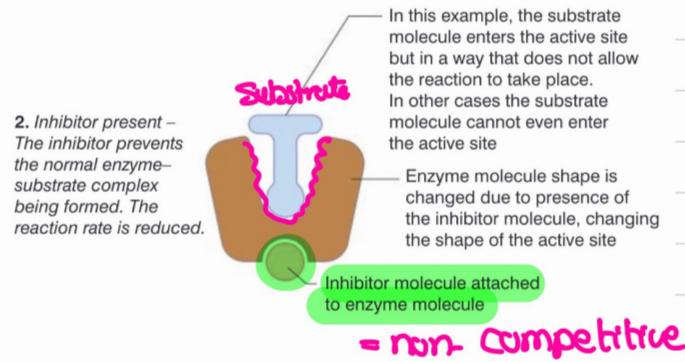
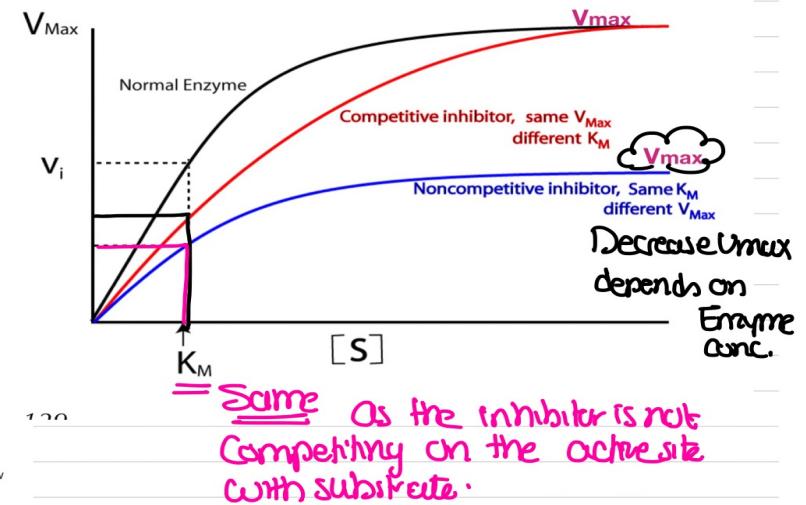


Figure 3 Non-competitive inhibition



- non-competitive.



Inhibitor bind to another site other than the active site

Causing a change in shape of active site

So substrate is unable to bind to active site .

V maxdepends on enzyme concentration ..decrease due to change in shape of active site .
Affinity stay the sam as the inhibitor is not competing on active site

1. Types of enzymes according to location of work: intracellular and extracellular enzymes:

Intracellular: enzymes secreted by cell and operate within cells. (DNA Polymerase).

Extracellular: enzymes secreted by cells and catalyse reactions outside cells.

Example; digestive enzymes.

2. Types of enzymes according to metabolic role

Anabolic: build up small molecules into larger ones in a cell using energy.

Catabolic: break down larger molecules into smaller ones within a cell releasing energy

1. Two polynucleotide strands , with monomer nucleotides .
2. Each nucleotide made from phosphate group . Deoxyribose and a nitrogenous base .
3. Running in opposite direction (anti parallel) strands , one from 3' to 5' and another from 5' end to the 3' end

4. Held together by hydrogen bonds between nitrogenous bases ..between amine group and carbonyl group of purine and pyrimidine bases on opposite site ..**where they pair up according to the complementary base pairing rule where each pair has purine with pyrimidine**

