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Date: ORGANIZATION AND MAINTENANCE OF ORGANISMS

(Basic Understanding of Topic)

Nutrients / Biological molecules:

⇒ Major nutrients:
- carbohydrates
- proteins
- fats / lipids
- nucleic acids
- H_2O

⇒ Minor nutrients:
- minerals
- vitamins
- inorganic chemicals

★. CARBOHYDRATES:

→ organic chemicals

→ ①. Carbon ②. Hydrogen ③. Oxygen

→ 1 : 2 : 1

→ general formulae: $(CH_2O)_n$ ← the no. 6

→ Example: glucose $C_6H_{12}O_6$

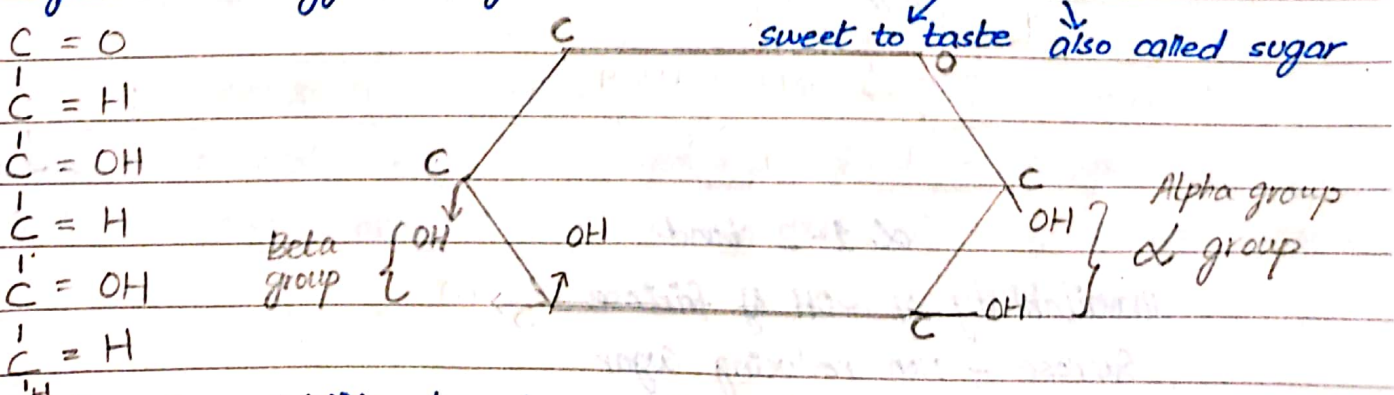
→ Carbohydrate's name comes from the name hydrated carbon

$H_2O \rightarrow H-OH$ ← presence of water

OH: hydroxyel group

→ every carbon must have water

→ In greek terminology carbohydrates are called saccharides. (sweet to taste, also called sugar)



→ soluble in water. solubility depends on simplicity.

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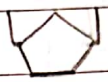
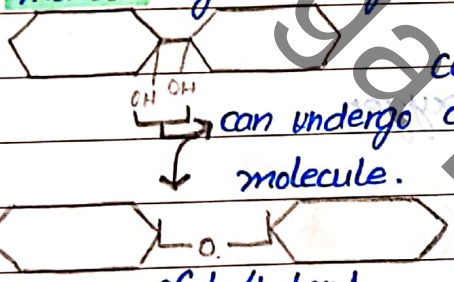
→ E.g: glucose – readily soluble
starch – slightly soluble
cellulose – insoluble in water

→ 3 basic types:

① MONOSACCHIRIDES:
one unit

Example: ∴ glucose $C_6H_{12}C_6$  hexagon
∴ frictose $C_6H_{12}C_6$ (reducing sugar)  pentagon

② DISACCHARIDES
Two units ↓ contains double energy as compared to monosaccharides.
Example: ∴ maltose (glucose - glucose) ⇒ reducing sugar

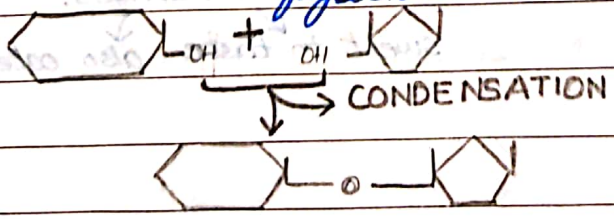


can undergo chemical reaction to remove one water molecule.

