Unit-1 = Patho = Pathophysiology

= Homeostasis =

The term homeostasis derived from two word -

Homeostasis
↓ ↓
Homeo Stasis
↓ ↓
Similar state.

It means the similar state of body at any situation of external environment is called homeostasis.

→ The condition of body in which the internal environment of the body is remain constant with the external environment is called homeostasis.

The concept of homeostasis was discribed by claudeg Vernard in 1865

→ The external environment of body like temp, Atmospheric condition, Humidity and weather is regularly change. but Pressure temp of our body, blood glucose level, blood creatinine level, blood volume, and CO_2 concentration is always remain constent due to homeostasis.

→ for example After blood loss or donating the blood the blood volume level becomes equal in few days

→ In hot conditions when the temp. of Atmosphere is ↑es then by homeostasis process sweating start so the skin becomes cool.

→ When the toxic subs is ↑es in our body then the rate of excreation is ↑es to remove the waste material.

Mechanism of homeostasis

The homeostasis in body is control by the two mechanism.

i) Positive feedback Mechanism.
ii) Negative feed back Mechanism

Component of homeostasis :

The homeostasis system of body is regulated by three component.

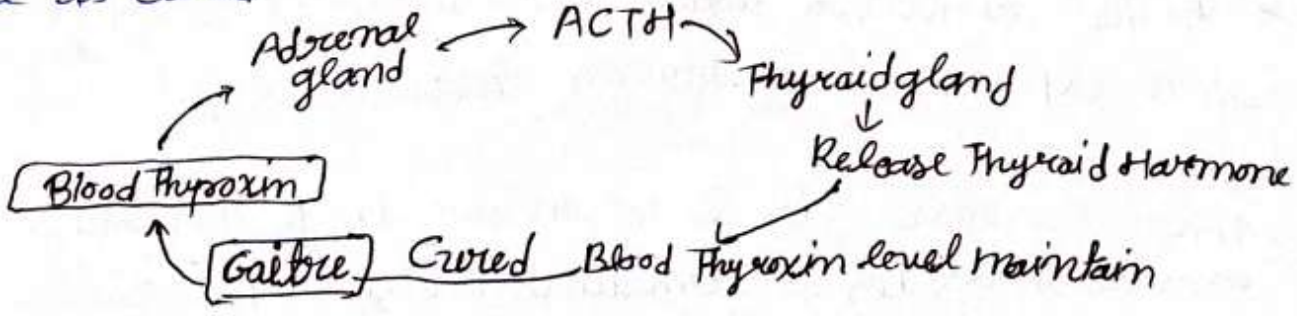
1. Sensory (Receptor)
2) Controller
3) Effector.

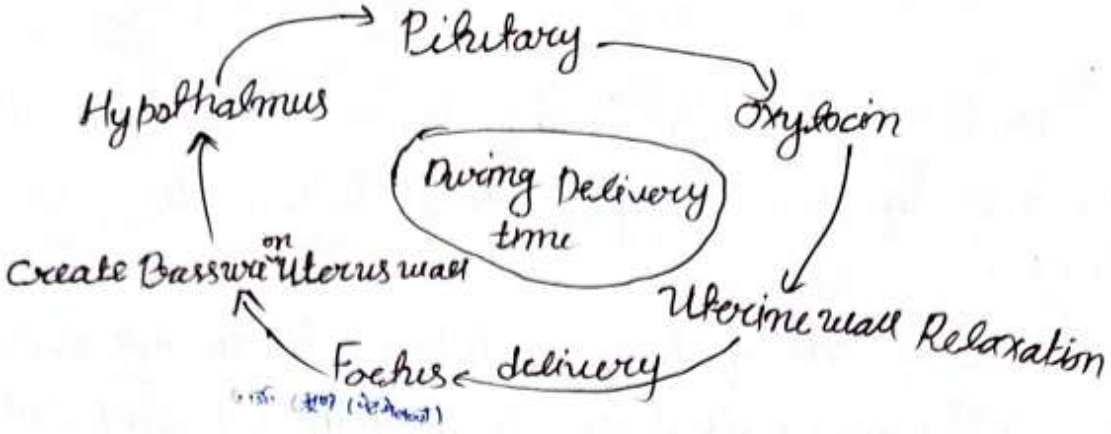
i) Positive feedback Mechanism :

When the homeostasis of body is maintain by increasing the response rate from low to high it is called positive feedback system.

⇒ Ex:(i) When the blood thyroxin level is reduce in our body then gaitre disease is appear.

⇒ In this situation thyroid cell sends signal to the adrenal gland and it release ACTH Haormone (Adreno Cartico Tropohin haormone) which stimulate the thyroid gland when thyroid gland is stimulated then it release the secreation of thyroxin haormone so the blood thyroxin level is maintain and gaitre is cured.



