

03/01/2020

- Instrumentation → Diagnostics
  - Biotechnology - RDT → Therapeutics
  - Biocompatible Prostheses
  - Biophysics → ECG, EEG, MEG, Action Potential
  - Biomechanics
  - Biological modelling.
  - Bioinformatics
- Diagnostics websites:-
- ① www.nih.gov
  - ② www.webmd.com
  - ③ www.drugs.com
  - ④ www.mayoclinic.com
  - ⑤ www.Merckmanual
  - ⑥ onlinemeded.com
  - ⑦ www.ncbi.nlm.nih.gov-pubmed
  - ⑧ www.medlineplus.gov

# Introduction :=

# Biochemistry := (fats, proteins)

# Diet & Nutrition

# Instrumentations

04/01/2020

# Applications = Diagnostics  
= Therapeutics

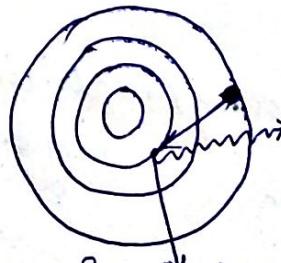
- 1) Engineering  
- John D Enderle,  
Susan M Blanchard,  
Joseph D Bresino.
- 2) Biomedical Eng.  
- W. Mark Saltzman
- 3) Biomedical Instrumentation & Measurements  
- Cromwell, Weber, Pfleiderer
- 4) Biomedical Instrumentation  
- Khandpur

X-Ray := X-Ray are high energy radiations.

$\lambda \approx 1 \text{ nm}$ .  
 $E = 120 \text{ eV to } 120 \text{ keV}$ . so, they are divided as soft & hard x-rays  
as they carry high energy (protons)

This high energy is produced when photon bombard with electrons, by this bombardment  $e^-$  are ejected. (Inner transition). so, the energy is released. This is

X-Ray.



How this energy is useful → .

Q.  $\gamma$ -Ray energy is higher than X-Rays. Then also why X-rays are important?

- ⇒ X-Rays are efficient rays to take photographs.
- X-Rays have right amount of energy which can go through flesh, blood & all but can't pass through bones. So, photographs can be clearly seen and cracks and other wears in bones can be seen easily as X-ray can pass through cracks but not bones.
- ⇒ City scan is harmful than X-ray.

## # Positron Emission Tomography (PET) scan.

- Metastasis → spread.      ↳ (not much harmful)
- ⇒ PET detects metastasis of cancer.
- ⇒ PET tells biochemistry of cells and tissues → physiology  
physiology → functions in body  
Analogy → structures in body.

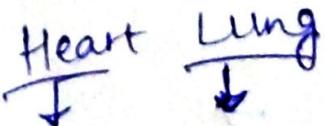
### How does PET work :- (PET principle)

Person is injected with radionuclide, they disintegrate into positrons and they react with electrons in body and emit  $\gamma$ -rays. These  $\gamma$ -rays coming out can be scanned and by this, the fault can be detected.

⇒ Brain physiology along with cancer can also be detected by PET.

## # Heart Machine :- (Heart Lung Machine)

Function :-



Pump will make flow of blood & then pass to oxygenator. This will make  $CO_2$  go out.

## # ECG :- (Electrocardiogram).

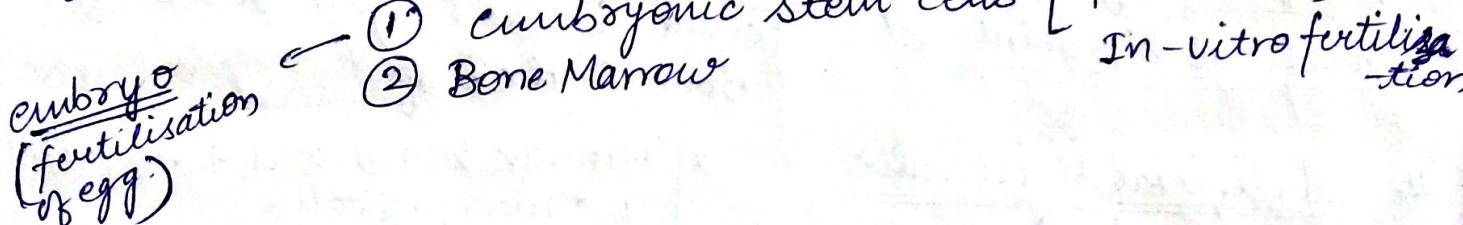
Electrodes record the electric potentials from heart.  
They can be seen if the heart is working properly.

## # Pleuriotent stem cells.

Stem cells:- The cells which have particular property of -

1. Give rise to same cell
2. Give rise to ~~any~~ other specialised cell.  
(Brain cells, blood cells, pancreas cells)

stem cells can be get from



- IVF steps-
- ① Ovarian stimulation (Hormone therapy)
  - ② egg pickup (aspiration)
  - ③ sperm preparation
  - ④ egg fertilisation
  - ⑤ embryo development
  - ⑥ Embryo transfer

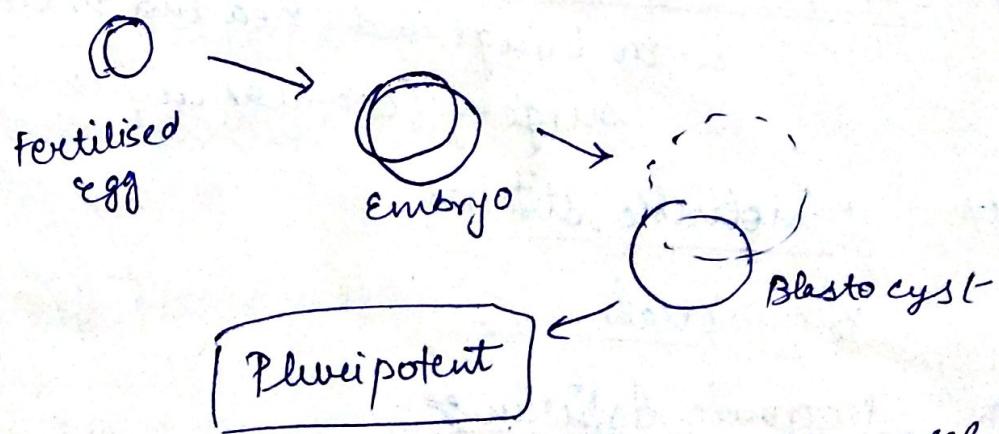
06/01/2020

## Pleuriotent stem cells:-

(Master cells).