α 1-4 bond
Glycosidic Bond

→ To gain energy from disaccharides is more difficult than to gain from monosaccharis

∴ sucrose (glucose – frictose)
↓
glycosidic bond



α 1-2 bond

unavailability of -OH of frictose
Sucrose – Non-reducing Sugar

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Glucose → liver → converted → stored in liver cells
(required) Blood ↓ ↑ to glucagon

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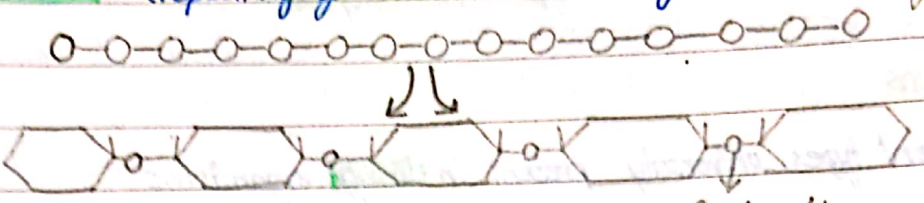
happens so that they won't disturb water potential of liver cells or continuous endosmosis resulting in cell bursting

③. POLYSACCHARIDES

multiple or more than two

because it is insoluble, more energy level because of the complex nature

Example: ∴ starch (repeating glucose units making a chain) (plant chemical)



no matter how many units bond will be α 1-4

⇒ used in plants as storage carbohydrate.

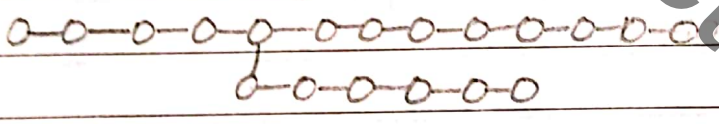
⇒ more bonds in polysaccharides = more storage space

⇒ preferable form of starch as would not finish it's entity by dissolving in cytoplasm disturbing its water potential.

∴ glycogen (repeating glucose units) (animal starch)

⇒ α 1-4 bond

⇒ branching chains of glucose every 10-12 units



⇒ because of the chain type it becomes a storage form for carbohydrates in animals.

⇒ insoluble in cytoplasm

∴ cellulose (repeating glucose units) (plant chemical)

enzyme for breaking β 1-4 bond

herbivores can digest due to presence of cellulase

(humans can't break β 1-4 bond) (remains undigested in humans)

⇒ β 1-4 bond making it more complex and rigid and cell wall harder.

⇒ can contain high levels of water due to the rigidity of cell wall.

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PROTEINS

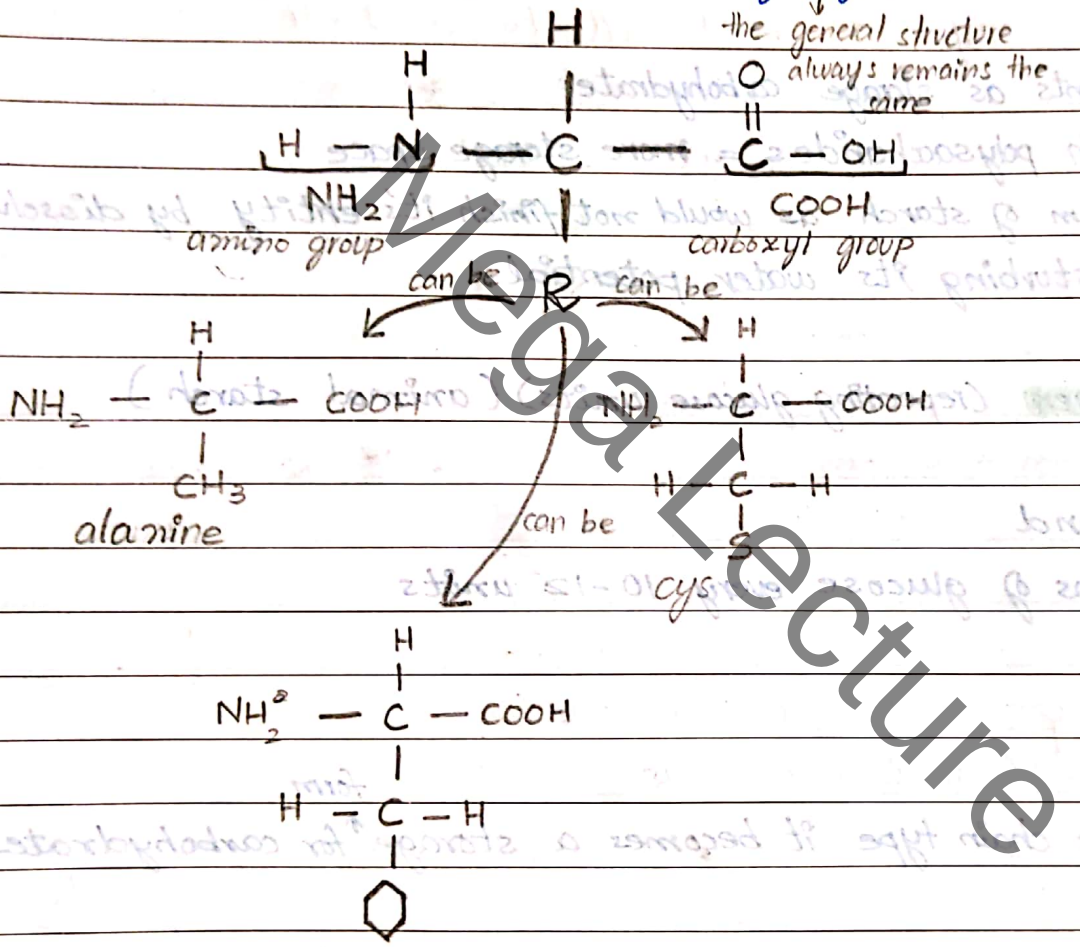
⇒ long chains of molecules → amino acids