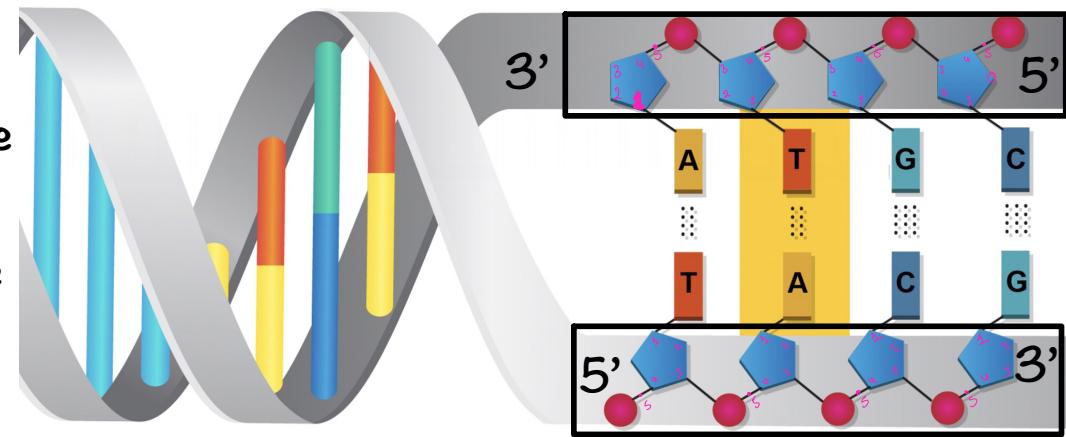
Adenine pairs with thymine

Cytosine pairs with guanine

5. Each strand has a sugar phosphate back bone with phosphodiester bonds.

2 strands twist form a double helix

Each full turn in DNA has 10 base pairs ...3.4 nm length



phosphodiester bonds.

1 nm length.

Base pair

Sugar phosphate backbone

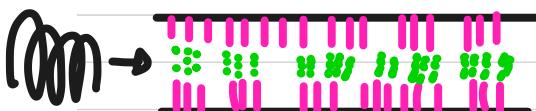
width = 2nm

Full turn in DNA
10 base pairs
3.4 nm

d The DNA double helix.

Steps of DNA replication

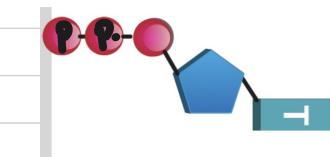
1. Double helix unwind



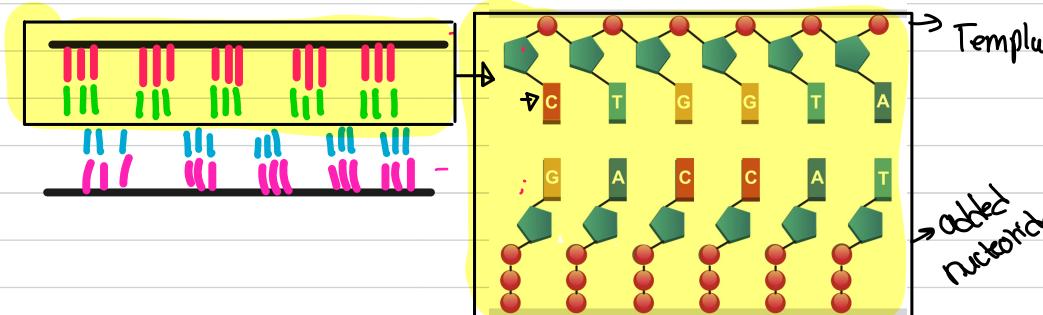
2. Helicase enzyme break the hydrogen bonds between complementary bases

Read

3. ACTIVATION to free nucleotides by adding 2 extra phosphate groups



4. Both DNA strands act as template strand where the activated nucleotides pair up with the complementary bases on each DNA strand and joined by hydrogen bonds



5. DNA POLYMERASE

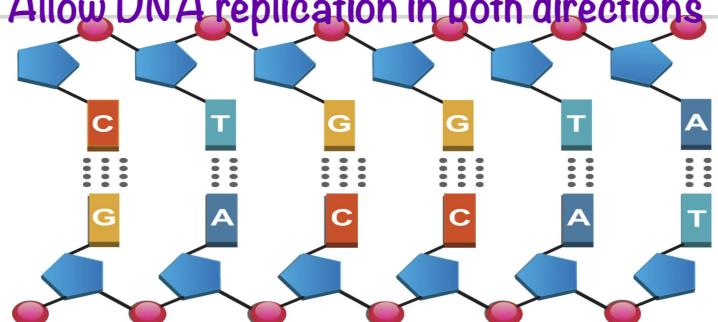
Bind to each strand of DNA to initiate replication