Cells that are self replicating and are

derived from human embryos



Pleuriotent

cardiac muscle  
into cells & tissues

Blood cells

Neural.

06/01/2020

In Vitro fertilisation → outside Mother's womb.  
In Vivo fertilisation → Inside Mother's womb.

# Artificial skin := Polymer scaffold

This Branch is tissue engineering.

# Artificial Heart :=

Artificial organs

Artificial hip joint

→ femur head (Ball) & socket of the joint.

Femur is the longest & strongest bone in the body.

# Artificial Heart valve

Biological value      Mechanical value  
(Human or Porcine)

\* Human heart has 4 valves:-  
1. Tricuspid valve  
2. pulmonary valve  
3. Mitral valve  
4. aortic valve

→ Defibrillator :- It restores normal heart rhythm by delivering a dose of electric current to the heart.

# Contact lens :-

# Drug delivery patch

# Cochlear Implant :- Impulses / nerves are ~~with~~ injected with things and hearing problems are handled by surgery (cochlear implants).

# Dissolvable stitches

Biomaterials =

# Electronic Aspirin =

Aspirin is drug which is taken for headaches. This drug block the nerves which has pain. so, we don't feel pain.

when kept on the pain part of body (outside). It electrically stimulate that nerve by ~~giving~~ electrical impulse. and blocks pain signals to the brain. It acts like Aspirin but electrically.

### # Camera Pill :-

It is capsule which have light emitting diodes (LED). which when taken into the body emits light inside the body. when Pill rotate inside the body, these LEDs take pictures. And then it radiate and the devices/detectors can ~~detect or take~~ show detected photographs.

# Also, there are remote controlled camera pills.

### # Bionic pancreas :-

Pancreas has four kind of cells.

Pancreas is important part of body.

Pancreas release insulin inside the body.

Glucagon is released and glycogen come out.

So, Bionic pancreas is type of Artificial pancreas. This device release insulin in body ~~and also~~ when sugar level increase in the body.

when sugar is less, glucagon is released in body.

→ Insulin & Glucagon are hormones.

↓  
when sugar is more      when sugar level is less.

### # Clarity - Transparent organs

# Nano Drugs :- It don't spoil other things. It goes & directly affect the part where required.

## Vocal Biomarkers :-

MRI Scanner :-

CT Scanner :-

future of Diagnostics

think about useful Bioengineering product that you can develop as a Biomedical engineer?

Ques) List useful devices which you know around are not listed yet?

~~(Ans)~~

17UME012 Aspoora Daga

Ans. 1) ⇒ Device that kill pain of old people.

Product that kill the pain in bones ~~of~~ of people . not only the muscular pain of body and also which give permanently relief to the pain and weakness of the body . For Example :- Artificial Bones ( ~~Anal~~ )

Ans. 2) ⇒ Useful devices which we know but not listed &  
→ Ear Thermometer.  
→ CRT tube.

08/01/2020

Chapter-3

Medical Terminologies

(1) Prefix + Rootword + suffix

(2) Basic fundamental word.

# Medical words :-

1) Anatomy - study of Bone structures of Body

2) Physiology - study of functions of Body (cells, all)

3) Pathology - study of diseases.

diseases study

Pathogenetics

Pathophysiology → study of abnormal functions.



<u>Prefix</u>	<u>Root</u>	<u>Suffix</u>	
	<u>Cardi/o</u>	+ <u>logy</u>	→ cardiology
1.)	(Heart)		
	<u>Cardi/o</u>	+ <u>logists</u>	→ cardiologists

2.)	<u>Peri</u> ↓ outer	<u>Cardi</u> ↓ heart	<u>itis</u> ↓ Inflammation	→ Pericarditis
	<u>Brady</u> ↓ slow	<u>Cardia</u> ↓ heart		→ Bradycardia
	<u>Tachy</u> ↓ fast	<u>Cardia</u> ↓ heart		→ Tachycardia
3.)	<u>Electro</u> ↓ electrical	<u>Cardi/o</u> ↓ heart	<u>gram</u> ↓ recording	→ Electrocardiogram (ECG)
		<u>Cardi</u>	<u>itis</u>	→ Carditis Inflammation of heart

APOORVA DAGRA

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08/01/2020

Ans 1.7 ⇒

Names →

1. Myocardium → Muscular tissue of heart
2. Epicardium → Innermost layer of pericardium attached to muscles.
3. Endocardium → Membranes inside of heart
4. Discarding →
5. Epicardial → cells in inner layer of heart
6. Noncardiac → Not affected with heart.
7. cardiothoracic. → Heart & chest or lungs related
8. Cardiomyopathy → Heart ~~disease~~ muscle disease of the

## # Root words :-

<b>Anthro</b>	<b>phobia</b>	fear of society/people
<b>Gyno</b>	<b>phobia</b>	fear of dogs
<b>Ecto</b>	<b>mophobia</b>	fear of insects
<b>gamet</b>	<b>ophobia</b>	fear of marriage
<b>gyno</b>	<b>phobia</b>	fear of women.
	<b>philophobia</b>	fear of love
	<b>caligynephobia</b>	fear of beautiful women

1. **Abdomin/o** → stomach
2. **arthr/o** → joints
3. **cyt/o** → ~~phys~~ cells
4. **derm/o** → skin
5. **gast/o** → stomach
6. **hepat/o** → hepatitis (liver)
7. **leuc** → white
8. **Oste/o** → bone
9. **Rhino** → nose
10. **Renal** → kidney
11. **Pulm/o** → lungs

, leucopenia → decrease in white blood cells.  
 leucocytes → wBC.  
 leucamia → Abnormal in Bone marrow  
 (WBC cancer)  
 leucoderma → white spots.  
 leucorrhoea → thick white discharge through vagina due to imbalance of estrogens.