⇒ compose carbon, hydrogen, oxygen, nitrogen

∴ AMINO ACIDS

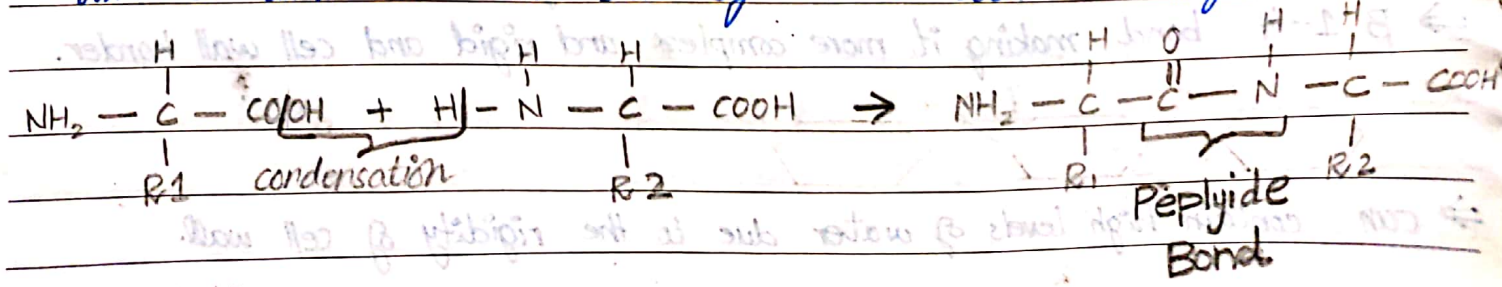
⇒ 22 different types universaly present in living organsisms

though there is specie-specific charges : - sequence of amino acid
- no. of amino acids



R : causes the variations : 22 types

⇒ whenever amino acids come side by side to each other they form bonds.



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longer the chain
the more the no. the more energy is storaged
the number can vary

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Δ − O — Dipeptide chain

(Δ − O − □ − Δ − ● − ■) — Polypeptide chain } no. of amino acid bonds are present.

⇒ polypeptide chain is packaged/compacted/folded for storage and to make a mature protein.

8888888 → packaged form

⇒ When folded they form hydrogen bonds. Positive charge on end and negative on another. can break very easily. /keeps the chain stabilized/

high pH, temp., concentra., can loose hydrogen bonds. (Enzyme denaturation)

represented as (- - - - - - -) loose attractive bonds

⇒ the folding causes the polypeptide to have a shape which can be different from others.
- enzyme — active site
- hormone — receptor site / binding site
- HB — oxygen binding site

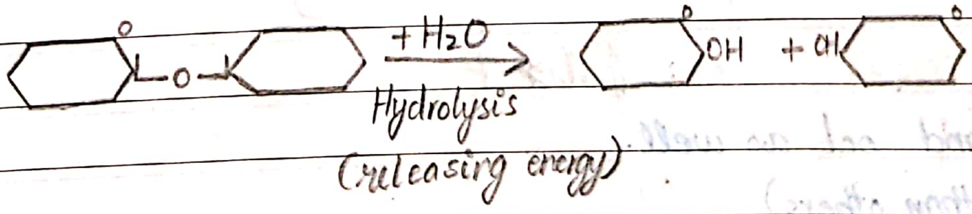
⇒ folding is not only important for stabilizing but also binding shapes. and for maturity of the protein

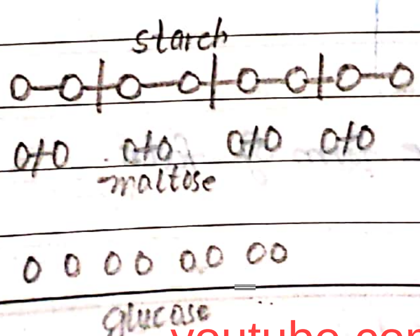
⇒ Proteins are hence, forming a shape ~~which~~ whose function is imp. to the body.

