formed of molecular subunits of globular protein (mw
This protein called tubulin resembles actin in certain respects
Peripheral fibrils are composed of protein (mw 500,000)
resembles to myosin. It has an ATPase activity which is
activated by Mg as well as by Ca. This ATP-ase called
dynein. Blepharoblast are derived from centriole.

Fibers of axoneme remain embedded in a fluid
matrix. In between the outer ring of peripheral fibers and
inner ring occur nine accessory fiber. Flagellum may
bear fine flexible lateral processes often called mastigonemes
on one side or both side. Mastigonemes bearing flagellum
called flimmer or ciliary flagellum.

The number and arrangement of
flagella varies in Mastigophora from one to eight
or more. Several flagella occur in parasitic form.
Flagella are divided into two types: tractella and
pullsella. Tractellum is situated at anterior end and
drag the body along whereas the pullsellum is generally
situated posteriorly and it pushes the body forward.

Origin of flagella :-

Flagella commonly arise from the anterior end of the body either directly or from a groove or depression. But in Trypanosoma flagellum originates at the posterior end from one Kinetosome of the two Kinetosome. In many forms it lies against the side of the cell body's membrane. When the flagellum beats the membrane of the cell is pulled up into a fold and look like a waving or undulating membrane. The Kinetosomes are centriole like structures and often lies at the bottom of flagellar pockets or reservoirs. Kinetoplast - is the cluster staining concentration of mitochondrial DNA. It is generally found in the part of mitochondrion lying close to the Kinetosomes.

Cilia :→ The cilia are highly vibratile small ectoplasmic processes. They arise from the basal granules or blepharoplasts and or Kinetosomes in the ectoplasm. cilia is characteristics of ciliata but they are also found in laval stages of Suctoria. They are arranged in longitudinal, diagonal or spiral row on all over the body or on the restricted region of the body. cilia may be of equal length on the body or may be longer at definite spots.

The electron microscope reveals the presence of an outer elastic membranous sheath continuous with the plasma membrane of the cell surface and enclosing the fluid matrix. Cilium also has 9+2 fibrilar arrangement like flagellum. All fibers remain enclosed within a delicate sheath. These 9 peripheral and 2 central fibrils form axoneme. In between the

outer and inner rings are present none spoke like radial lamellae. An axoneme is centred on basal granule or blepharoplast which exhibits 9 peripheral subfiber triplets. each disposed in a twist like fashion.

The cilia may form membranelles, undulating membrane and cirri etc.

Structure of cilium.

myonemes :- The myonemes are very fine contractile fibrils in the pellicle of flagellates, ciliates, sporozoans and infusorians. In more complex ciliates myonemes may extend into the endoplasm. They may be arranged longitudinally, transversly or spirally. Myonemes are primarily organelles for the metabody e.g Euglena, Paramecium and secondarily for locomotion by muscle like contraction e.g monocystis, Plasmodium etc.

