Date: 18/7/18
Page

Higher Invertebrates

Annelida

Annelus ↓ little ring

eidos ↓ Form.

Name was given by Lamark.
Due to presence of ring like str. it is k/a annulus.
Due to presence of metameric segmentation they are known as segmented worms. (True segmentation)

→ Metameric segmentation - Body is divided into several segment both externally & internally.

characters —

1. Metamerism
2. Closed Blood Vascular System.
3. Appearance of true coelom. (they are the 1st Eucoelomate)

General characters of phylum Annelida —

→ Most of the individual of this phylum are aquatic but some terrestrial organisms are also reported.
→ Organisms are showing the tubicolous behaviour. (burrowing)
→ They are commensal or parasite.
→ The body is elongated, bilaterally symmetrical, triploblastic and metamerically segmented into similar metameres.
→ These are the 1st individual in which true coelom appeared that means they are the 1st Eucoelomate. (Schizocoelic Coelome tht)
→ Epidermis is made of a single layer of columnar epithelial cells which is externally covered by a thin cuticle not made up of chitin.

→ erythro cruorin (2)

→ Body wall is dermo-muscular
→ Locomotary organs are present throughout the Body. They are segmentaly repeated chitinous bristles k/a Setae. and present embedded in the skin.
→ Digestive System is straight and complete and the process of Digestion is entirely extracellular.
→ Blood Vascular System is closed type & Respiratory pigments are either haemoglobin or ~~Erythropo~~ Erythrocruorin and they are present in dissolved form.
→ Respiration is done by the moist skin or the gills present or the parapodia
→ Excretory System consisting of metamerically disposed coilled tubes k/a Nephridia.
→ The Nervous System is present in the form of a pair of Cerebral ganglia which is analogous to brain & a double ventral Nerve chord bearing ganglia & lateral nerves in each segment.
→ Sensory organs like organ for touch, perception, taste buds, photoreceptors. and sometime eye & lens are present.
→ The individuals are hermaphrodite.
The development is indirect type. & the help of a larva k/a ~~Tropophore larva~~. Trochophore larva.

* cocoon is a str. in which fertilisation as well as development occurs

Date 19/7/18.

Classification of Annelida -

Individuals of phylum annelida., there are about 8700 species of this phylum. These species can be divided into 4 classes & the basis of classification is presence of setae or chaetae/ chaitae.

Setae are hair like str. present all over the body of Annelides. Setae can be present directly on the body surface or attached to locomotory organ i.e parapodia.

Classes

Polychaeta	Oligochaeta	Hirudinea	Archaeannelida / Archiannelida.
So many setae + int. + Parapodia	Few setae (+nt directly on the skin)	① Neither parapodia nor setae + nt. (Leeches)	Primitive ① They have the primitive character of Annelides.
② → They active swimmer due to parapodia	① + nt in the moist soil,	② No clitellum but bec. they are the individual that are facultative ectoparasite so they need suckers for attachment & suck the nutrients + nt at both ends.	
④ → Clitellum is absent.	③ They have a muscular box like str. clitellum which help in the formation of cocoon. (They are tubicolus)		
① → Present in most soil or in water.	2) Parapodia absent. & setae directly embedded into the skin.		
③ → Sexes are seperate, Gonads	4) Sexes are not seperate, individuals are hermaphrodite & development is direct type,		
4) Development is indirect Trochophore larva + nt.			

→ class polychaeta is divided into 2 subclasses →

1) Errantia (Nereis)
2) Sedentaria (Spirorbis)

→ class oligochaeta is divided into 4 orders →

1) Plesiopora
   Plesiothecata (Tubifex)
2) Plesiopora ~~Prosopora~~ Prosothecata (Enchytraeus)
3) Prosopora (~~Branchy~~ Branchiobdella)
4) Opisthopora (Pheretima)

→ class Hirudinea is also divided into 4 orders →

1) Acanthobdellida (Acanthobdella)
2) Rhynchobdellida (Glossiphonia)
3) Gnathobdellida (Hirudinaria)
4) Pharyngobdellida (Dina)

→ class Archiannelida is not divided into any other group. it includes Dinophilus.

Nereis

Systematic position.