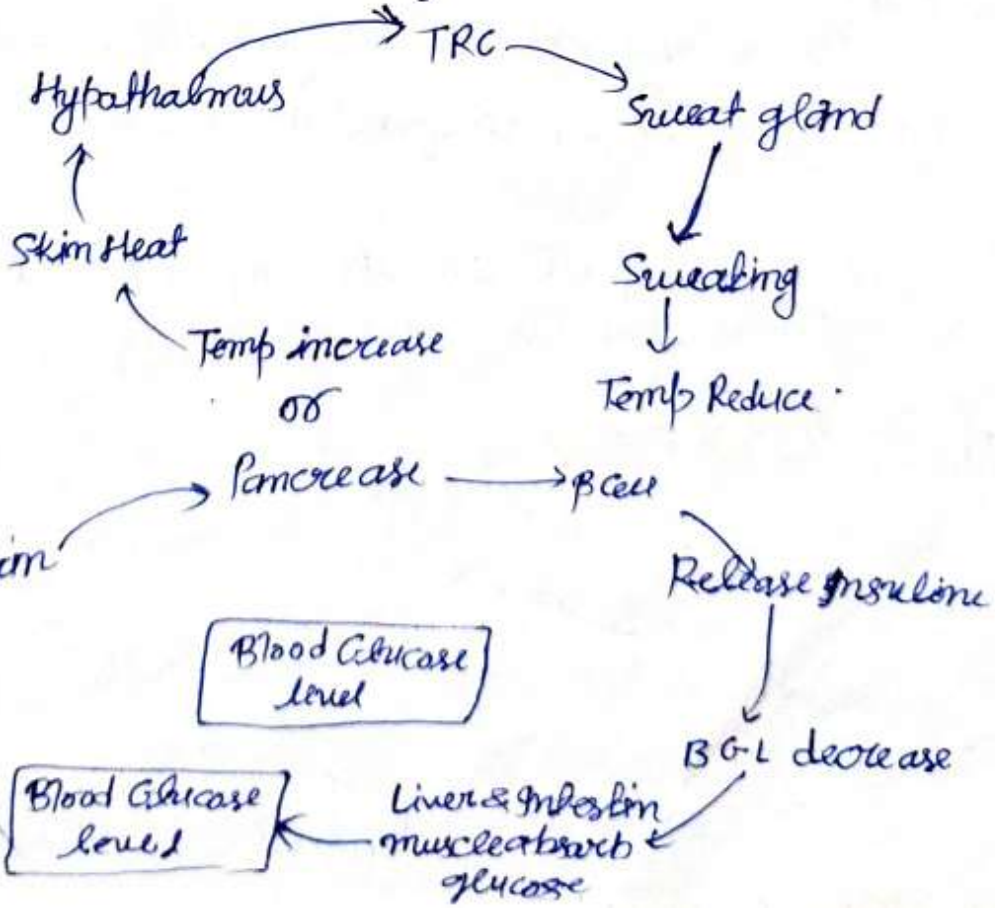


Negative feedback System :-

When the homeostasis of body is maintain by decreasing the response rate from high to low is called Negative feedback system.

Ex. When the body temp is ↑es then normal temp (37°C) (98.6°F) then skin receptor send signal to the hypothalmus. Hypothalmus stimulate the temp regulation centre (TRC) and which send information to the sweat gland.

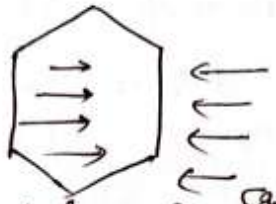
sweat gland starts sweating all skin so the temp is reduce.



Cell Injury

When the internal and external stress of cell is imbalance then the normal functioning of cell is disturb this is called cell injury.

→ Each and every cell of body maintain there homeostasis. but when the homeostasis of cell is disturb by any cause then it is called cell injury.



→ Cell injury is happened due to two reasons.

i) Adaptation
ii) Necrosis.

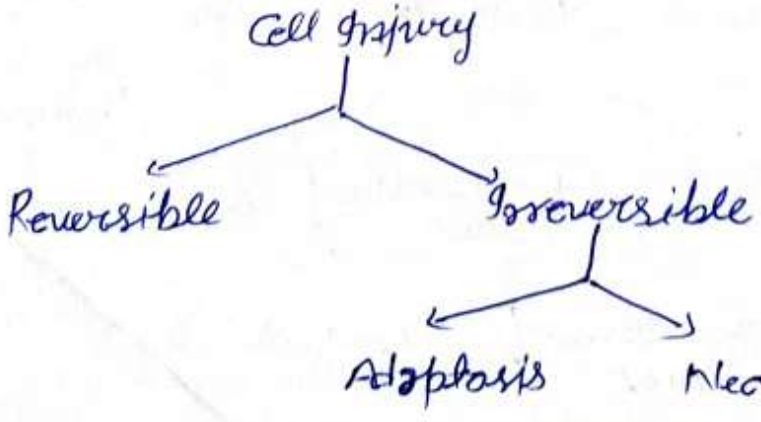
→ **Adaptation**

Due to any external extress the adjustment of the cell and change in there function is called Adaptation.

→ **Necrosis:-**

The damage of cell are its any part due to loss of O_2 and nutrition is called necrosis.

Types of Cell Injury :-



Reversible :-

When cell again retain the its normal condition and normal function after the cell injury then it is called Reversible cell injury.

Irreversible :-

After Apoptosis and necrosis process cell becomes dead and it cannot retain there normal condition. then it is called irreversible process.

Pathogenesis of Cell Injury :-

The pathogenesis of a disease is a biological mechanism that leads to the diseased stage

→ It also describe the cause of disease, origin and development of disease and its nature acute or chronic.

→ On the basis of pathogenesis cell injury of following type.

→ (i) Cell membrane damage.

ii) Nuclear Injury.

iii) Ribosomal Injury

iv) Mitochondrial

v) DNA.

i) Cell membrane damage :- The cell membrane of body is made up of diff. proteins, phospholipid & channels.

→ If there is any change in the functioning of channel in transport of ion then it is called cell membrane damage.

following are the some imp disorders related to cell membrane

→ 1) Hyaline membrane disease → It is disease of infants occur in lungs.

ii) Alzhimer disease ∴ It the phasphalipid damage of brain cell.

iii) Cystic fibrosis ∴ It is the cell membrane damage of muscle.

iv) Duchenne Muscular dystrophy ⇒ Membrane damage of muscle.

v) Mitochondrial damage

Mitochondria is also known as the power house of the cell and when mitochondria is damage then the ATP production is failed.