Mode of Locomotion :-

There are four different modes of locomotion occur in Protozoa -

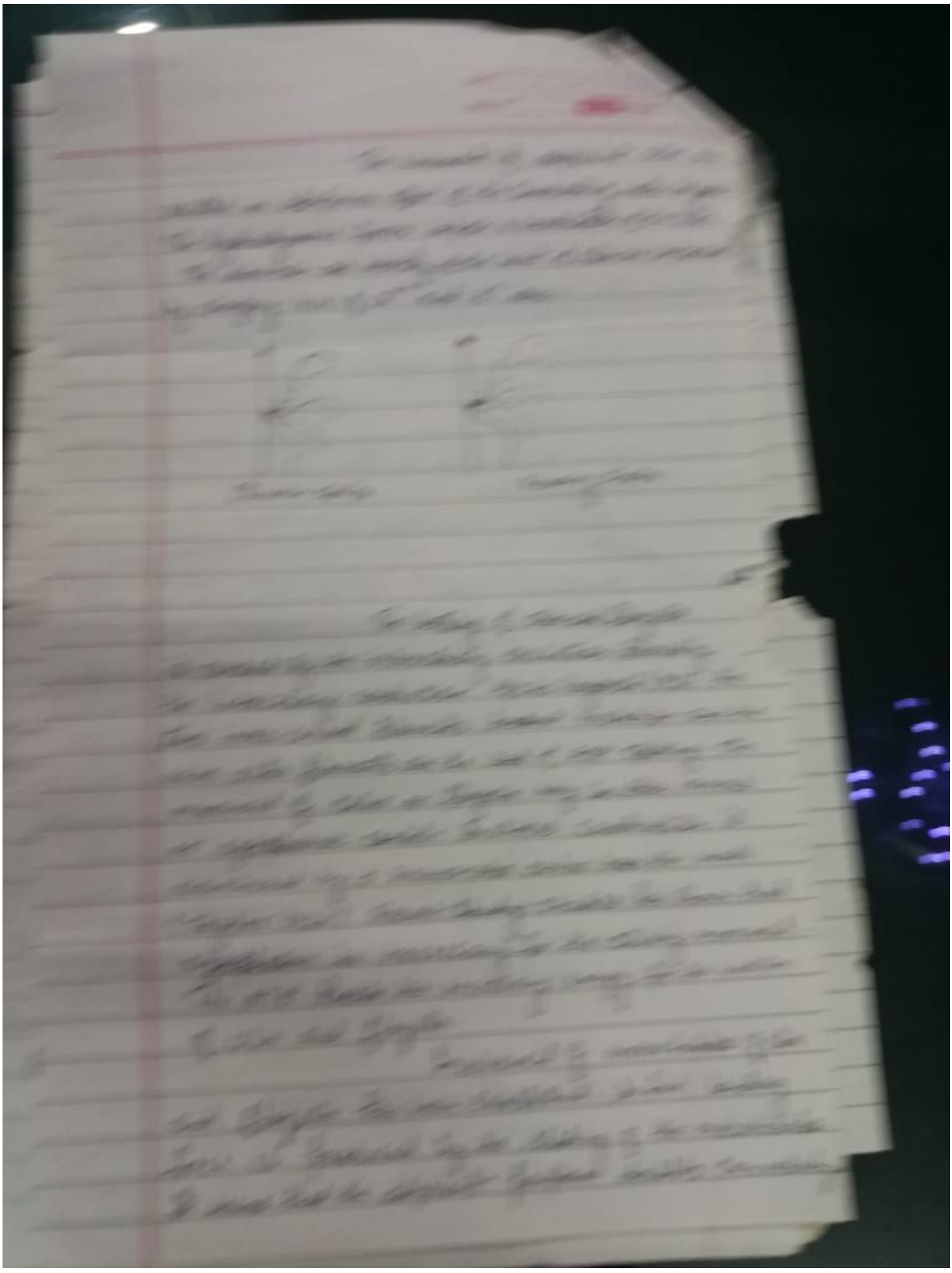
1. Amoeboid movement.
2. Flagellar movement
3. Ciliary movement
4. Metabolic movement.