Phylum ~~annelida~~ - Annelida (Metameric, worm like individuals ē a distinct head)
class - Polychaeta (so many setae are present on the lateral appendages. K/a Parapodia)
Order - Errantia (Free swimming or burrowing individuals Pharynx protrusible with jaws & teeth)
Family - Nereidae
Genus - Nereis.
Species - Virens.

~~External Morphology~~

Habit and Habitat

It is a free living individual, Predaceous, carnivorous present in Sea Coastal Area i.e in shallow water. It is also burrowing (tubicolous)

External Morphology

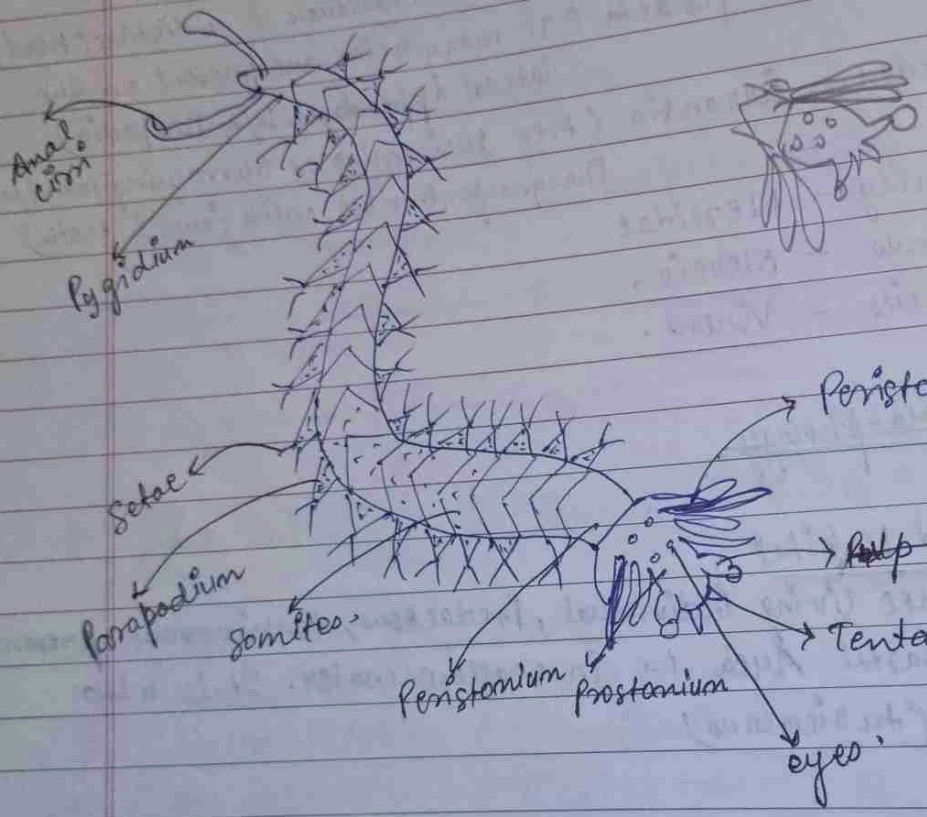
The body is elongated, cylinder, bilaterely symmetrical somewhat broad at anterior end but tapering at posterior end. It is slightly flattened dorsoventrally, the dorsal surface being convex while ventral surface flat or even somewhat concave. The length of adult form varies a few to about 40cm the colour of body also varies species to species. In some species like Nereis Pelagica the body colour is brownish In N. cultrifera greenish and in N. Virens the body colour is steel blue.

stomium - mouth.

classmate
Date
Page

Body division

The body is divided into 2 parts. The 1st is a head which is further divided into 2 sub parts i.e Peristomium & Prostomium.



Body of the Nereis is metamerically divided into a no. of segments arranged in linear series k/a Metameres or somites. The body consist of 3 distinct regions

1- Head
2- Trunk
3- Pygidium

Note- Acording to some worites Pygidium is the part of trunk so body is divided into two mains parts i.e head & trunk which are further subdivided into Peristomium

anterior
Prostomium, trunk and Pygodium respectively.