⇒ Mitochondria is composed of Atleast 9000 thousand types of gene in which 3% gene involve in the synthesis of mitochondria. And rest 97% gene are involve in other function.

Mitochondria is present in every cell of body except sperm cell and RBC.

⇒ In mitochondria Extra chromosomal DNA is present and by the alteration in DNA structure by gene mutation is caused mitochondrial damage.

⇒ Symptom of mitochondrial damage -

i) Poor growth.

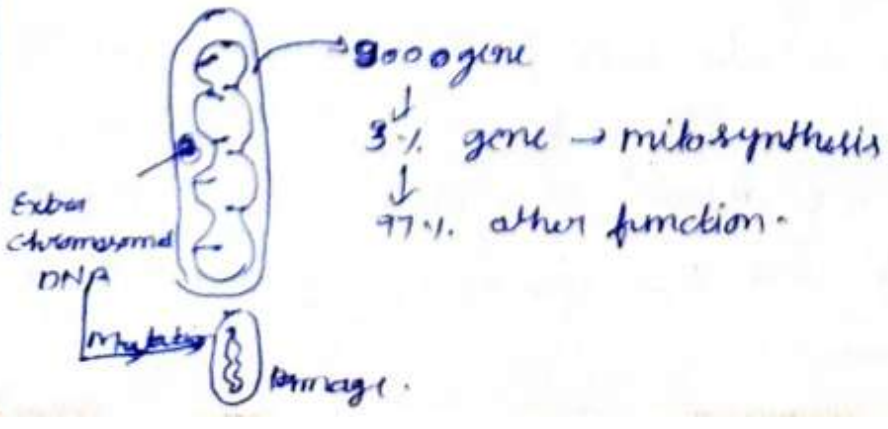
ii) Loss of muscle contraction.

iii) Visual problem.

iv) Hearing problem.

v) Heart liver and kidney disease

vi) Neurological problem Dimentia (याददाश्त)



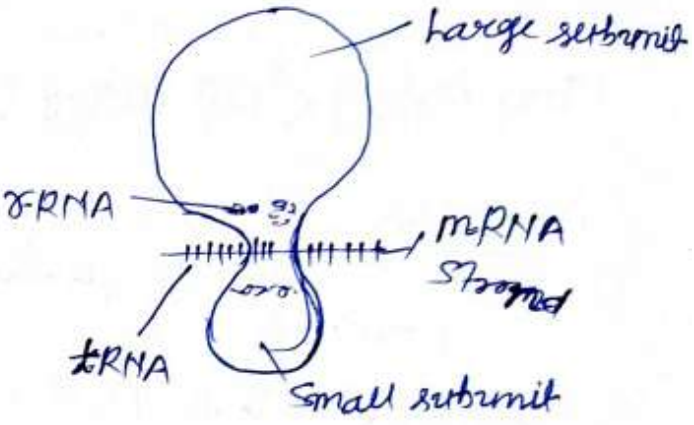
Ribosomal Damage

Ribosome is the essential organ for protein synthesis and the damage of structure of ribosome is called Ribosomal damage.

⇒ If there is any change in the structure of rRNA then it may cause Ribosomal damage.

⇒ Abnormal Ribosome biogenesis is linked to several human genetic disease.

i) Diamond blackfan Anaemia
ii) Cancer.
iii) Dyskeratosis. Congenital.
iv) Shawachman diamond disease.
v) Treacher. collins. syndrome.
vi) Cartilage hair hypoplasia.



Nuclear damage:

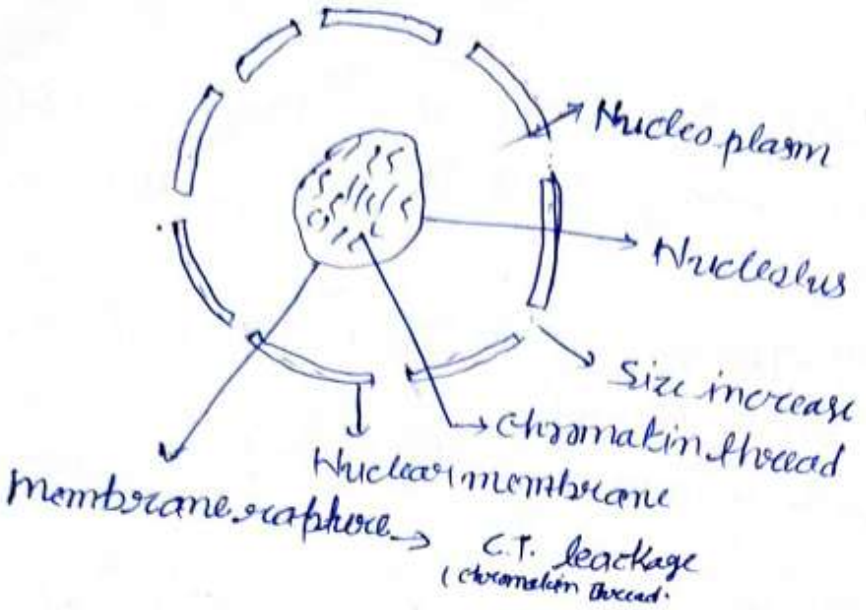
The structure of nucleus is consist of following part

i) Nuclear Membrane.
ii) Nucleo plasm.
iii) Nucleolus
iv) chromatin thread)

when the nucleus pore size ↑es or ↓es then nucleolus is damage then it may cause nuclear damage.

following disease are caused by damage to the cell Nucleus.