⟷

// Reversal / Breakage of Bonds:

Glycogen Bond:





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HYDROLYSIS : Breakage of bonds. Releases energy

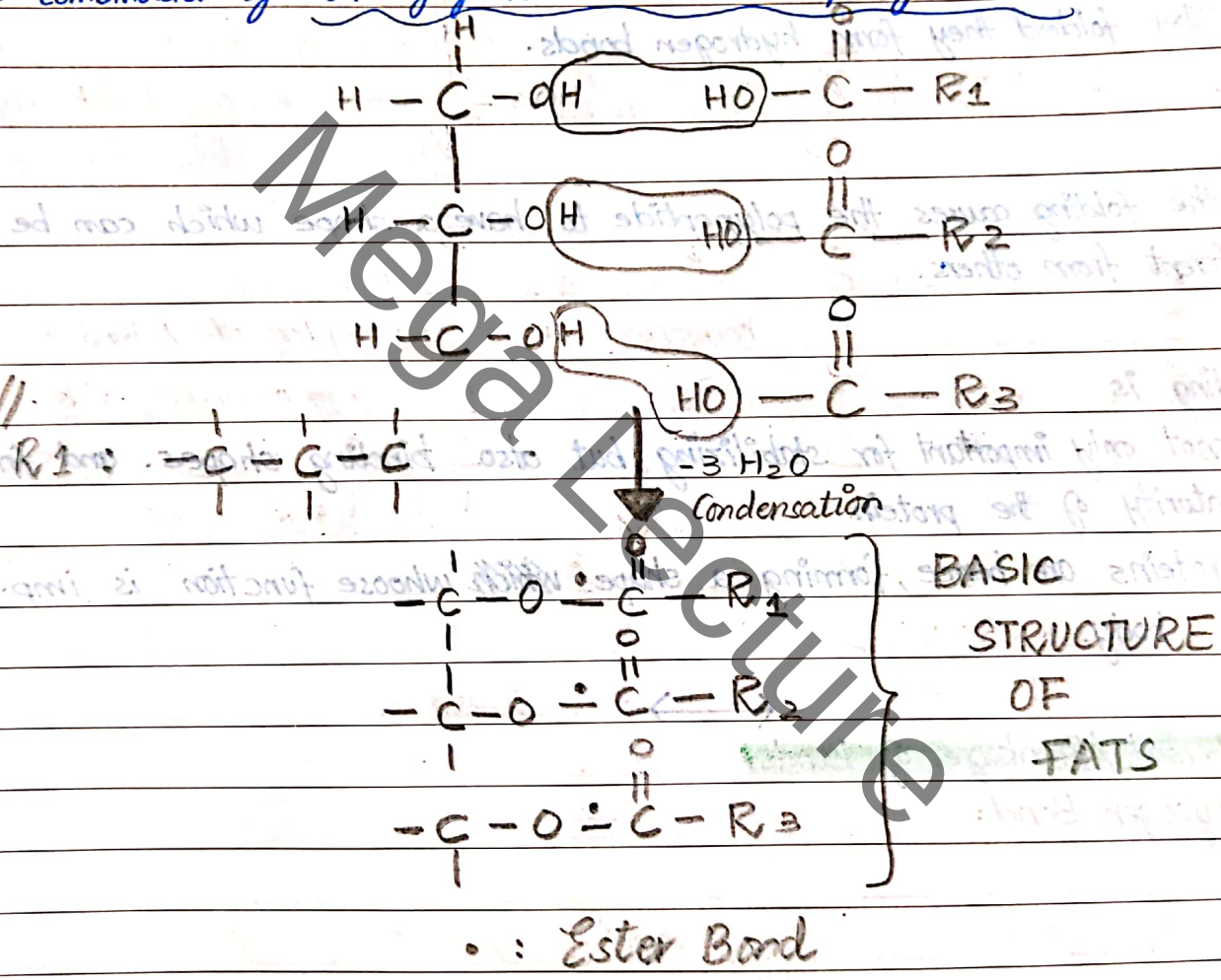
CONDENSATION : Bonds are made. Energy is stored

FATS

➡ storage chemibiologic molecules, energy reserves for future use

→ made of carbon, hydrogen and oxygen

→ are a combination of one glycerol and three fatty acids



• : Ester Bond

⇒ called lipids and ocl as well.

→ complex (more than others)

→ difficult to break down

→ conserves more energy

→ human body favours to store energy in the form of fats.