Add nucleotides one by one to the new growing DNA strand / chain

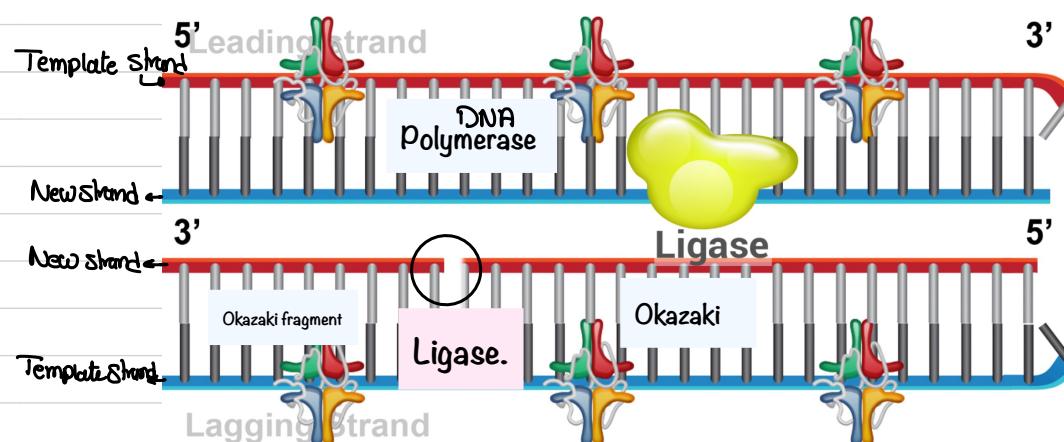
A) thus it allows the complementary base pairing rule . Line up nucleotides

B) form the phosphodiester bond between nucleotides

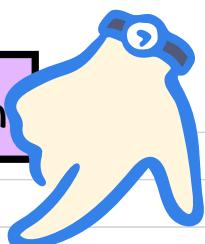
Repair mistakes in replication
Allow DNA replication in both directions



6. Ligase enzyme responsible for the formation of phosphodiester bonds between Okazaki fragments / nucleotides



Semiconservative replication



1. Double helix unwind

2. Helicase enzyme break hydrogen bonds between complementary bases .

Activation to free nucleotides by adding 2 phosphate groups

3. Both DNA strands act as template strands where the activated nucleotides pair up with complementary base on each DNA strand and joined by hydrogen bonds .

4. DNA polymerase

Add nucleotides one by one to the new growing DNA strand / chain

A) thus allowing complementary base pairing rule

B) form the phosphodiester bond between adjacent nucleotides

5. Ligase enzyme responsible for the formation of phosphodiester bond between okazaki fragments / nucleotides .

6. Process continue along DNA molecule

7. Produce 2 identical DNA molecules by semiconservative replication ...newly formed DNA molecule has an old parental strand and one new strand

B

Translation

Takes place in the ribosome in the cytoplasm

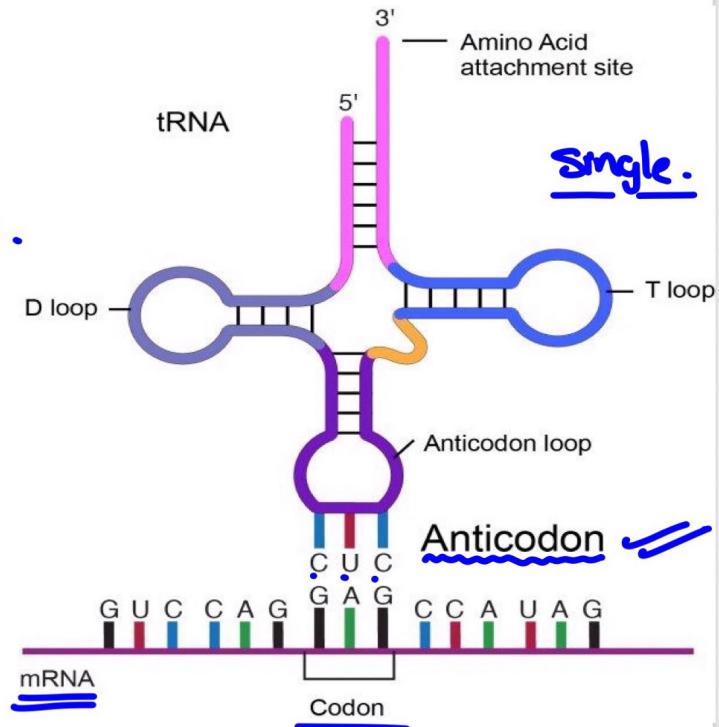
It involves :