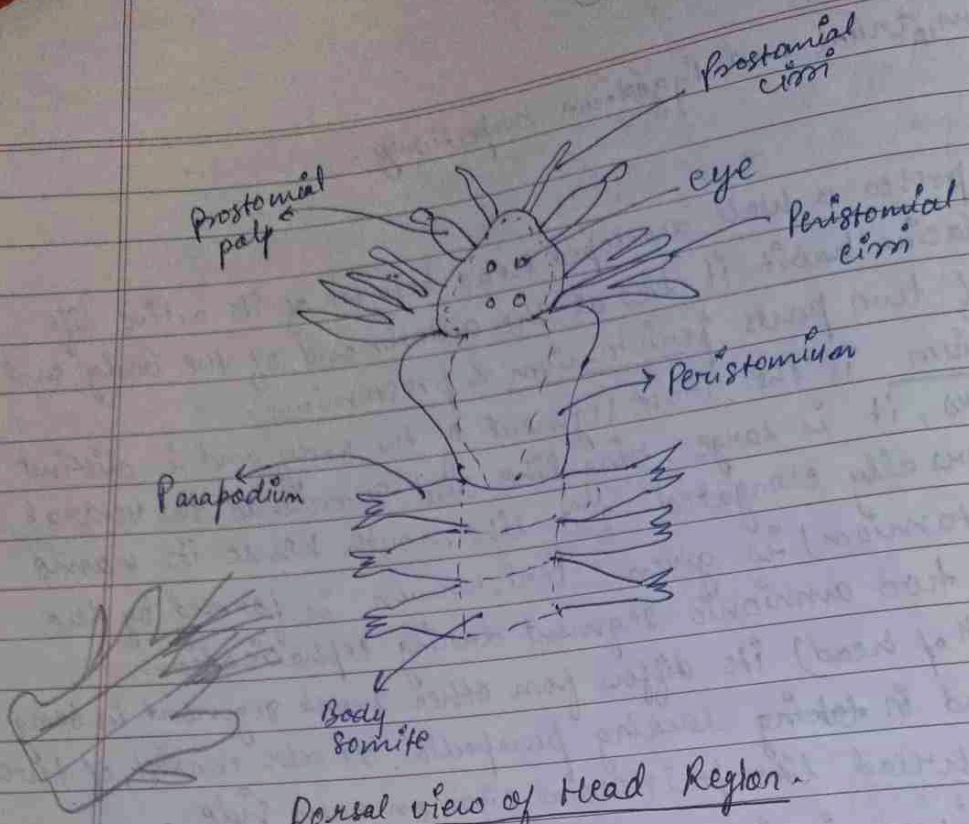
Head

Nereis posses a well developed head because of its active life and predacious habit it lies at the anterior end of the body and consist of two parts peristomium & prostomium.

Peristomium is the first segment of the body and is distinct from others, it is large, ring like and surrounds the ventral transversally elongated slit like mouth hence its name is (Peristomium) is given. Peristomium is formed by the fusion of two amniomic segment during cephalisation (formation of head) its differs from other trunk segment in being longer and in ~~taking~~ lacking parapodia. It also consist of two pairs of thread like peristomial cirri on each side.

Peristomium cirri are homologous to Notopodial & Neuropodial cirri of parapodia of the trunk segment.

Prostomium is not a true segment of the body but a dorsal anterior projection of peristomium. Some scientist suggest that prostomium is the first two segments, it is roughly triangular, dorsoventrally ~~flatenned~~ flattened it bears two pairs of simple pigmented eyes on dorsal surface. A pair of short cylindrical, sensory prostomial tentacles and a pair of short, stout, fleshy and jointed pulps. Palps are somewhat contractile and their small distal joint can be retracted into large proximal joint. Tentacles, Pulps and cirri all serve as sensory organs.