→ lower abdomen has more fat deposition

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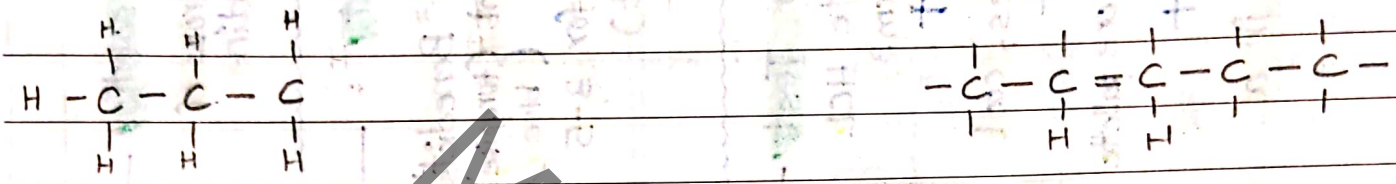
∴ **SATURATED FATS**

→ single bonds in carbon R chains

∴ **UNSATURATED FATS**

→ double or triple bonds in carbon R chains



SATURATED

not advised as moves as semi-solid. makes a disturbance to the walls of vessels also would disturb the contents of blood plasma.

HYDROGENATION

Add hydrogens

UNSATURATED

oil

advised to use oil as moves as a liquid and is more convenient for blood vessels.

increasing blood pressure.

making clots which can block vessels

→ larger in size than glucose & amino acids

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TEST	OBSERVATION	RESULTS
① Iodine Test / Starch solution 2cm³ of starch sol. + 3-4 drops of (yellowish brown) Iodine	→ Blue Black Colour → Brown Colour	Positive starch test Negative starch test
② Reducing Sugar Test 2cm³ of glucose sol. + 2cm³ Benedict's (doesn't act in acidic medium only in neutral) ← reagent (turquoise blue) + heat in water bath for 3-5 minutes (for indirect heat) e.g. glucose, fructose, maltose, lactose	→ Green → Yellow → Brown → Orange Beet Red ← Brown (mild appearance if concentration is less) → Blue colour remains same	Positive sugar test Negative Test
③ Non-Reducing Sugar Test 2cm³ of sucrose sol. + dilute HCl (can perform hydrolysis in presence of enzymes) ← 2cm³ + heat for 3-4 minutes, cool at room temperature + sodium hydroxide (solid) one pallette + Benedict's reagent + heat again for 3-4 min. in a water bath e.g. sucrose	→ Blue → Green → Yellow → Brown Beet Red ← Brown ← Orange	Positive Non-Reducing Sugar.

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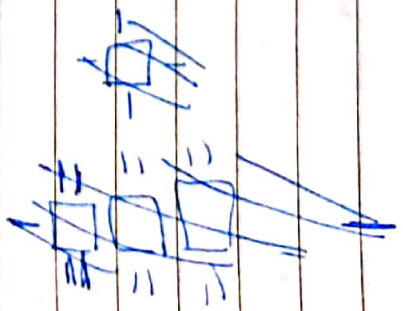

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Water is an inorganic solvent

TEST	OBSERVATION	CONCLUSION
④. Biuret Test / Protein Test $2cm^3$ of Egg Albemin + $2cm^3$ of sodium hydroxide + 3-4 drops of $CuSO_4$ in a standing table	→ Voilet colored ring  → Blue	Positive Protein Test Negative Protein Test
⑤. Emulsion Test / Fats Test $1cm^3$ of sample oil + $1cm^3$ of alchol ethenol / ether (organic chemical) + shakeee + distilled water $1\ cm^3$	→ White emulsion / suspension appears at the top  → Clear solution	Positive Fats Test Negative Fats Test

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PROVIDED THINGS:
5 Test Tubes
One stand
All the Chemicals

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MINOR NUITRIENTS

MINERALS

→ not produced by the living organs
→ chemicals which are required, absorbed by plants their roots
→ intake of plants, they enter the organisms body.

E.g //

- **Nitrogen** (present in form of salts, nitrates (NO_3^-), nitrites (NO_2^-))
  lack causes stunted growth (in blood absorbed by) become proteins → growth
- **Magnesium** (central chemical of chlorophyll)
  lack results in chlorosis → yellow leaves; presence affects photosynthesis
- **Iron** (central chemical of HB) e.g/ liver, red meat, beans & nuts, dried fruit
  defiency results in decreased oxygen in blood → anemia; increasing O_2 carrying capacity of blood
  - Defencies can be recovered by increasing the intake.
- **Phosphates** (PO_4^-) (used to make nucleic acids) genetic mol. (DNA/RNA)
- **Calcium** (Ca deposits in bones and teeth and makes it strong) e.g/ cheese, eggs, milk, leafy green vegetables
  specifically required by animals on different levels; also imp. for muscle contraction; also imp. for nerve impulse

⇒ All are required in minor quanties but on regular level. Their lack can cause . . . and can result in diseases.