A) mRNA

B) ribosomes (2 subunits)

C) tRNA

tRNA



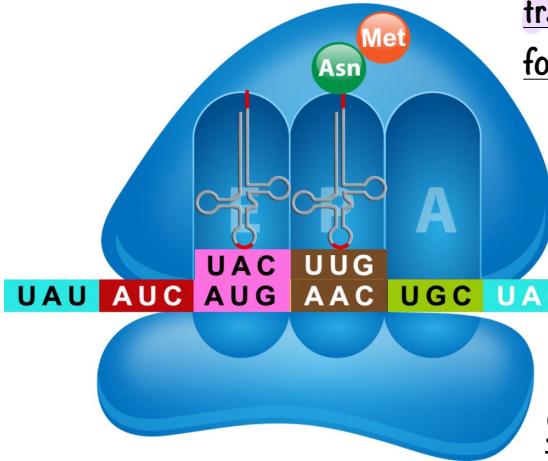
1. Single stranded molecule , with base pairs attached by hydrogen bonds

2. Has anticodon , which has a complementary base sequence to a particular codon on mRNA .

3. At the other end of tRNA is a site where a specific amino acid attached (under the control of a specific enzyme using energy from ATP)

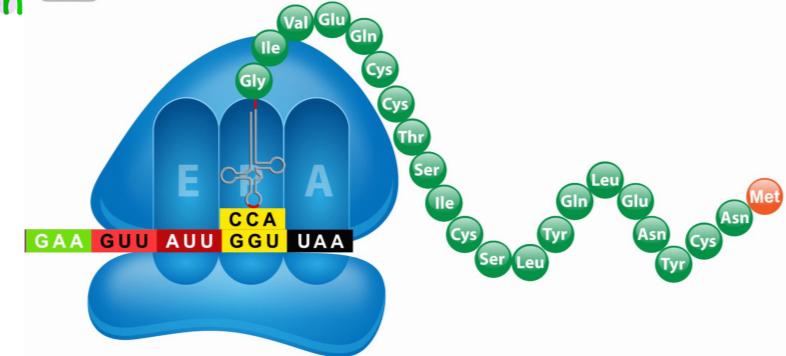
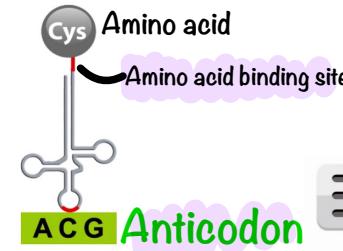
4. tRNA carry / bring a specific amino acid to the ribosome ...where its specific anticodon pair up with the corresponding codon on mRNAbring two amino acids close together allowing the formation of peptide bond in condensation reaction .

Steps of translation



Large ribosomal subunit which contains an enzyme (peptidyl transferase) that catalyse the formation of peptide bond

Small ribosomal subunit to which mRNA attach



1. mRNA attach to smaller ribosomal subunit exposing 6 bases at a time to the large ribosomal subunit .
2. tRNA is carrying amino acids , and link up its anticodon to the corresponding codon on mRNA where they bind by temporary hydrogen bondsthen another tRNA bring another amino acid to the ribosome .
3. tRNA bring 2 amino acids close together to allow the formation of peptide bond by CONDENSATION REACTION catalysed by PEPTIDYL transferase in the large ribosomal subunit .
4. This complete till we reach to the STOP CODON (UAA, UGA, UAG) which doesnt code for amino acids , it terminates translation .
5. Polypeptide chain enter the RER

Gene mutation

Random change in base sequence of DNA during DNA replicationthus producing new allele ..leading to protein of different function / shape.