→ i) Cornelia de lang Syndrome.
ii) Revesz syndrome.
ii Schinzel Geidion syndrome
iv) Spinal muscular atrophy
v) Triple 'a' syndrome



Morphology of cell Injury / Adaptive

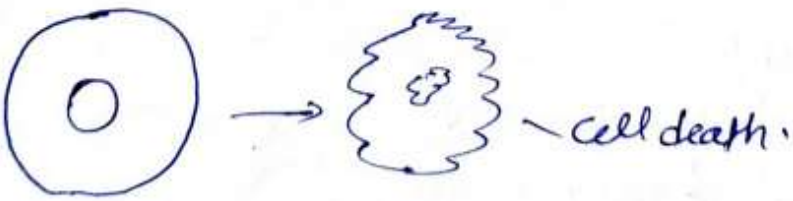
i) Atrophy:- It is the partial or complete wasting of cell of any part.

→ Atrophy is due to poor O2 supply, poor neutrition supply, gentic mutation lass of harmonal support. etc.

→ Atrophy is the general physiological process of reabsorption and breakdown of tissue.

- Muscle Atrophies, Distrophies of harmone, Gland Atrophies.

Vaginal Atrophies.

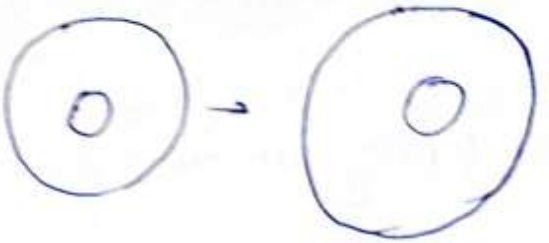


ii) Hyperbsophy

It is the ↑es in the volume of any organ or tissue due to in largment of its component of cell.

⇒ When the size of cell is ↑es this is called hyperbsophy.

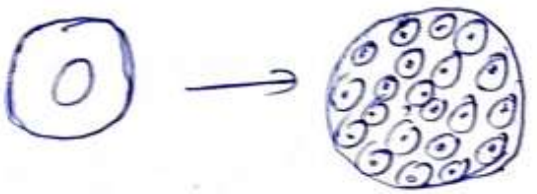
→ Ex Dilated cardio myopathy.



iii) Hyperplasia

When the size of cell remain constant but the no of cell is ↑es this is called hyper plasia.

Ex. Benign Prostatic hyperplasia, Cushing syndrome.
Endometrial hyperplasia; Cebeceous hyperplasia.



iv) Metaplasia

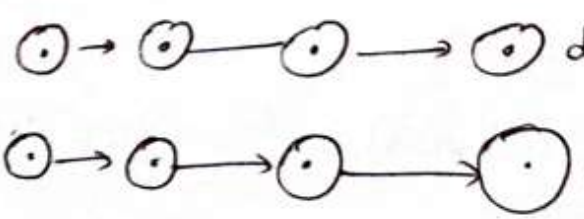
It is reversible transformation of one differentiated cell in to another differentiated cell

→ It may be a normal maturation process are caused by abnormal stimulus.

⇒ When the function of one cell is completly change in to function of diff. cell is called metaplasia.

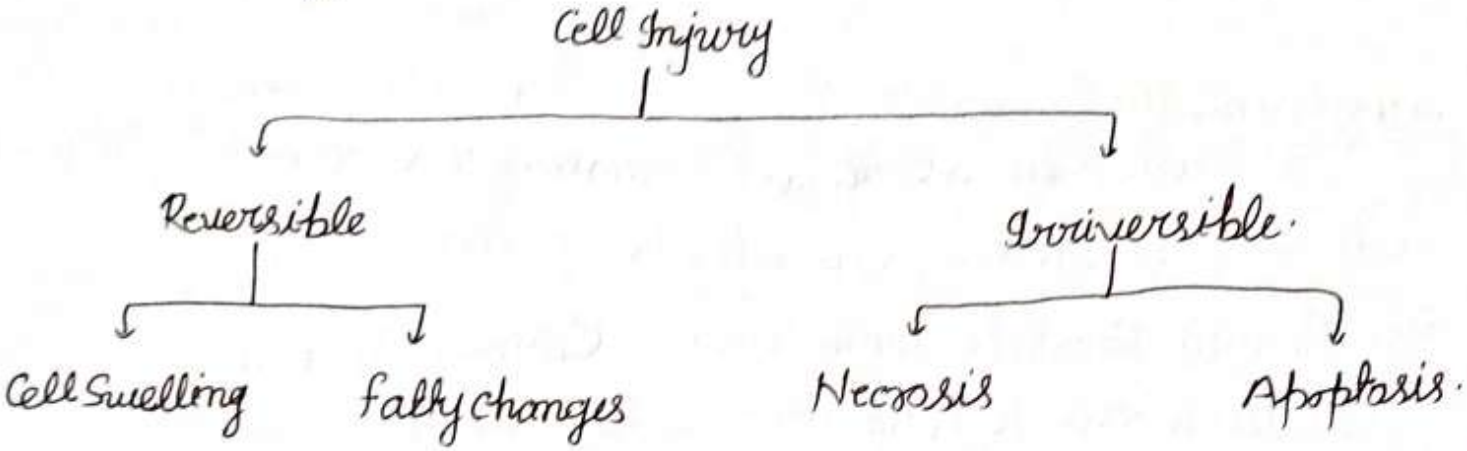
5) Dysplasia :

When the growth of cell is stop and its shape and size remain constant as per germ cell.