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VITAMINS

→ organic chemicals
→ not produced by animals, produced by plants
→ required by animals though

E.g //

- **Vitamin A** (source is carrot and citrus fruits)
  - ↓ lack (extreme) results in night blindness, weak eyesight
  - produces retinol → imp. for improvement of vision

- **Vitamin C** (source is egg, milk and meat and citrus fruits / leafy green vegetables)
  - ↓ lack of VC causes bleeding gums, pale skin
    - ↓ scurvy gums
  - also called Ascorbic acid
  - imp. for our normal gums and skin

- **Vitamin D** (source is liver, fish liver oil (cod-liver oil), eggs and fish and sunlight)
  - ↓ lack in infants will cause (reversable) weaker, soft and bending bones.
    - Rickets
  - also known as calceferol
  - imp. for movement Ca, PO_4. it makes bones stronger. No vitamin D and presence of Ca, PO_4 is no use
  - direct exposure of skin to the sunlight

⇒ animal bodies can not store vitamins. Fresh supply of vitamins.

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→ Herbivores at the level of appendix have certain bacteria that digest cellulose. It produces the enzyme cellulase

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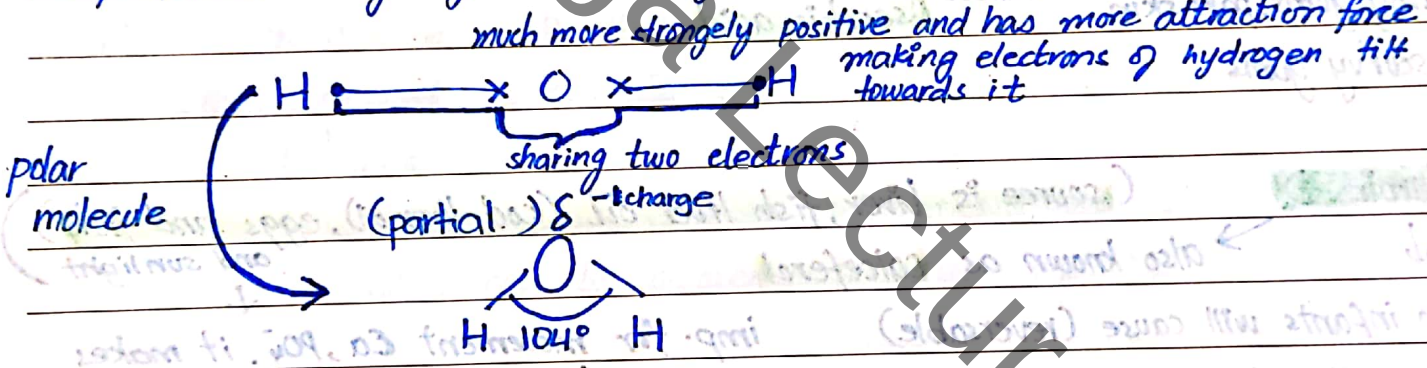
FIBER

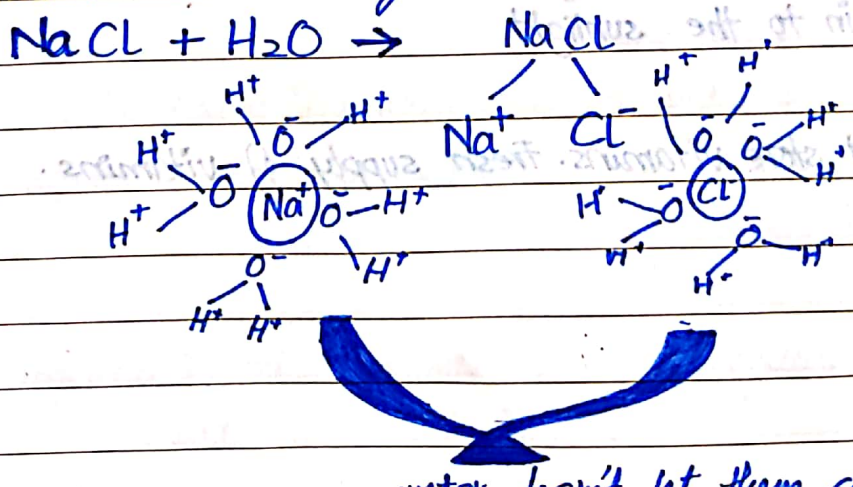
→ also termed as Roughage
→ undigested waste material (plant food)
→ presence of water in plants make faeces soft which lets it pass through the last part of digestive system
→ lack of plant intake — constipation (damages wall of last part)
→ undigested cellulose also blood
→ it can absorb water from digestive track which makes it soft
→ minor quantity e.g. fruit, vegetables & cellulose