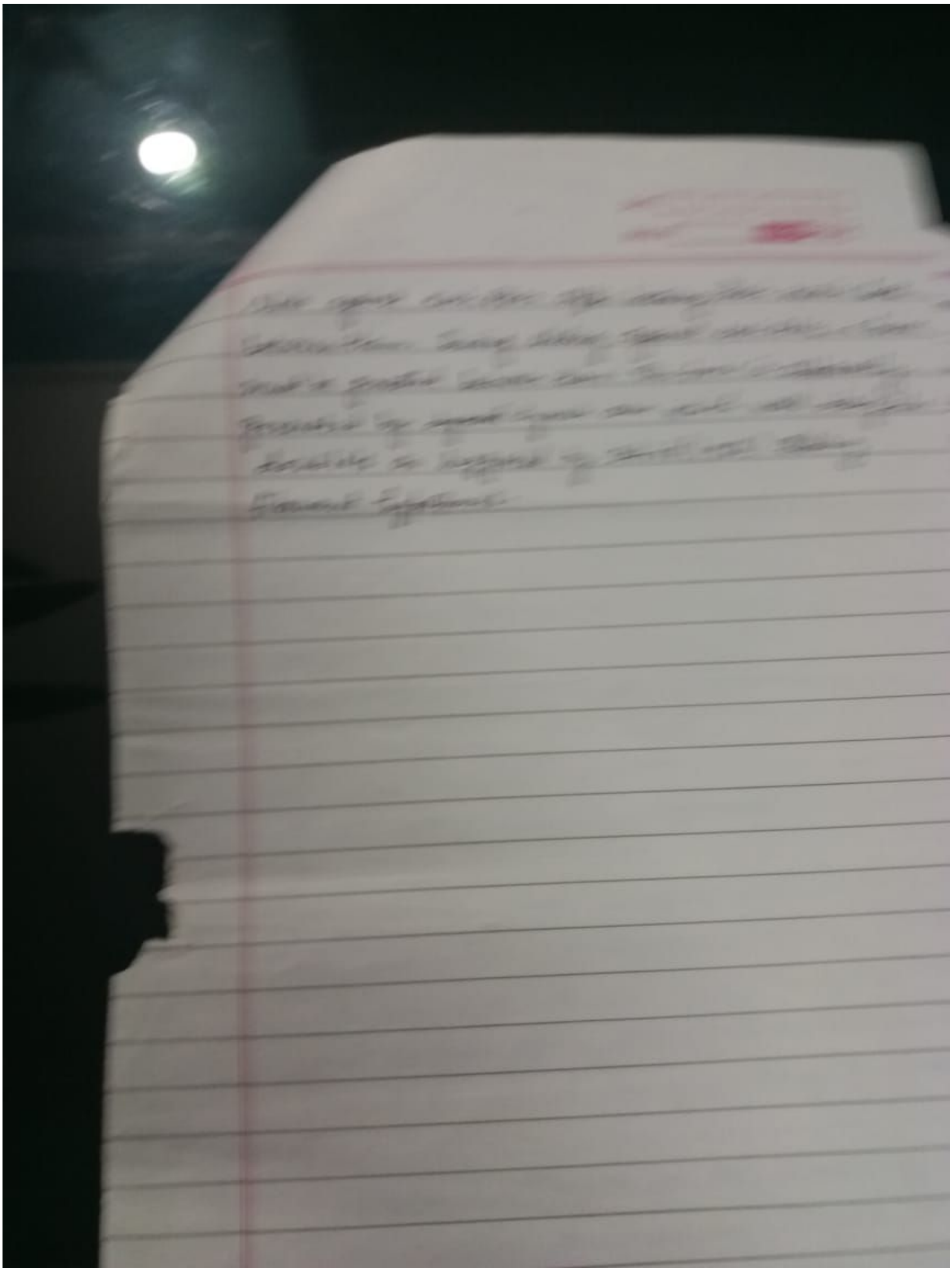
Of the above mentioned mode of locomotion amoeboid and metabolic movements are the simple mode while the flagellar and ciliary movements are the complex mode of locomotion in mastigophora and ciliata.

Flagellar movement — Flagellar movement is caused by continuous or lashing movement of flagella. Following four types of flagellar movement have been reported -

(1) Screw propellar theory :— A/c to Butschli the spiral turning of the flagellum like a screw exerts a propelling action and pulls the animal forward. Spiral waves arise repeatedly repeatedly from the base of flagellum one another after the other and moving towards the tip.

(2) Circular beat theory :→ Metzner suggested that the flagellum beat in a circle tracing a cone and produce sufficient current to pull the animal forward.





are filled with gel like materials, the Colloid which takes the eosinophillic stain. The bases of epithelial cells are in contact with fine and delicate basement membrane which also encircle the follicle.

The study from electron microscope reveal two types of cells in thyroid

1) Principal cells
2) Parafollicular cells.

1.) Principal cells — They chiefly line the follicle having their apical end facing inwards i.e towards the follicular cavity and their basal end are flat and facing outwards Mitochondria and golgi complex are present and they vary in no with the activity of cells. The apical end of principal cells have microvilli facing the lumen of the follicle which engulf the colloid into the cells by a process of phagocytosis.

2.) Parafollicular cells or "C" cells :—

These cells are formed singly or in groups within follicle and interfollicular connective tissue. These cells are longer than the principal cells and are responsible for the production of a hormone thyrocalcitonine that lowers the blood calcium.

The follicles are bounded bordered and supplied by connective tissue which has blood vesicles, lymph and microphagous and parafollicular cells.

The cavity of thyroid is filled with a gel like substances the colloid. It is chiefly composed of mucheprotein, thyroglobulin and proteolytic enzymes.

PHYSIOLOGY →

The thyroid produces 3 types of hormones.

1) Thyroxine (Tetra iodothyronine)
2) Tri-iodothyronine
3) Thyrocalcitonine

The ① and ② are secreted by principal cells while ③ by parafollecular cells.