Types of cellular damage :-

Cell Injury on the basis of .... if is of two type.



Cell swelling :-

In the cell membrane of any cell Na, K ATPase pump is present which is responsible for the movement of ion.

This pump require energy for functing.

In the case of hypoxia or ischemia the energy is reduce. so the Na, K ATPase pump stop working.

Due to this excess of Ca^{++} ion and water accumulates inside cytoplasm, so the volume of cytoplasm is increase. and this is called cell swelling.

It causes some increase in sugar and increase in the weight of the organ.

On microscopic observation small clear vaccules may be seen within the cytoplasm.

If the cell swelling for long time then cell will be dies.

Fatty changes :-

The cell membrane of cell is made up of phasphalipi when the excess amount of fatty acid deposited b/w the cell membrane and cytoplasm then it is called fatty changes.

Due to increases in thickness of the cell its function is change and can impair the activities of cell.

In liver in largement of the hepatocytes due to fatty Acid can lead to cholestasis.

fatty changes is also known as fatty degradition. fatty fatty metamarphasis or fatty steatosis..

Necrosis :-

Necrosis is a irreversible cell death in which the cell membrane and its orgen are rapture. cell Necrosis include following thing.

→ Pyknosis :-

Srinking of chromosome.

→ Karyorrhexis :-

Break daum of Nucleaus.

→ Karyolisis

Desalution of cell Nucleaus.

Apoptosis :

It is a programmed cell death of harmful cell in the body.

This is controlled by the different enzymes like Caspases.

The cell surface of the cell is change in such away that our immune system recognise → then as self.

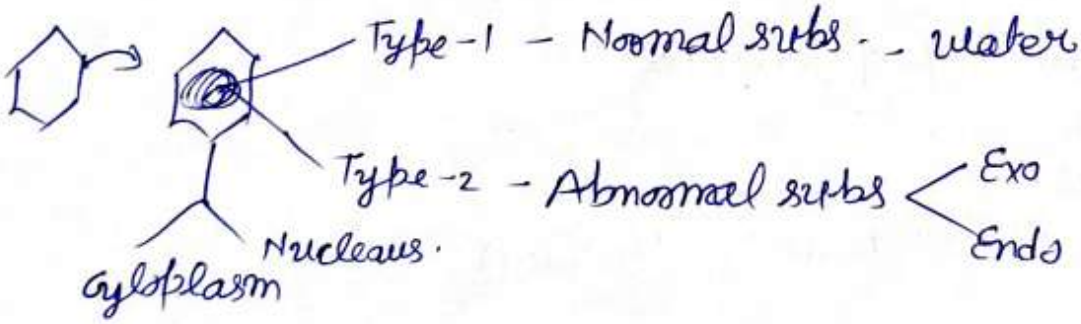
So the microphase cell phagocitosis the cell.

Intracellular Accumulation :

The accumulation of useful or harmful substs inside the cell is called intracellular Accumulation.

Basicaly these substs are accumulated in either cytoplasm or a nucleus.

on the basis of nature of substs. Intracellular Accumulation is of two type.



Causes of Abnormalities

There are mainly four types of enbracellular Accumulation seen.

i) When the rate of production is ↑es and the rate of metabolism is ↓es then the endogenus substs are

Accumulated inside the cell
Ex fatty changes in the liver.

ii) When the protein for enzyme synthesis are mutated then the respective enzyme stop working and proteins are accumulated.

Ex. Accumulation of mutated α protein Antityprin a causes the Accumulation of tryprin protein.

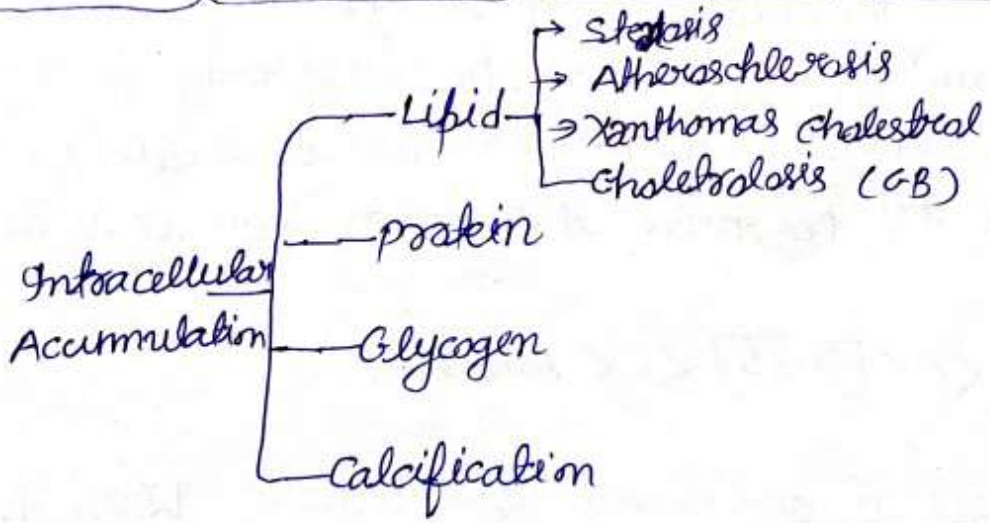
iii) When some intracited enzyme are destroy ~~are~~ lysasome degenerate then a lot of endogenus subs. are accumulate.

Ex Fat, Protein, Carbohydrate, Water.

iv) Some times some exogenus material are accumulated which cause cell death.