## # Prefix :-

1. **endo** - within
2. **hyper** - above normal
3. **hypo** - below normal
4. **Macro** - large
5. **Micro** - small
6. **Peri** - around.

7. **Dichmophobia** → fear of pointed objects

**Hydrophobia** → fear of water

**Haemophobia** → fear of blood

**Autophobia** → fear of being alone

**Chlorophobia** → fear of Confinement

## # Suffix :-

1. **algia** - pain
2. **graphy** - process of recording
3. **ist** - one who is specialised
4. **itis** - Inflammation
5. **ologist** - pain specialist
6. **pathy** - disease
7. **phobia** - fear of something
8. **scope** - tool

**Aclophobia** → fear of darkness  
**Zoophobia** → fear of animal  
**Endrophobia** → fear of men  
**Acrophobia** → fear of height  
**Astraphobia** → fear of thunderstorms

## # Abbreviations 1-

1. bid → twice a day
2. bise → in die
3. tid → thrice a day
4. ca → cancer of lungs
5. BP → Blood pressure
6. CXR → chest x-ray
7. GI → gastrointestinal
8. IM → Intramuscular
9. IV → Intra/venous
10. ER → Emergency room.

10/01/2020

benign → non-cancerous

malignant → cancerous

Adenoma → swelling

Syndrome → A group of signs of symptoms occurring together.

AIDS - Immunodeficiency syndrome

IBS - Irritable Bowel syndrome

Premenstrual syndrome → physical & mental signs occurring together

Metabolic syndrome →

Aetiology → cause of disease

Prognosis → prediction of outcome

Metabolism → Set of chemical reactions occurring in living organisms to maintain life.

Properties of

life → 1. Structure  
2. reproduce & grow  
3. respond to stimulus

Metabolism

Catabolism      Anabolism  
↓                  ↓  
lipid

= Metabolic Pathway - A series of chemical reactions accelerated by enzymes called Pathway  
A Collection of Metabolic pathways is called Metabolic networks.

→ carboxylic acid --

## # Citric Acid Cycle / Krebs cycle etc - (TCA cycle)

Large no. of chemical reactions take place. In this cycle,  
power is obtained in mitochondria of organisms by  
releasing stored energy through oxidation of Acetyl-CoA.  
Eukaryotic cells → Cells have nucleus with well defined membrane.  
Prokaryotic cells → Cells are not well developed.

## # Homeostasis etc Balance

~~It is response of all chemical reactions taking place &~~  
It is a physiology process that monitors & observe & maintains a stable internal environment or equilibrium in response to fluctuations in outer environmental weather.

Different cases :- Pressure, Temperature, Heart rate, ph balance, Blood concentration, osmoregulation

- ① Temp. is most important (Body Temp.) ↑ ↑ Priority level & importance
- ② sugar level.
- ③ Organ :- Brain, liver, kidney (gives balance).

## \* Negative feedback Mechanism etc

↳ Principle of Homeostasis.

# # Negative feedback Mechanism

014-... Imp-Read

## ① On temp. Basis :-

Body Temp.  $\rightarrow$   $98.6^{\circ}\text{F}$  or  $37^{\circ}\text{C}$ .

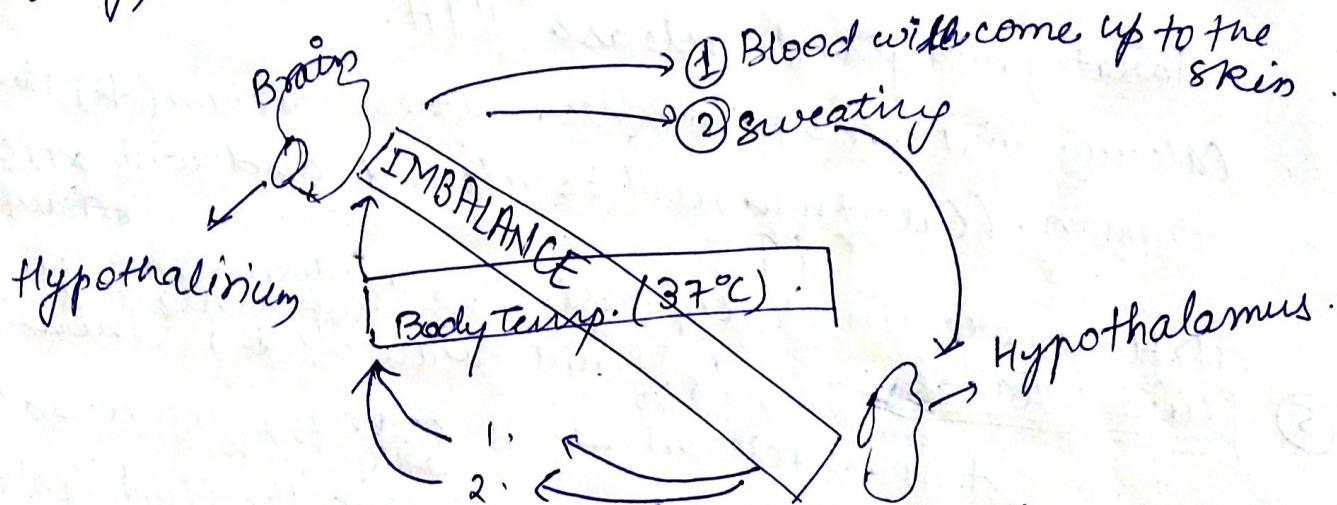


1. Blood vessels near to skin.
2. sweating



### Hypothalirium

In summers, ~~capillaries~~ capillaries dilate and the blood cells will come up and radiate heat- & secondly due to sweat glands (sweating of body) radiates heat.