WATER

→ imp. for all living organisms + single cell



→ polar charecterstic makes it an universal solvent.
→ can dissolve maximum of the solute (except fats and oils)
↓ only dissolved by organic chemicals



water doesn't let them combine

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→ required for all metabollic reactions in cells
→ required to transport materials in and out of cells
→ required to transport materials within the body of a multi-cellular organism. E.g : . minerals from roots to leaves
. nutrients from digestive system to all cells
→ required to maintain body temperature. E.g: . sweating in animals
. transpiration in plants
→ acts as a reactant for photosynthesis
→ maintains shape of plant cells and interm whole of the plant body. known as Hydroskeletal
→ is involved in movement of parts of the plant. E.g: . opening + closing of flowers
leaves towards the sunlight

sources of water:
- food & drinks
- metabolic processes e.g/ aerobic respiration

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★. with reference to energy do not use production of energy. only release

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FOOD AND ENERGY

Living cells → Mitochondria
(for the formation of ATP the energy released here is enough)

→ Glucose + O_2 →→→→ $CO_2 + H_2O$ + Energy (ATP)

• energy conserving chemical
↓ Adamin Triphosphate
(required at the level of active transport)

all are food materials should be brought to level of glucose

→ Carbo., Proteins, Fats

Carbo. → carry less energy
Proteins → than proteins & carries energy less than fats.
Fats → carry maximum energy
fats because of their simple nature

ADP + P → ATP
↓
Adamine DiPhosphate + Phosphate
• the bond is broken to consume energy

ADP + P
Release ↓↑ Conservation
ATP

→ Fats are energy storing molecules. (isn't a ready source of energy)
→ Proteins are taken to form living structur (isn't a ready source of energy)
(to add new cells, for muscles) etc. -es.

→ Carbohydrates are a ready source of energy
→ Glucose + O_2 → $CO_2 + H_2O$ + Energy
(priority is given to carbo. → fats → proteins)
→ a condition of prolonged starvation, a body requires regular intake of energy hence carbohydrate stored is used.
→ after carbo. we use fats.
→ after fats we use proteins.

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CARBOHYDRATES REQUIREMENTS FOR LIVING ORGANISMS:

→ ready source of energy
→ extra carbo. are stored in energy reserves in form of starch (in plants), glycogen (in animals)
e.g/ pasta, rice, potatoes, sugar, vegetables

PROTEIN REQUIREMENTS FOR LIVING ORGANISMS:

→ energy carrying molecules
→ are involved in formation of biomass. Eg: muscles (in animals), chemicals in body (enzyme, hormones, receptor)
→ used as last priority in absence of carbohydrates and fats available for cellular respiration
e.g/ meat, fish, eggs, peas, beans, lentils, soya

FATS REQUIREMENT FOR LIVING ORGANISMS:

→ are energy storage molecules
→ extra fats are stored either in the form of glycogen or as adipose tissue underneath the skin
→ " " " they provide us insulation (extra heat remains inside the body against extreme low temperatures outside)
→ protective cushions around delicate organs. Eg: kidneys, ovaries
→ plants store fats in form of reserved food in their seeds
e.g/ cheese, butter, margarine, oils, nuts

TEST FOR AMOUNT OF ENERGY:

→ Take a specific food material on a spatula
→ Heat it
→ Heat energy released is calculated by placing a beaker and thermometer
→ Rise in temperature is the amount
→ more chances of error because gaps between the spatula and beaker will not give us exact amount of energy
→ so a calorie or jouls meter.

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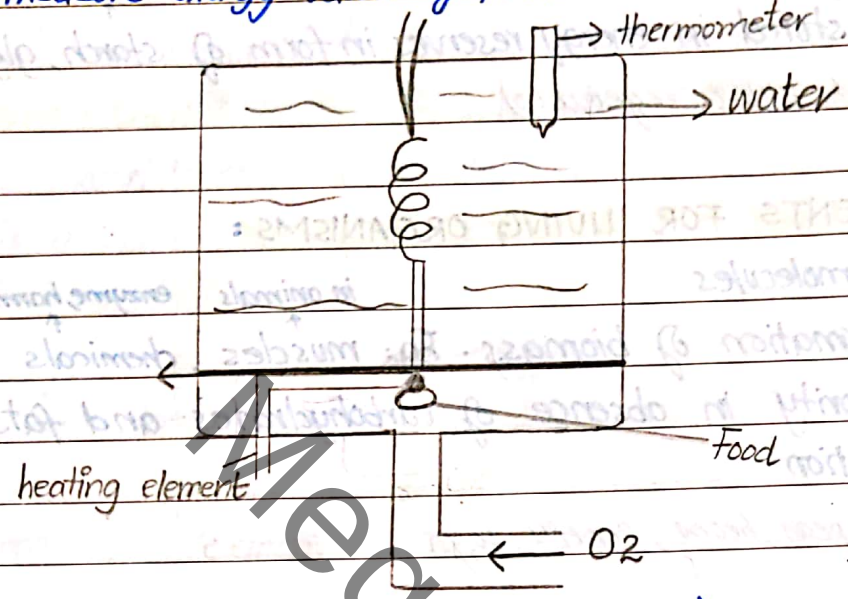
→ calorie meter is also called bomb-calorie meter