Ex Accumulation of silca particle in lung silicosis.

→ Intracellular Accumulation of some major component & disease.



Accumulation of lipid

All kinds of lipid - fat, fatty Acid, Tri glyceride & Cholestrol, deposit inside the cell and can cause following disease.

Steatosis

The diposited of triglyceride inside parenchyma cell is called steatosis.

⇒ The causes of steatosis include toxin, Protein, Malnutriation Diabities, and obct.

ii) Atheroschlerosis:- It is the diposition of chloresterol, Tri glyceride, LDL, VLDL, in the indothelial membrane of blood vessel is called Atheroschlerosis.

iii) Xanthomas :- It is the accumulation of chalestrol in the connective tissue of skin and tendons.

iv) Chalestrolosis It is the accumulation of chalestrol in gall bladder.

Acidosis & Alkalosis :- The average pH of the blood, cell and body fluids are about 7.35. and when the pH of body fluid is reduce and becomes less than 7.35 then it is called Acidosis and when the pH ↑es more than 7.35 then it is called Alkalosis.

Acidosis <<< [7.35] <<< Alkalosis.

Acidosis:- Acidosis is also known as acidemia. When the acidic component are ↑es in our blood. then it cause Acidosis.

→ Acidosis can be classified further as metabolic Acidosis.

Metabolic Acidosis

When some metabolic acid like lactic acid, Carbonyl Acid are ↑es in our blood then it is called metabolic acidosis.

Metabolic Acidosis can be occurs by two reasons.

1) Hypoxemia :- Lack of O_2 can ↑es the Acidosis.

11) Hypoperfusion :-
When the rate of blood flow is ↓es then the rate of excretion is also ↓es this may cause acidosis.

Respiratory Acidosis

Due to ↓es in respiration rate when the level of CO_2 is ↑es in the lungs then it cause Respiratory Acidosis.

→ This condition is also known as hypercapnia.

Sign & Simptom of Acidosis

- ⇒ Headache
- ⇒ Sleepyness (Sleepiness)
- ⇒ Confusion.
- ⇒ Seizure (कंपकपी होना)
- ⇒ Weakness.
- ⇒ Diarrhoea.
- ⇒ Coughing
- ⇒ Increased heart rate.
- ⇒ Nausea & Vomating.

Alkalosis :-

When the pH of body fluid is 1es more than 7.35 then it is called alkalosis.

In this condition the H^+ ion conc is 1es and (by) bicarbonate concentration is increase.

⇒ The cause of metabolic Alkalosis can be divided in to two categeary; Depending on urine and chloride level.

1) Condition - 1 :-

Chloride responsive alkalosis → The urine chloride level is increase is more than 10 meq/liter

2) Chloride resistent Alkalosis

When the urine chloride level is more than the 20meq/liter.

Electrolyte Imbalance :-

Electrolytes are very imp. for maintaing the homeostasis of body.

⇒ Different electrolyte, like, Na, K, Ca, Mg, And PO_4^- helps to regulate the heart and neurological function. fluid blance & Acid base balance, and the abnormelities of electrolyte may cause cell injury.

Unit-1
Chapter-2

∴ Basic Mechanism involved in Inflamation ∴

Inflmation ∴ Inflamation is the one of the most imp and most useful diff. mechanism of our body, It protect our body by killing the foregin partical but our own tissue are injured.

The basic simptoms of Inflamations are ∴

1) Swelling (Shumoo)
2) Redness (Rubor)
3) Heat (Calor)
4) Pain (Dalar)
5) Loss of function (Laesa)

Inflamation involve cellular or tissue ppt; the role of Inflamation is to protect the body contain impurious agent that inhabites in our body.

It is very common to have some degree of necrosis in the area of inflamation.

Types of Inflamation ∴

On the basis of area of inflamation in body it may be of fallowing types.

i) Dermitis ∴ Inflamation in skin.
ii) Nephritis ∴ Inflamation in Kidney.
iii) Glomerular Nephritis - Inflamation of Glomerulaus.
iv) Conjuctivitis ∴ Inflamation in

v) Meningitis - Inflamation in Brain

vi) Myocitis - Inflamation in muscle

vii) Artheritis - Inflamation in Joint

viii) Pancreatis - Inflamation in Pancreas

ix) Enteritis - Inflamation in

x) Hepatitis - Inflamation in liver

Inflamation can be further classified on the basis of duration (अवधि)

(i) Pre acute Inflamation
(0-4 hr)

(ii) Acute Inflamation
(3-5 day)

(iii) Sub Acute Inflamation
(Fourday - 1 week)

(iv) chronic Inflamation
(1 week to month)

(v) chronic Active
(- Permanent)

M.Imp

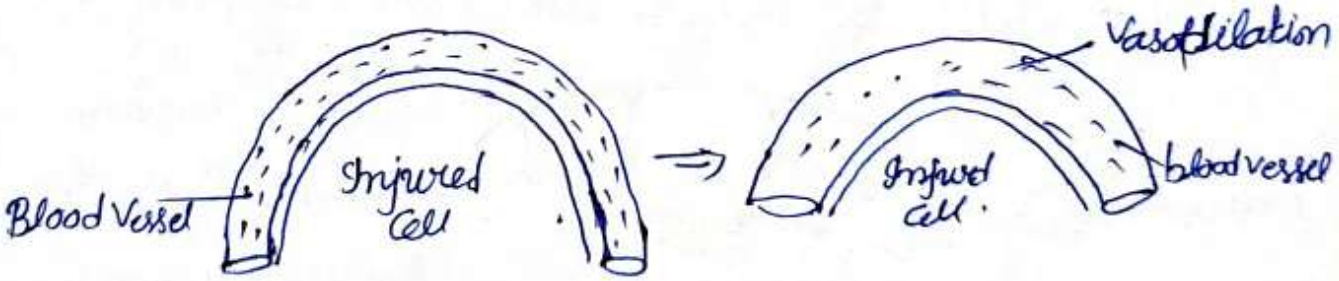
Mechanism of Inflamation :-

The mechanism of Inflamation Invalve fallawing steps :-

(i) Migration
↓
(ii) Rolling & Athession
↓
(iii) Emigration
↓
(iv) Chemotaxis
↓
(v) Degradation
↓
(vi) Inflamation