Causes of mutation:

Exposure to mutagens : chemicals as tobacco smoke and mustard gas
Physical such U.V rays , x rays

Where errors are being copied during replication

When wrong base is being inserted

Types of mutation

Point mutation
(substitution)

Affects only one triplet code

Change in one single base of DNA code

Has one of three effects

Silent mutation

The base substitution is silent ..where the altered codon code for same amino acid

AGC....serine

AGT....serine

Non sense

The base substitution can be non sense . Where the altered codon corresponds to a stop codon , so new poly peptide might be shorter

TTC....phenylalanine
TTG...stop codon

Mis sense

The base substitution can be mis sense mutation where the altered codon , code for another amino acid

CCA....proline
CCT.....arginine

Frame shift

Deletion

One nucleotide is missed out ..so the entire base sequence is altered ..coding for an entirely different protein ...where all amino acids are different after mutation ...so 3D shape of protein is changed

The closer to the start , the greater the effect

Shift reading backward one place

Insertion

One extra nucleotide is insertedso the entire base sequence is altered after mutation ..so all amino acids after mutation are affected ,code for different protein

Shift reading forward one place

17. Transcription factor is a protein molecule that control the transcription of gene from DNA to form mRNA

By binding to specific sequence of bases on DNA

18. Steps and key words of splicing

19. Controlling gene expression outside the nucleus

Post translational change (change in poly peptide ..shortened / lengthened)

20. Epigenetics : Changing the phenotype without changing genotype

I. DNA methylation

Methyl group (+vely charged) is added to cytosine base next to Guanine base in DNA chain by enzyme DNA methyltransferase

Change arrangement of DNA molecule and physically block binding of RNA POLYMERASE AND TRANSCRIPTION FACTOR

Silencing of gene
REVENT TRANSCRIPTION OF THIS
GENE

2. Histone modification

A) histone methylation

Add a positively charged methyl group to lysine amino acid in histone proteins
.....so increasing positive charge of histone proteins
.....so stronger attraction between DNA and histone proteins
.....converting euchromatin into heterochromatin
.....RNA polymerase and transcription factors can't bond to promotor and enhancer sequence ...so no transcription ...so silencing of gene

B) histone acetylation

Acetyl group is negatively charged ..so upon binding to histone proteins ..it will decrease the positivity of histone proteinsChromatin to become loosely packed ...euchromatinGENE ACTIVATION

21.

Epigenetic modification(accessibility to TF or not)

A) DNA methylation ...methyl groupphysically block binding of TF and RNA polymerase to promoter regionsilencing gene

B) histone modification

- histone methylationeuchromatin (loose) ... heterochromatin (tighten)silencing gene
- Histone acetylationheterochromatin (tighten)euchromatingene activation

Different environmental factor

1. Diet
2. Level of exercise
3. Smoking
4. Stress

22. Cell differentiation

Chemicals arrive and stimulate the cell (histone acetylation / modification ,DNA methylation / transcription factor)

2. Differential gene expression takes place (certain gene become activated)

Gene coding for insulin is switched onin beta cells of pancreas and yet switched off in nerve cell .