If Imbalance is created then blood cells will go down and will radiate less heat.

when Body Temp. ( $\downarrow$ )  $\rightarrow$  Body shivers.

Hypothalamus detect the body temp.

## ② sugar Basis :-

when insulin is released from pancreas, it act as key to open up the blood cell and glycogen will come out of cell.

Pancreas  $\xrightarrow{\text{release}}$  insulin  $\xrightarrow{\text{when sugar level } (\uparrow)}$  insulin  $\xrightarrow{\text{in cell}}$

13/01/2020

- 1.) Temp.
- 2.) sugar level
- 3.) iron
- 4.) Calcium
- 5.) fluid Balance
- 6.) Acid/Base

Metabolism  
(Homeostasis)

③ Tony

④ Calcium Basis :- when calcium is less,  $\downarrow$  PTH Hormone. is released.

Parathyroid glands release PTH.

calcium will come from Bones. when Calcium ( $\downarrow$ ) then hormone (Calcitonin) will be released and will stick  $\uparrow$  on surface

⑤ ADH  $\rightarrow$  Arginine Vasopressin  $\rightarrow$  This Hormone made from Hypothalamus in Brain

fluid Balance :- If fluid Balance ( $\downarrow$ ) then ADH is released  $\rightarrow$  It ~~decreases~~ then decrease the

amount of urine, maintain the fluid Balance

ADH tells your kidney how much water to conserve.

sodium concentration  $\rightarrow$  Kidney is responsible for sodium conc. and is responsible for urine output.

Hormone Renin ( $\uparrow$ ) when sodium conc. is ( $\downarrow$ ).

Amf  
⑥ Acid/Base Balance :-

pH of Blood is 7.35 to 7.45. Avg. is 7.4.

pH is conc. of  $H^+$  ions. It exist in form of  $H_3O^+$ .

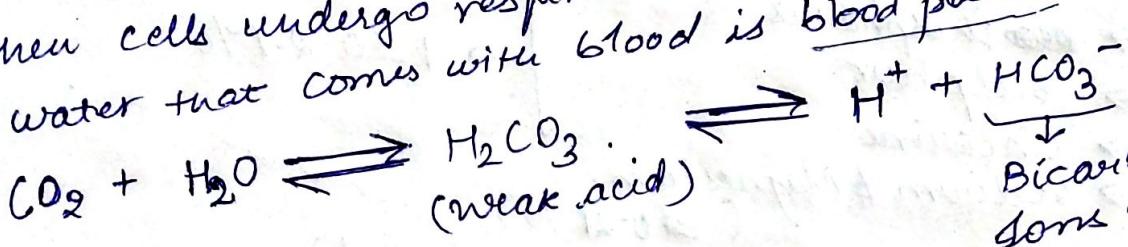
$pH = -\log(H^+)$ .  $(H^+)$  is in range of  $10^{-7}$ ...

If pH is less than 7  $\rightarrow$  Acid.  
equal to 7  $\rightarrow$  Neutral  
More than 7  $\rightarrow$  Basic.

If pH ( $\downarrow$ ) below 7 then blood is acidic. That problem is termed as acidosis or acidemia.

If pH ( $\uparrow$ ) above 7.3 or 7.5 then blood is more basic. That problem is termed as alkalosis.

When cells undergo respiration, it takes  $O_2$  and release  $CO_2$ . The water that comes with blood is blood plasma.



Bicarbonate ions.

Kidney's function - It filter or removes waste & balance fluid. Kidney maintain balance in acid-base by excreting acids into urine & returning  $HCO_3^-$  (base substance) to the blood.

\* (RTA) Renal tubular acidosis is disease that occurs when kidneys fail to excrete acids in urine  
(Renal  $\rightarrow$  kidney).

- ① Respiration
- ② Renal function
- ③ Bicarbonate buffering

when Respiration occurs as  $HCO_3^-$  and  $H^+$  (alkalis) come ~~back to~~ back from kidney to body, respiration rate ( $\uparrow$ ) then the reactions goes backward & released  $CO_2$ . when  $CO_2$  in body ( $\uparrow$ ), the respiration rate ( $\uparrow$ )

# Biochemistry :-

## Revision of chemistry :-

### ① Elements :-

Mostly important elements present in great amounts -

- 1) Water  $\rightarrow$  70%      Group ① Carbon - 18%  
 2) Carbon  $\rightarrow$  18%      Hydrogen  
                                   Nitrogen - 9%,  
                                   Oxygen } 5 to 20%

### Group ②

- 1.5%  $\rightarrow$  calcium  
~~→ Phosphorus~~  
 → sulphur  
 → chlorine  
 → sodium & Magnesium.  
 (0.25%)

}  $\rightarrow$  1 to 2.1%

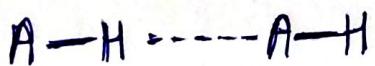
### Group ③ $\rightarrow$ Trace elements (less found).

- Iron  
 Chlorine  
 Zinc  
 Iodine  $\rightarrow 10^{-9}$

Anaemia  $\rightarrow$  due to lack of Iron, vitamin B-12

Anemia  $\rightarrow$  Destruction of RBC.

### ② Hydrogen Bond := It is due to attraction with molecules.



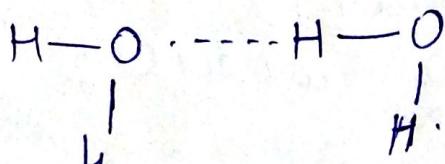
A, B are either fluorine, chlorine  
or Iodine.