(i) Migration

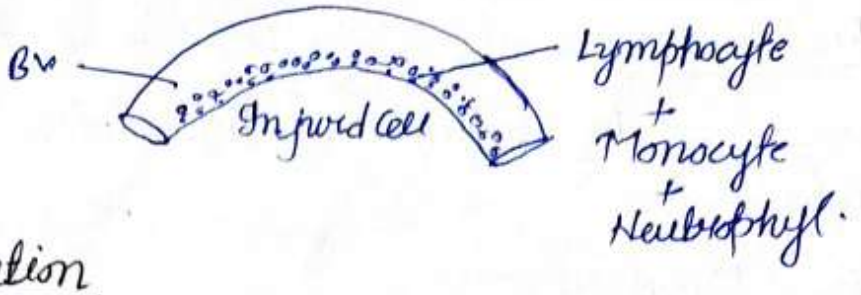
In this step vasodelation start of the blood vessel above the injured cell., So the lumen size of blood vessel is increases so the flaw of blood is also ↑es at that injured Area.



(2) Rolling & Athession

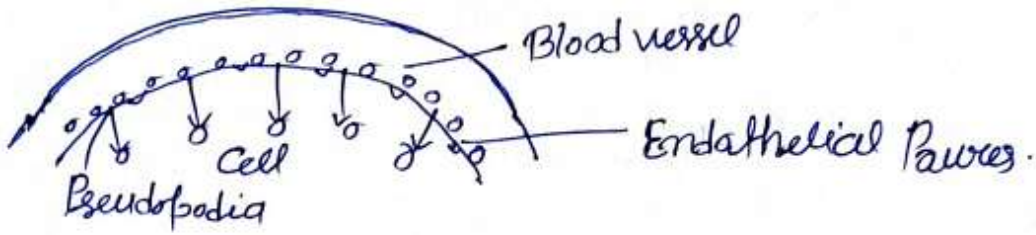
When the flaw of blood is ↑es then the more lymphocite, Monocyte, And Neutrophil cell moove towards the ~~adhere~~ ~~on the~~ injured cell and get Athere on the endothelial layer of the blood vessel.

After rolling and Athession they form ~~a~~ thick layer on the cell surface.



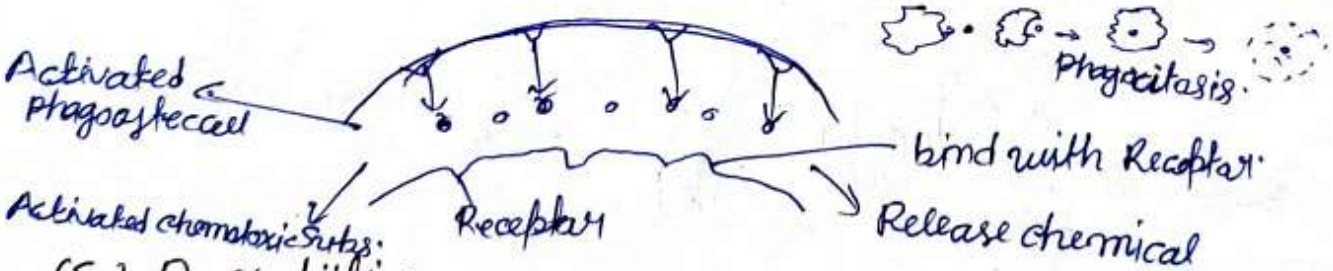
(3) Emigration

On the inner lining of endothelial membrane endothelial pores are present which is also known as pseudopodia. Across this pseudopodia the lymphocyte, monocyte and Neutrophyl cell get migrade into inside the cell.



(4) Chemotaxis :-

When lymphocite, monocyte and Neutrophyl cell comes inside the cell then they bind the histamin receptor and activate phagocitis cell and release some toxic chemicals.



(5) Degradation

After releasing the Phagocitis cell they engulf the foreign particle and degrade them this is called phagocitosis.

→ Histamin receptor release some toxic subs which distroy the foreign particle along with that cell.

(6) Inflamation

Due to effect of toxic chemical subs that particular area of skin is get affected, it swell, becomes red, Produce some heat and pain occurs, These events are called inflamation

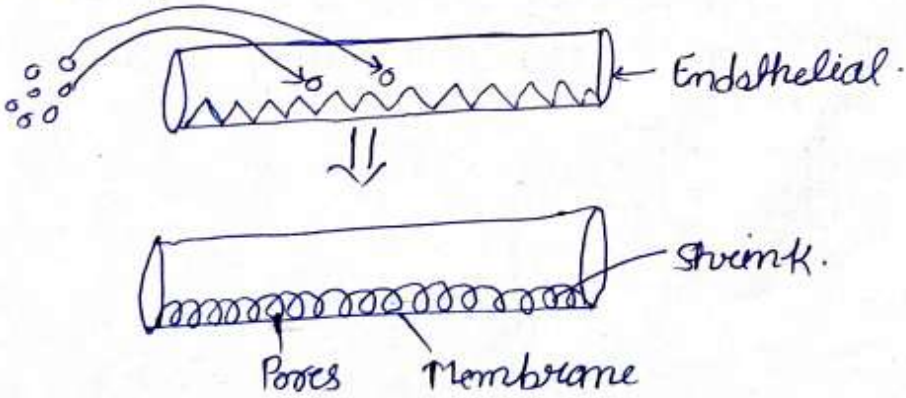
∴ Alteration in Vascular Permeability and Blood flow ∴

During inflamation the permeability of blood vessels is increase so the blood flow is increase.