3. Transcription is initiated producing mRNA from activated gene (TF)

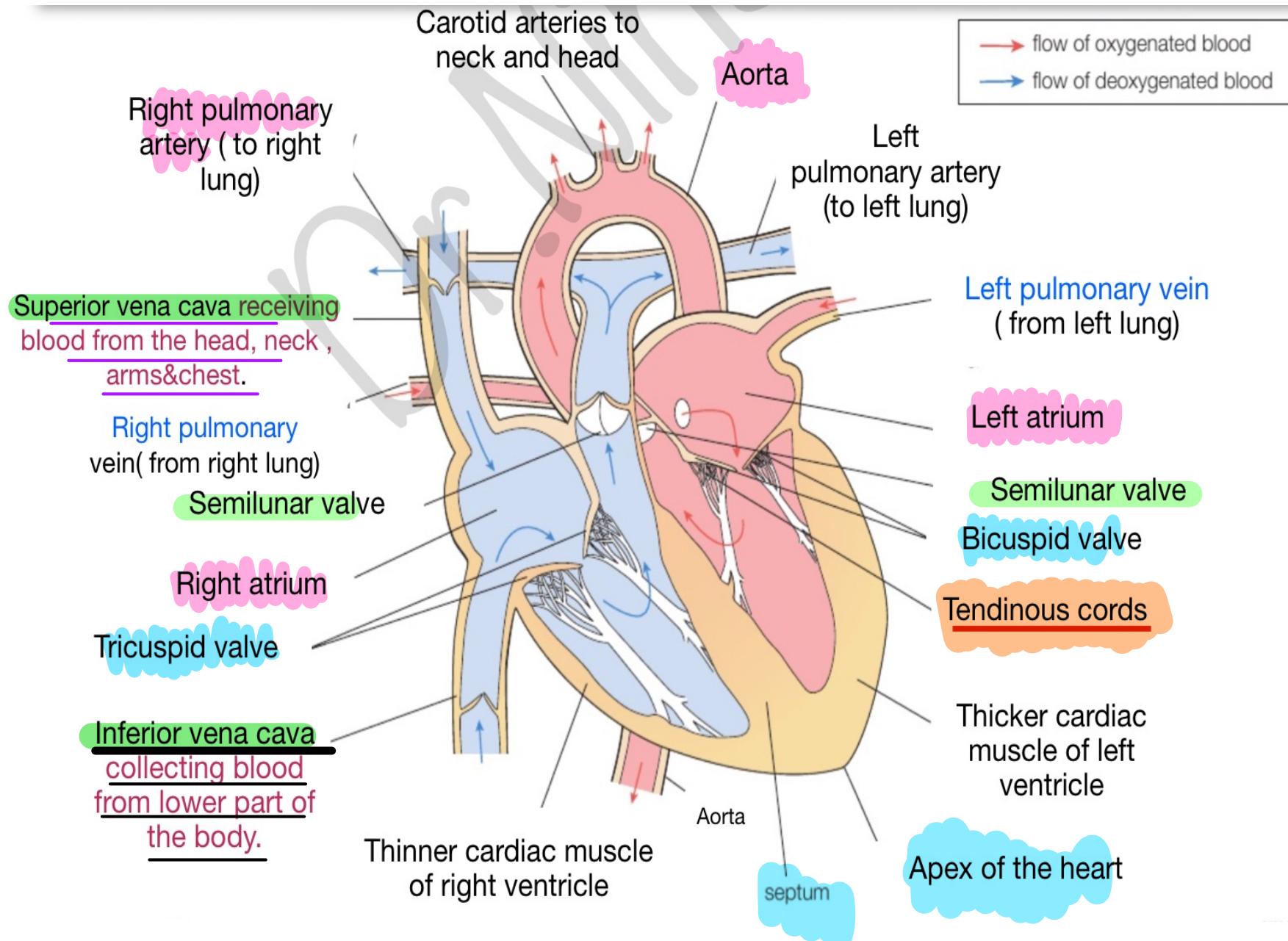
4. Then transcribed mRNA is translated to form polypeptide

Permanent modification of cell structure and function .

LORD

In vein atrium

Awayarteryventricle



Structure of the heart

1. Chambers ...mentioned before

2. Septummentioned before

3. Valves :

A) atrioventricular valves :

B) semilunar valves

Function:

Open to allow the blood to flow in one direction (from ..to ..) and close to prevent back flow of blood .

Thus maintaining pressure and steep concentration gradient of oxygen and Carbon dioxide .