High electronegative  
They have e<sup>-</sup> affinity and they try  
to pull e<sup>-</sup> from Hydrogen.

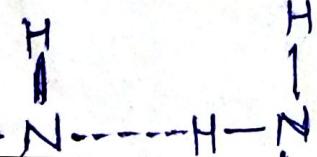
A, B should have at least one or two lone pairs.

### Example of H Bonds :-

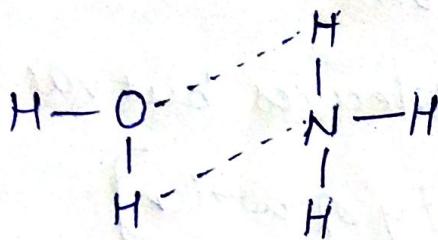
#### 1) water,



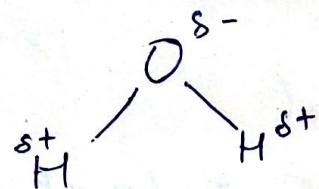
#### 2) Ammonia,



3) Amonium - water : —  $\text{NH}_3 \text{H}_2\text{O}$



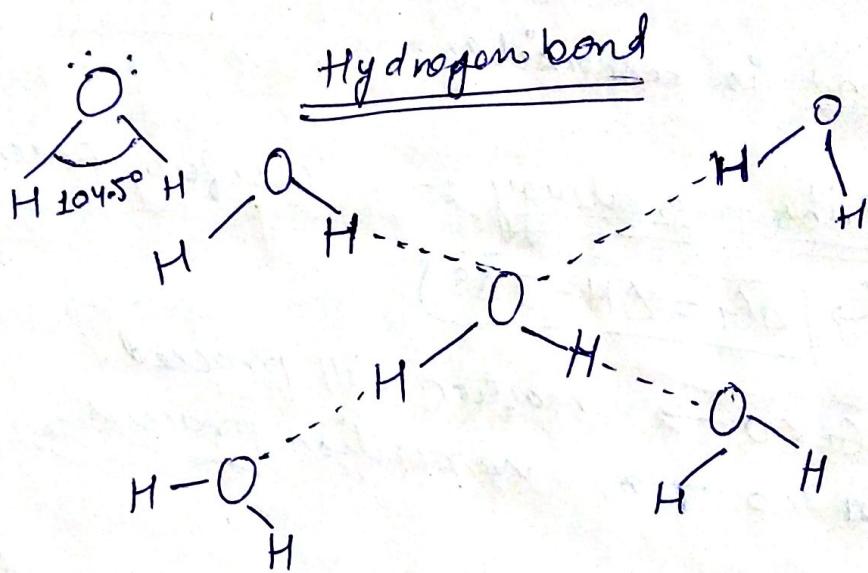
water is a polar molecule



Dipole Bond.

- partially attract  $e^-$  with Hydrogens.

Bent structure :-



~~Ans~~

Properties of water :- 1) It is universal solvent

2) Hydrophilic  $\rightarrow \text{NaCl} + \text{H}_2\text{O} \rightarrow \text{Na}^+ \& \text{Cl}^-$

3) Polar Molecules  $\rightarrow$  can't dissolve in molecules.

$\hookrightarrow$  Hydrophobic

4) Amphiphilic  $\rightarrow$  Both polar & non-polar molecules are present

$\text{O} \text{ H} \rightarrow$  nonpolar

5) It is excellent coolant. It cools because it has high specific heat due to high specific heat.

- 6.) insects can walk on water because it has good surface tension
- 7.) High Boiling & freezing point.
- 8.) Less density. ( Much Molecules but vacant ).  
 (Density of Ice < Density of water)

15/01/2020

# Salt has property to absorb. So, Heat is trapped and we feel relief through pain when kept on it.  
 Heated salt

H-Bond is responsible.

# Gibbs free energy :- useful free energy.

$$\Delta G = \Delta H - T\Delta S$$

$\Delta G < 0 \rightarrow$  reaction will proceed.

$\Delta G > 0 \rightarrow$  no reaction proceed.

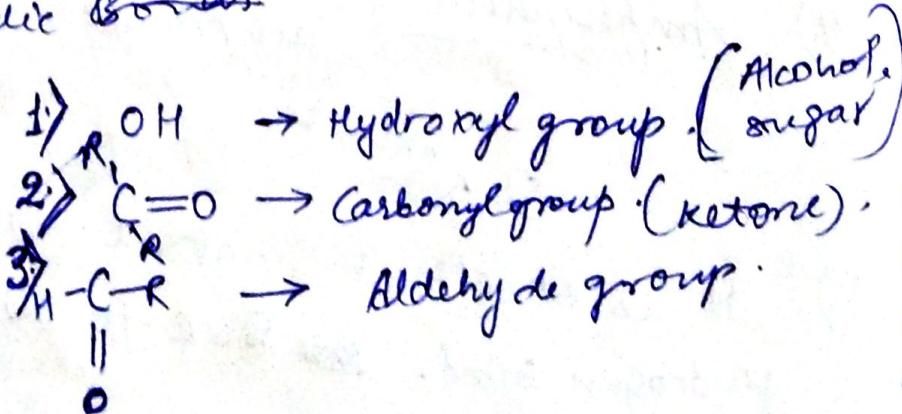
ATP.

Carbon is stable and make four stable bonds.  
 Simplest bond is Hydrocarbon.