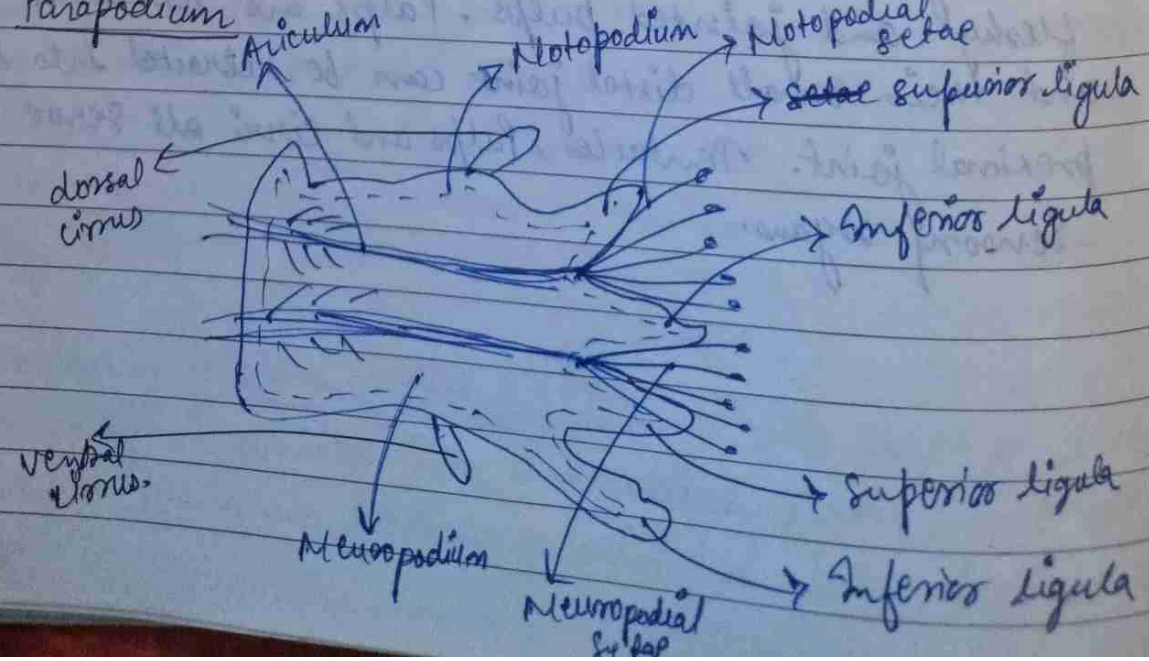
Dorsal view of Head Region.

Trunk

The trunk represent the rest of the body (except anterior head region). It includes 80 to 200 ~~sever~~ equally divided segments known as body somites. The last segment of the trunk is different due to presence of anal cirri known as Pygidium. It is also devoid of Parapodia.

All the body somite and parapodia on lateral side

Parapodium



Parapodium is a flattened, fleshy, vertical flap like outgrowth of body wall on the lateral side of the trunk segments, these are hollow structures enclosing coelome which is continuous to the trunk segments.

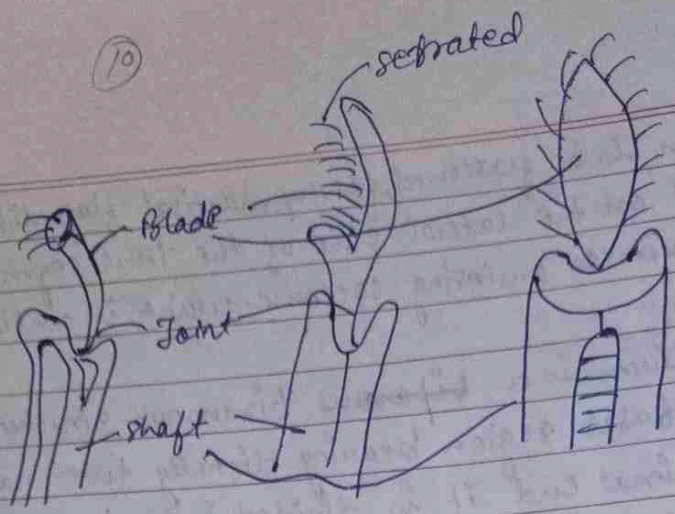
A parapodium is a ~~biparous~~ bisamous structure consisting of a proximal basal region bearing distally two ramii or parts. At the proximal end it is divided into two main part or ramus. The dorsal portion or part is k/a Notopodium while the ventral part is k/a Neuropodium. Each of these parts are further divided into two leaf like lobes k/a ligula. The dorsal ligula is k/a Superior while ventral ligula is k/a inferior. ligula. ~~Both of~~

Both dorsal and ventral parts bear a cylinder tenticular ~~prosses~~ process at its base k/a cirrus. Notopodial or dorsal cirrus is slightly longer than the Neuropodial or ventral cirrus.