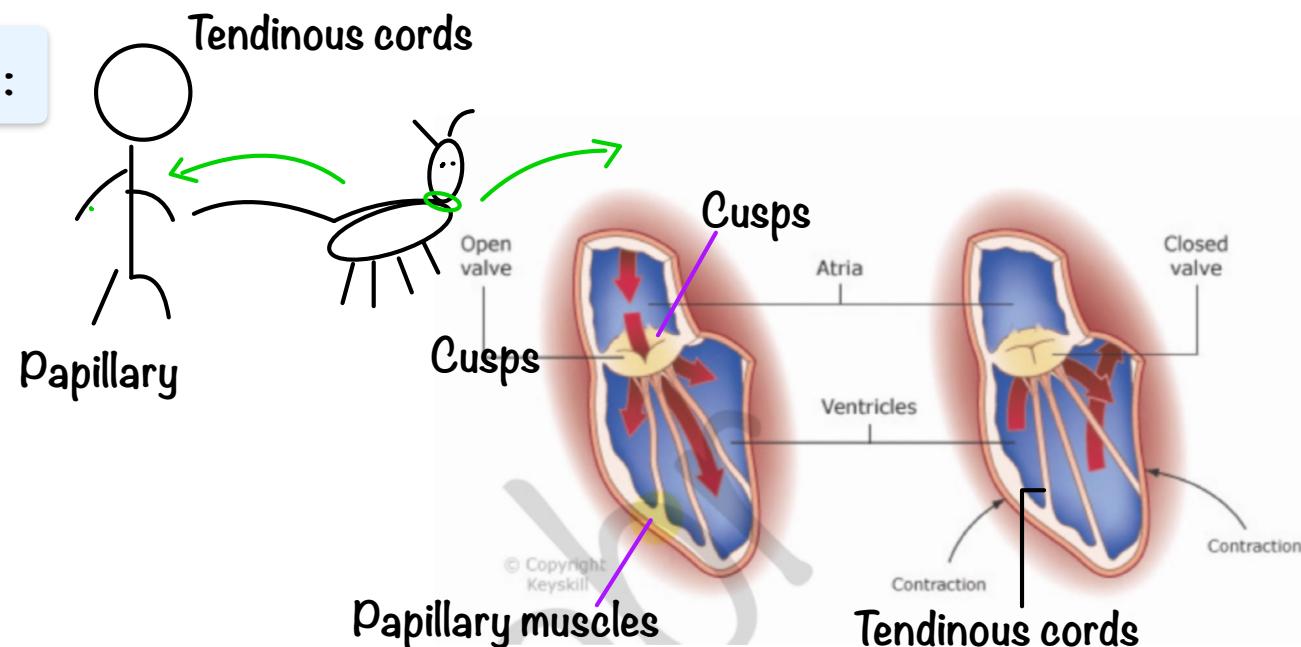


Semilunar valves : prevent back flow of blood from aorta to the left ventricle

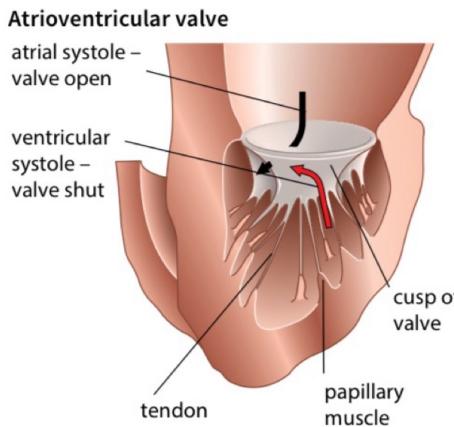
And from pulmonary artery to right ventricle

How atrioventricular valves are adapted :

Ventricular systole ..increase in blood pressure in ventricles ...papillary muscle contractwhich are attached to the cusps of the atrioventricular valves by TENDINOUS CORDS ...so this contraction pull on the tendonsto close the valve and hold the cusps in place and prevent them from turning inside out .

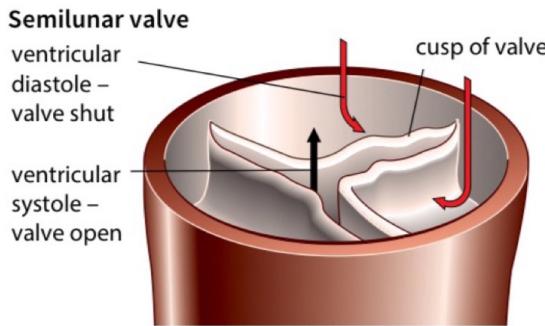


Semilunar valve



:he

gh



Ventricular diastole

Low blood pressure in ventricle

Semilunar valve

Close when the heart muscle relaxdiastole

Where the pressure in ventricles decrease

Slight back flow of blood from arteries

Blood fill the semilunar valves Cusps

(cause the cusps to come close together)

Preventing back flow of blood