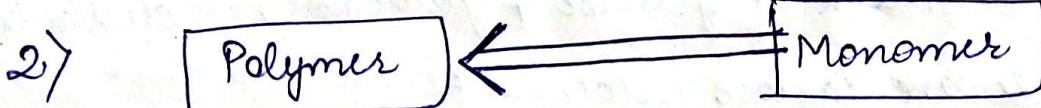
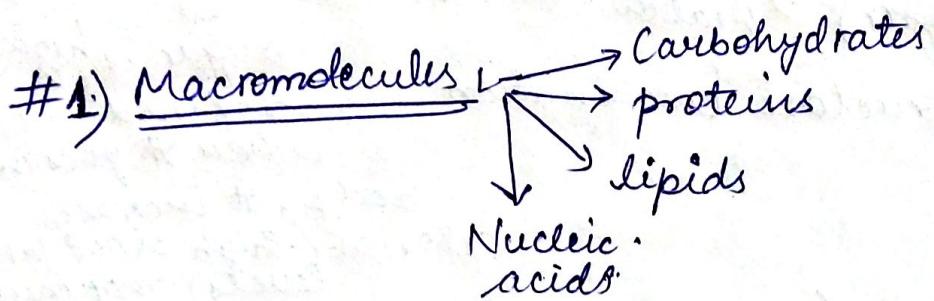
$C_nH_{2n+1}$  → Saturated Hydrocarbon  
 (all are single bonds).

- \* double or triple bonds → unsaturated Bonds.
- \* Aromatic bond → cyclic Bonds
- \* Functional groups :-

Carbonyl group ( $C=O$ )  
 Aldehyde -  $CHO$   
 Ketone  $R-C(=O)R$



- 4) Amino group  $-NH_2$
- 5) Carboxyl group  $-COOH$
- 6) Phosphate group  $PO_4^{3-}$
- $R-C(=O)-OH$  fatty acids

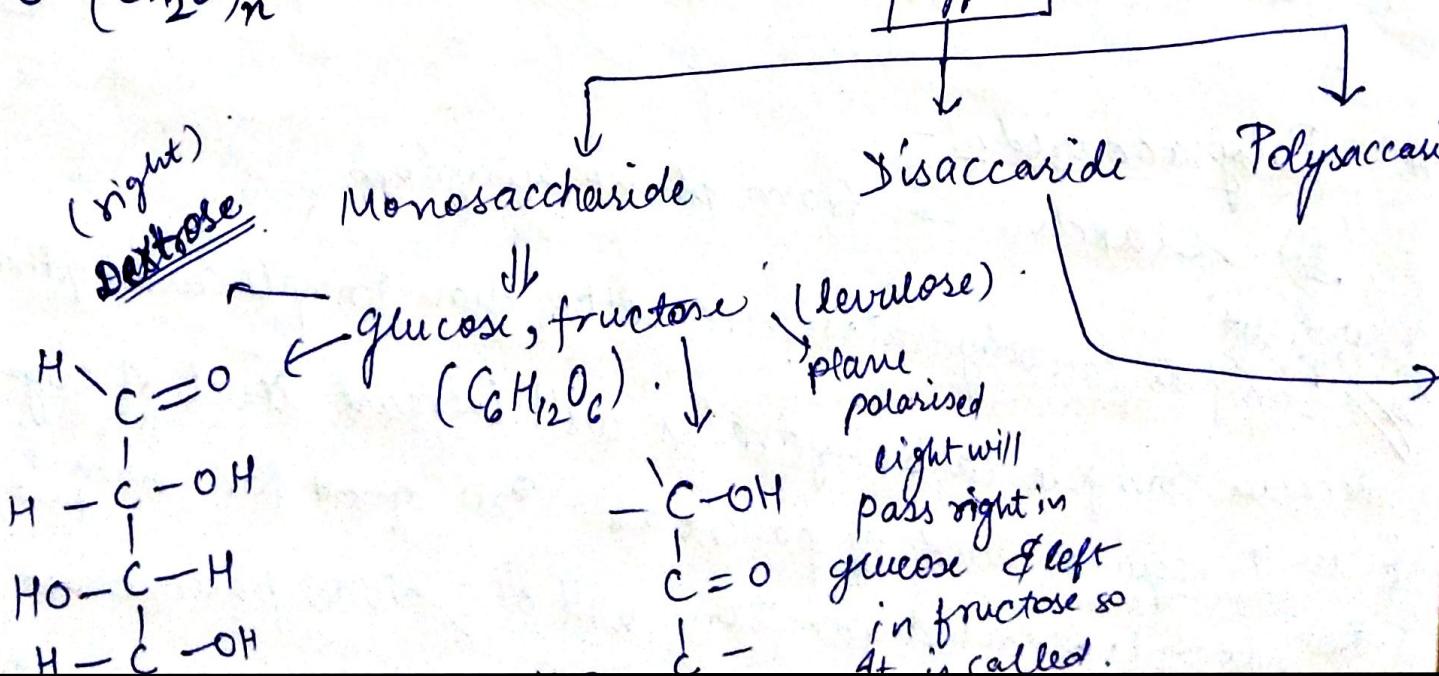


small molecules release  $H_2O$ .  
 small molecules (Monomers) combine together & form polymer. This process is called polymerization.

### # Carbohydrates -

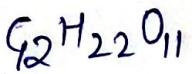
- ① Sources - Rice, Chapati, Potatoes, Sugar
- ② Energy (primary source of energy).
- ③  $(CH_2O)_n$

#### Types



## Disaccharide

1) Maltose → Two molecules of glucose



2) Sucrose → (sugar) → bad for health (why?)  
↳ glucose & fructose combination

3) Lactose → Milk (glucose + galactose). diabetes  
Some people are lactose intolerant.

The inability to fully digest sugar (lactose) in dairy products. This is caused by deficiency of an enzyme in body called lactase ..

- \* Milk → good for babies as in smaller age, they form lactase (enzymes). After years of 21, Milk should not be taken because it is not digestible. & decrease amount of starch.
- \* Excess calcium from milk can increase risk of prostate cancer. (Milk sugar linked to higher risk of ovarian cancer).

## # Polysaccharides-

1) Starch → from plant kingdom.

~~Why complex carbohydrates?~~ complex carbohydrates are better than simple carbohydrates

Because simple carbohydrates will increase level of sugar & will require work of pancreas. But good for instant energy.