Biochemistry of ① and ② hormones :-

Both there hormones are synthesized from two raw materials namely inorganic iodide and tyrosine.

Accumulation of iodide — The inorganic iodide derived from food passes into follicle cells through active transport. The normal daily intake being about 150 µg. It is absorbed as iodine.

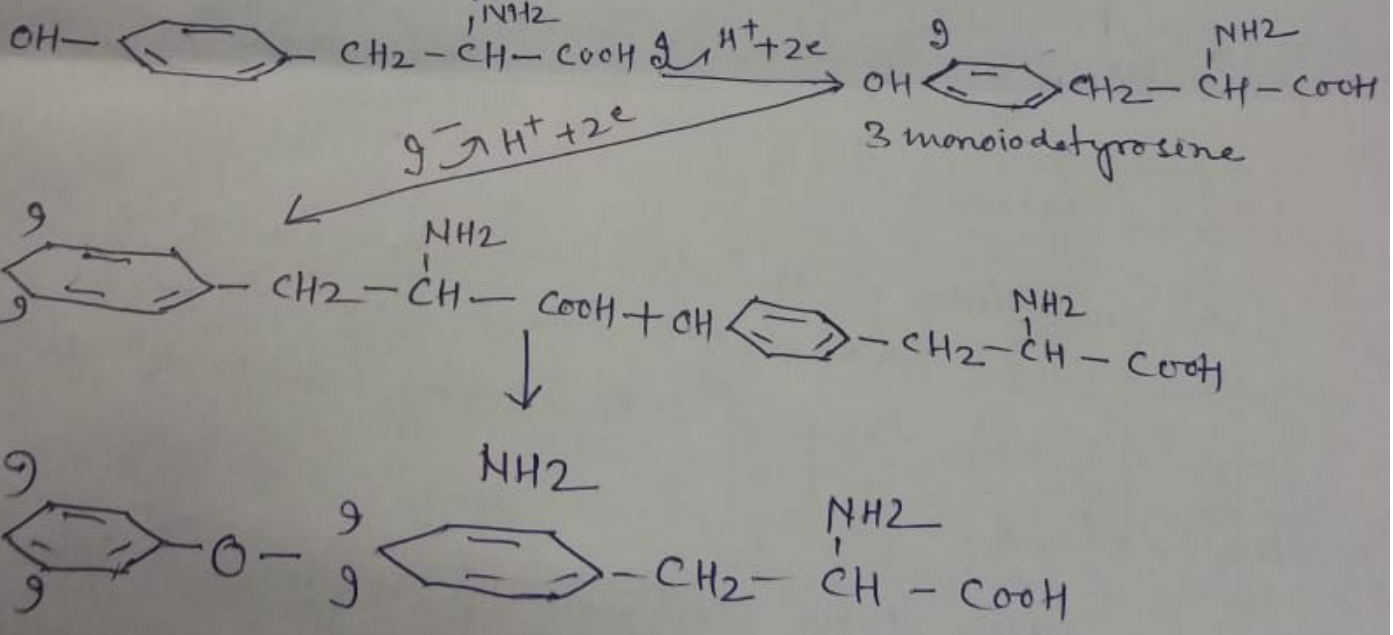
Iodide ions within the thyroid follecles are oxidised to free iodines by oxidative enzymes ~~Pero~~ Pre oxidase or Peroxidase.

2. Immediately iodine combines with the tyrosine to form 3 monoiodotyrosine (MIT) and then 3'5' diiodotyrosine (DIT). These changes takes place the tyrosine radicals on the surface of thyroglobulin molecules.

3) Thyroxine is formed by coupling of two molecules of DIT with elemination of alanine.

Tri iodothyronine is formed by the coupling of MIT and one molecules of DIT.

The thyrotrophic hormones of the anterior pituitary helps in every steps of the Syntheses of thyroxine. Peroxidase enzymes play an essential role in the oxidation reaction and coupling of DIT molecules. Thyroglobulin occurs as a colloidal aggregates within the follicle. It is glycoprotein with mol. wt 6,60,000.



3, 5, 3' 5' – Tetraiodothyronine Thyroxine.

Action of thyroxine — The usual effects of thyroxine are as follows–

i) Calorigenic:– Thyroid hormone accelerate the energy production, O_2 uptake and basal metabolic rate (BMR). The calorigenic effects of thyroxine is due to direct effects on the cells.