There are following 5 reasons for alteration in vascular permability.

i) Retraction of Endothelial Cell & leakage:-

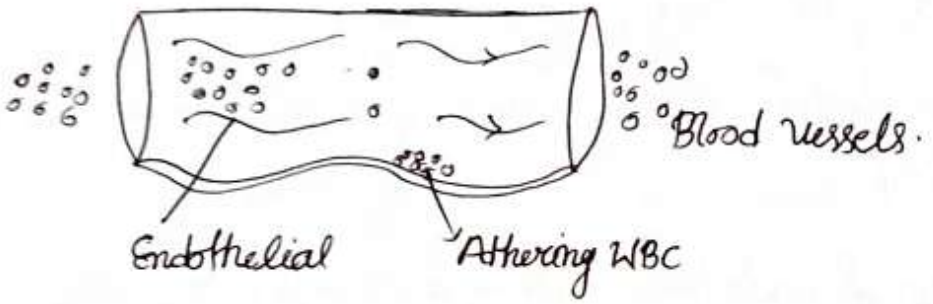
When inflametary medicators bind with the receptors of endothelial membrane then the endothelial membrane is shrink and by the deposition of chemical mediators the permability of blood vessels is increase after leakage.



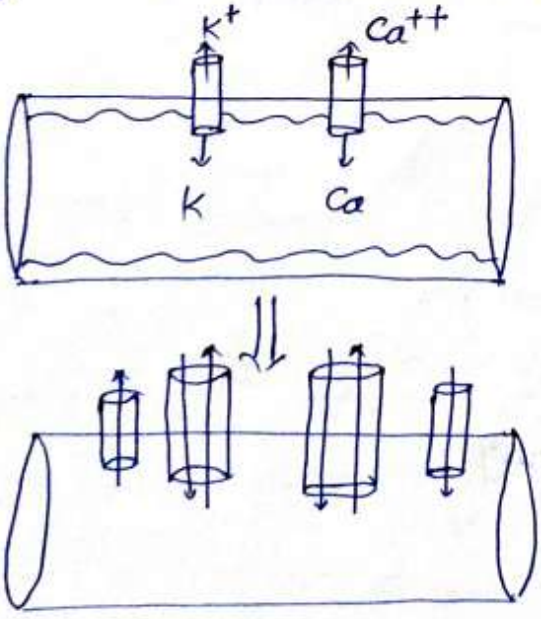
I) Retraction of endothelial cell & leakage.
II) Direct endothelial injury.
III) Leucocyte dependent cell injury.
IV) Increase Transcytosis.
V) Leakage from new capillary.

2) Direct endothelial Injury:-
Due to effect of injury toxin and endothelial necrosis the permability of blood vessels is alter.

3) Leucocyte dependent Cell Injury :-
Neutrophyl or leucocyte when adhere on the surface of endothelial membrane when they release some inflametory mediators and alter the permability of blood vessels.



4) Increase Transcytosis :-
In the blood vessels different pores and (chemical) channels are present by which the transcytosis of ions takes place.
But when the ns of channels or the size of channels is increase then transcytosis is increase and permability is altered.



5) Leakage from New Capillaries :-

After damage of organs and blood vessels. by the proliferation process new blood vessels are form which release the VEGF (Vascular ~~Endothelial~~ growth factor) and Endothelial cells are leaky.

Migration of WBC during Inflamation :-

Medeators of Inflamation :-

During inflamation WBC cells like neutrophyls, Acidophyl, Basophyl and Macrophase migrate towards the inflammetary site and they release lots of chemical which cause the inflomation these chemicals are knaum as Inflametary mediators.

On the basis of effect on organ inflametary mediators canbe classified into following types.

1) Vasodilation :-

Histamine
Nitric Oxide
Prostaglandish (PG)

[PE] → PGE_2, PGI_2, PGF_2

2) Increased Vascular Permability :-

- Histamin
- Bradykinin
- Reactive oxygene species (ROS)
- Leukotrienes (LT)

[LT] < LTE_4, LTD_4, LTC_4

→ Plasma activating factor (PAF)

3) Chemotaxis :-

- Leucotrienes < LTB_4, LTC_4
- Chemokines
- Interleukin [IL] < IL_1, IL_8

4) Fever :- < Prostaglandish, IL_1, IL_8

5) Pain :- Brady kinine.

Prostaglandin → (PGF_2)

6) Tissue Damage :- - ROS
- Nitric oxide
- Lysosomal Enzyme

Histamine :- Histamine is present in the granules of basophyl and platelets but its main source is masked cell which is present in connective tissue., Histamine is responsible for the early response in type-1 hyper sensitivity reaction or allergy, It is imp in the immediate active phase of increased vascular permability, During asthma histamin is release from the smooth muscle of bronchi and causes constriction of windpipe. There are following chemicals which stimulate the release of histamine from masked cell like immunoglobulin (IG, IL, Cytokines and neuropeptedes) etc.