~~But~~ complex carbohydrates will require pancreas

metabolism slowly & ...

2) Glycogen

3) Cellulose → from plants

↳ It acts as a fibre, they are imp. & can't digest and won't give energy.

Animals can digest cellulose but humans can not.

20/01/2020

# Honey :- pH → 4 (acidic)

- contains proteins, potassium, amino acids, fatty acid
- when falling sick, taking honey is beneficial
- moisture is reduced to 70% to 76% by Honey bee in honey

\* Ketogenic diet

- for weight loss.
- doesn't derive energy from carbohydrates
- fish, eggs,

\* Intermittent fasting :- food window of ~~within~~ 8 hrs rest 16 hrs for resting (no eating)

\* Glycemic Index :- food having high glycemic index content should be avoided.  
↳ tell us that glucose level is increasing.

\* Insulin Index → tell us insulin level.

# Carbohydrates -

Glycemic level } < 55 → good for health)

56 to 59 → medium

> 60 → Bad.

35 to 75% energy comes from carbohydrates.

storage of energy  
structure of plant  
instant energy } → functions of carbohydrates.

## \* Simple Carbohydrate & Complex carbohydrates

Roti, chawal.

## # Fats / lipids :-

### Characteristics :-

- ① Insoluble in water.
- ② highly soluble in organic solvents.

### Functions :-

- ① Store energy.
- ② Cell communication.
- ③ structural components.

Our Brain prefers carbohydrates for energy rather than fat.  
Brain takes energy from ketone.

## \* Fatty acids:- ① long chain of carbon (-COOH group)

→ saturated fatty acids (single bonds).

→ solid at room temp. blw long C chain.

→ animal origin mostly.

→ not good for body (Example - Butter)

Coconut oil is saturated fat not good for health

But good for health not good for health

As it is not long chain of saturated carbons. because it is a medium chain

→ Monounsaturated can be digested

→ one double or triple bond.

→ Polyunsaturated (PUFA)

→ mostly ~~animal~~ plant origin

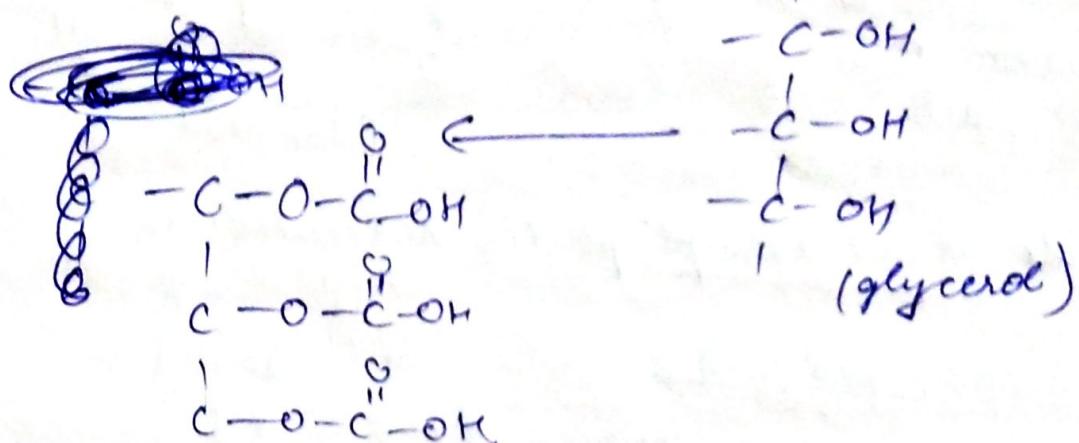
→ fish oil, olive oil.

→ ω3 & ω6 fatty acids one side

# Popular fats :-

Neutral fat  $\rightarrow$  1) Triglyceride

Glycerol is molecule  $\rightarrow$  with 3 carbons &  $\begin{array}{c} \text{OH} \\ | \\ -\text{C}-\text{OH} \\ | \\ \text{C}-\text{O}-\text{C}-\text{OH} \\ | \\ \text{C}-\text{O}-\text{C}-\text{OH} \end{array}$  groups  
 $\text{H}_2\text{O}$  will be released to form Triglyceride.



\* Artery will become narrower due to deposition of saturated fat, that disease is called Atherosclerosis.

$\Rightarrow$  ~~9~~ 9 calore per gram ~~of~~ in fats (twice that of carbohydrates)

2) phospholipids  $\rightarrow$  They are modified form of Triglyceride

One of fatty chain is replaced by phosphorus group.

Large No. of phospholipids are present in cell membrane.