2) Metabolism —

a Carbohydrate metabolism –
It stimulates absorption of glucose from the intestine, promotes neoglucogenesis and causes hyperglycemia

b Protein metabolism — Thyroxine in small amounts stimulates the breakdown of protein especially in skeletal muscle

c Fat metabolism — The serum cholesterol rises in hypothyroid state e.g cretinism and myxoedema. In hyperthyroidism, the serum cholesterol falls

d Iodine metabolism — Thyroxine helps in the absorption of inorganic iodide from intestine, oxidation of iodide into iodine, formation of MIT, DIT and subsequent formation of thyroxine.

Mineral metabolism:– It causes the removal of calcium and phosphorus from bones (osteoporosis)

Relation with vitamin — Thyroxine helps in the conversion of B-Carotene into vitamin A within the body.

Growth — It causes normal growth in the childhood. Low production of thyroxine results in dwarfism while more production results in gigantism.

Mammary gland — Increases the output of milk [illegible]

Heart rate and circulation — Thyroxine accelerates rate of [illegible] of blood within heart.

Kidney — Increases nitrogen excretion and [illegible]

Nervous System — Increases the sensitivity of nervous system

<u>HYPOTHYROIDISM</u> — Hypothyroidism Causes —

1) Cretinism — in young
2) Myxoedema — in adult

1) Cretinism — Symptoms do not appear till 6 months because enough hormone is present in mother's milk. The chief features are as follows —

1) The milestones of child development such as Bending up of heads (3 mths), sitting and [illegible] (6 mths), standing, walking and speaking (12-18) are all delayed.

<u>Skeleton</u> — Short limbs like fingers, deformed [illegible]

Skin — Rough, thick, dry and wrinkled [illegible] Scanty, irregular [illegible]

Face — Swollen [illegible], thick lips, large protruding tongue, broad nose and depressed bridge

Sex — Sex glands [illegible] and secondary sexual characters [illegible]

Myxoedema —

1) Face, Skin and body — Swollen puffy oedematous look of face and whole body due to deposition of myxomatous tissue. Hair fall out from axile, pubic and eyebrow. Swelling of tongue and larynx causing hoarseness and slow slurring speech.

Mental condition — Dullness, loss of memory.

Gastrointestinal tract and metabolism — Appetite reduced and constipation. Body temperature low. Body wt increased. Increased susceptibility to cold.

HYPERTHYROIDISM — Hyperthyroidism causes 'Graves disease' or exophthalmic goitre. It is due to excessive secretion of the thyroxine. Symptoms are as follows —

1) Enlarged thyroid
2) Increased basal metabolic rate.
3) Protrusion of eyeball with a staring look, less twinkling of eyelids due to deposition of fats. Body wt decreased.
4) Mental condition sharp, emotional and restless.
5) Osteoporosis due to excessive loss of ca and Phosphorous
6) Skin soft, moist flushed due to vasodilation.
7) Blood sugar raised lead to glycosuria. Increased iodine contents
8) Heart rate increased may be upto 140/minutes. Blood pressure values may be high or low.

Locomotion in Protozoa

Locomotion means the movement of an organism from one place to another place in search of food, shelter and partners for better survival. Protozoans exhibit diverse mode of locomotion across the various groups, but the modes of locomotion can be broadly divided into flagellar, ciliary and amoeboid movements and metabolic movement. Four major types of locomotor organelles occur among Protozoa and usually each type of them is characterized by a class like as follows —

Class	—	Locomotory organelles
Sarcodina	—	Pseudopodia
Mastigophora	—	Flagella
Ciliata	—	Cilia
Sporozoa	—	Myonemes.

Pseudopodia are temporary extension of cytoplasm especially ectoplasm. Among sarcodina, Pseudopodia are modified into Lobopodia, Filopodia, Reticulopodia and Axopodia etc. Pseudopodia performs amoeboid movement based on sol-gel theory or change of viscosity theory.

Flagella - Flagella are the locomotory organs of the mastigophora or Flagellates. Flagella are long, delicate whip like structures. ~~These are thread like projection~~ A typical flagellum consists of an elongated, slift axial filament, the axoneme enclosed by an outer sheath. In axoneme nine longitudinal for peripheral paired fibers surround the two central longitudinal fibres. The inner central fibers is enclosed by a membranous inner sheath. Axoneme arises from a basal granule, the blepharoplast or Kinetosome. The microtubular fibril of axoneme is