→ used to measure energy value of foods



$$\text{Energy level of food} = \frac{\text{Rise in temperature } (^{\circ}C) \times \text{Volume of water } (cm^3)}{\text{Amount of food sample } (g)}$$

[Jouls (J)] = A cal./grams or A kilo jouls/gram

1 calorie = 4.2 jouls

$$\text{Energy value of food in kj} = \frac{A}{100} \times 4.2$$

→ Recommended Daily Allowance gives us a condition of balanced diet.
↓ on wrappers

FACTORS AFFECTING BALANCED DIET

① Age : infants need more ready source of energy. (carbo. + prot. + minerals) ← rapid growth
middle aged less ready source energy (physical activity only no cell division)
old aged least because resting

② Gender : males of same age require more energy as compared to a girl of same age because of a larger sized body

③ Occupation: (amount of physical energy) an office worker less energy a labour requirs more

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④. Physilogical Condition: (physical disorder) diabetic requires a diet with diabetic conditions → less carbohydrates
high blood pressure → less fats
anaemic condition → iron rich diet

Balanced Diet = Basal Metabollic Rate/Index (BMI) + Physical
+ Food Action

BMI → amount of energy required to perform basic functions/metabollic activity
Ex: circulatory system, respiratory system, excretory system

P.E → daily work, excercise evident to us

T.A → amount of energy required for digestion of food

1 gram of Fats —— 39 KJ
1 gram of Protein —— 20 KJ
1 gram of Carbohydrates —— 17

★ the higher the person's mass, the more energy they need.
★ children require comparitively lesser amount

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Improving Foods (Modification of food)

FORTIFICATION:

→ Adding any 1 nutrient to increase the food value

→ E.g// fortified milk (NIDO), wheat (+ fluoride), water (+ fluoride), mineral wates (+ - salts in distillation) strengthens outer layer of teeth
↓ stay down during distillation

ADDITIVES:

→ Adding different chemicals to improve different conditions of food that not lead to enough nutrient level

→ E.g// • colouring agents (improving colour) رنگ کے لئے
↓ tartazine, B-carotene

• flavouring agents (give flavour), vanilla essence, mono-sodium glutamate (MG)

• preservatives (improving decomposi-) antioxidants, sulphur dioxide

• thickners (improving texture), cellulose (cornflour), Xanthan

★ not always beneficial. They cause side by side harms. ← excessive use

• tartazine —

• sulphur dioxide — sensitivity in asthematic condition

• mono sodium glucamate — nausea, vomiting

• freshwater + fertilizer — unfit for drinking
↓ we still have an indirect use

• pesticides are absorbed by plants — not readily degraded,
↓ toxic chemicals ↓ converted less harmful and excreted
(decreases population of animals in the end of food chain) thining egg shells of birds which break before hatching, mental and nervous condition is affected

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BALANCED DIET

MALNUITRITION

↓
Bad

i more food consumption than required
ii very less food consumption than required
iii unbalanced food consumption (1 nuitrient more than required)

i extra food than immediate need is stored in the body at different level. E.g// {extra carbo. → glycogen → liver cells
extra proteins → amino acids → (degraded) deamination
→ more urea → urine → out of body
forming muscles and storing
{extra fats → fatty acids & lipids → Adipose tissue under skin

→ overweight condition ⇒ OBESITY

ii leads to defeciencies of certain specific nuitrients.
E.g// Vitamin C → scurvy condition
Vitamin D → rickets
Iron → anaemia

★ causes: Kwishiorkor
{Protein deficency — less use of mother food (infants)
they are consuming more carbohydrate diet.
→ lack of muscles as a result
→ very thin arms and thin legs and lower body enlarges

★ Marasmus
overall diet defiecency (all nuitrents) — less amount of food
→ only staying alive

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→ very lean body
→ one of the cause is overpopulation / uneven distrubition of food / advancment in medical (decreased death rate) / [redacted] polution (dry conditions, less rainfall, low water table) / flooding (fresh water reserves should be conserved) / global warming → causing abrupt melting

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