22/01/2020

Structure-Types :- (A) Triglyceroid

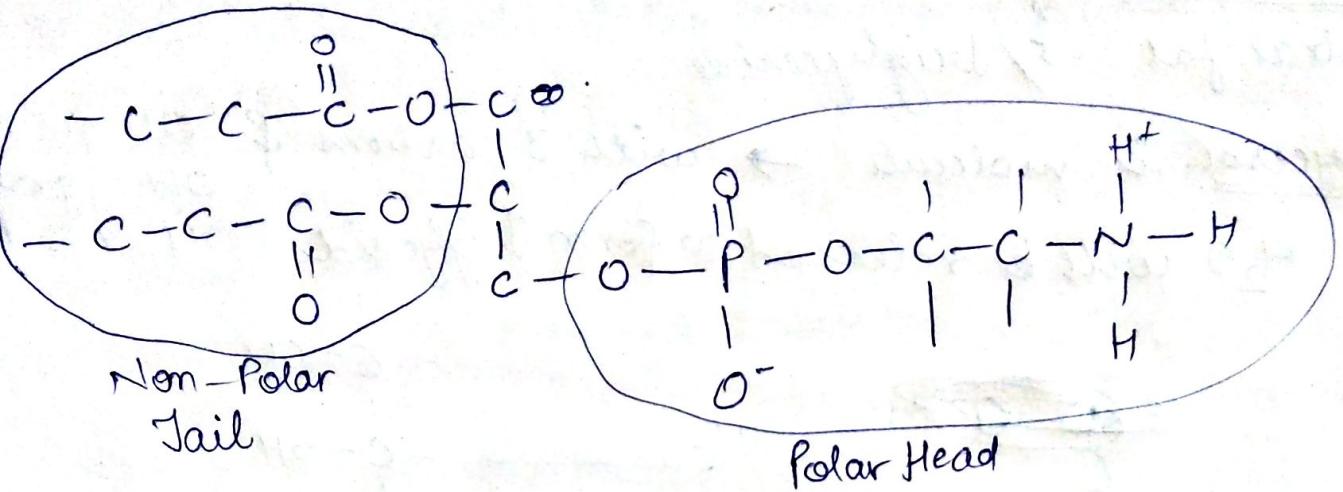
(B) phospholipids (Bilayer) -

(C) Cocoa Butter

(D) Hydrogenation

(E) Essential fatty acid .

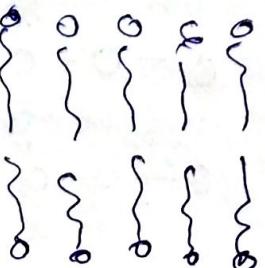
$\rightarrow$  Phospholipids are called Lipid Bilayer. As it has polar Head & Non polar tail. These molecules are called Amiphilic molecules.



This is called Amphiphilic molecules.

\* Phospholipid Bilayer :-

(group of molecules)

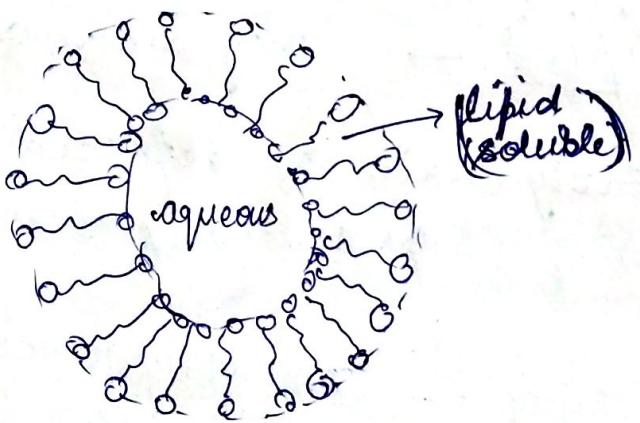


\* ~~Artificial~~ Artificial Bilayer :-

(1) Micelle



(2) Liposomes :-



3) Cocoa Butter :- ~~(Hydrogenation)~~ <sup>(Theobroma oil)</sup> It is pale yellow, edible fat extracted from cocoa bean. It is used to make chocolate as well asointments.

4) Hydrogenation :- Converting liquid fat to solid fat. It makes compounds saturated with hydrogen atoms.

process of hydrogenation.

Trans-fats are form of unsaturated fat associated with a number of negative health effects.

Trans fats (unsaturated fatty acids) is bad for health because it raise our bad (LDL) cholesterol levels & lower your good (HDL) cholesterol levels.

It increases risk of developing heart diseases & stroke.

### 5) Essential fatty acids :- (EFAs)

It refers to fatty acids required for biological process but do not include fats that only act as fuel.

### 6) Ghee, & Butter :-

good for  
health

as it can be digested  
and smoke point is  
higher ( $485^{\circ}\text{F}$ ). to  
roast vegetables.

saturated fat

smoke point is low ( $150^{\circ}\text{C}$ )  
( $350^{\circ}\text{F}$ ).

[smoke point is burning point]

Smoke point ( $\downarrow$ )  $\rightarrow$  smoke point  
smoke point ( $\uparrow$ )  $\rightarrow$  digestive

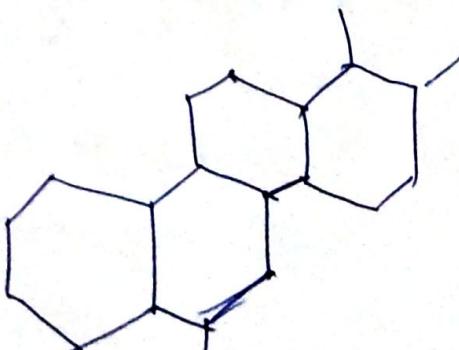
$\Rightarrow$  Ghee has less lactose than Butter

Ghee  $\rightarrow$  A1 protein  
 $\rightarrow$  A2 protein

(lactose intolerant)  
people who cannot  
fully digest lactose  
(sugar).

Desi cow has hump on their head that attracts or gets radiation from sun. This hump is deposit of fat. Brahman cattle have hump, they can stand the heat & insects don't bother them much.

### # Steroids :-



Steroids :- → mostly found in non veg. items.

1.) Cholesterol :- ↗ essential for <sup>making</sup> sex hormones.

biosynthesized by animal cells.

It should be < 200 mg/dl.

200 to 239 → Borderline

> 240 → high.

(Testosterone, Estrogen).

↙ (ii.) Liver also uses it to make bile (fluid that plays role in processing & digestion of fats).

↙ (iii.) Building blocks of cell membrane.

↙ (iv.) They produce Vitamin D [converts

2.) Controversial drugs.      Sunshine [into Vitamin D].

(Anabolic steroids - THCs). (v.) animal origin  
→ type of cholesterol.

Cholesterol → → carry cholesterol from ~~liver~~ liver to tissue.  
→ LDL (low density lipoprotein).  
↳ [Bad cholesterol].

→ HDL (high density lipoprotein)

↳ [Good cholesterol].

→ carry cholesterol from cell to liver.

~~22/01/2020 Assignment 8~~

~~Ans:-~~ → Sugar is bad but honey is good because,-

1. Sugar contains

Steroid → Corticosteroids

→ Sex Steroids