Different parts of Parapodium are internally supported by a long, stout and black chitinous rod k/a Aciculum. It also serves for attachement of setal muscels thus serving as a short endoskeleton.

Each part also bears a bundle of long, fine, chitinous bristles k/a setae. Each setae is ~~caused~~ lodged into a setal ~~sack~~ shaft that is formed by the impushing of epidermis and arises from a single formative cell. which lies at the base of ~~sac~~ shaft. New setae are continuously produced by the setal ~~sac~~ shaft as older ones are lost. Setae are made up of two parts i.e a proximal ~~sac~~ shaft and distal blade

Paramoecium



Typical | Long bladed | Oar shaped.

[Types of setae]

Setae of Nereis are generally of two type; one type of setae has a small shaft ——— and a long cylinder, straight and pointed blade with one edge serrated this type of setae are k/a long bladed setae. In other type of setae the blade is stout, short and with an incurved ~~nosed tip~~. notched tip. this type of setae are very common and k/a typical setae.

A third type of setae also found in Nereis but it is present only in specific form of Nereis k/a Heteronereis (reproductive form). In this type of setae the blade become oar like that's why it is called Oar shaped setae.

→ Setae are used for protection & for obtaining a hold on the smooth inner wall of burrow.

→ Parapodia near the middle region of trunk are largest & gradually decreases in size towards the two ends. All the parapodia are essentially similar except that the 1st two pairs which lacks Notopodial setae.

→ Parapodia are the organ of locomotion & respiration. Beside parapodia each segment of the body also have a nephridiopore. Nephridiopore is a minute excretory pore through which nephridia communicate with the exterior.

Each parapodium of a neplridia bearing segment bears this pore at the base of ventral cirrus.

Pygidium —
Pygidium represents the last segment of the body, it differs from other segments due to lack of parapodia and presence of anus & anal cirri.

→ Structure of Body wall

It consists of four layers —
① Cuticle - Protective (chitin)
② Epidermis → epithelial cells (columnar), Gland cell, Sensory cells, ^ Basement membrane
③ Muscular layer or musculature. → circular, longitudinal & oblique.
④ Peritoneum.

1- Cuticle
It is the outermost thin, tough & chitinous layer with a system of intersecting striations. which imparts iridesce to it. It is secreted by the underlying epidermis & is perforated by numerous minute opening of epidermal gland cells.

2- Epidermis
It lies beneath the cuticle and comprises following type of cells.
→ epithelial cells - The epithelial cells are present in the form of a single supporting layer made up of columnar epithelial cells. which rest on a thin basement membrane. The epithelial layer is not continuous but interrupted by certain type of mucous secreting gland cells & sensory cells.
Mucous secreted by these gland cell help in maintaining the tube layer of burrow by mixing it sand particle.

Antero coelom
Retro coelom
Blastopore

Date
Page

12

3- Musculature

Nereis has a well developed musculature, consists of 3 types of muscles - circular muscles, longitudinal and Oblique.

→ Circular muscle forms a continuous layer beneath the epidermis & slightly thicker at ventral side

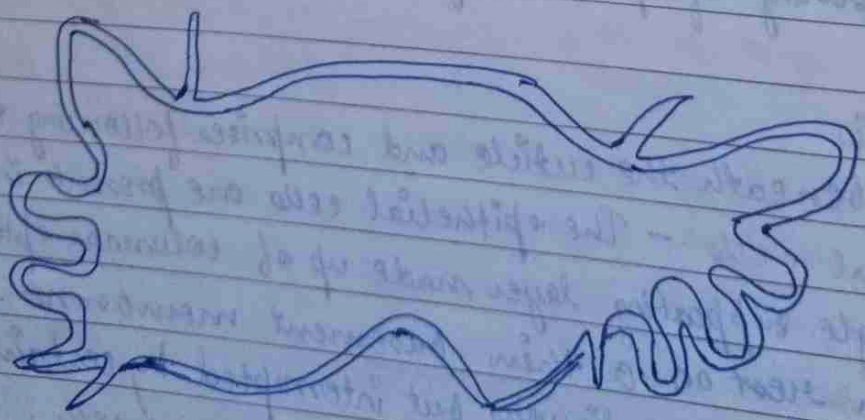
In parapodia circular muscles are modified to form a complicated System of Parapodial muscle k/a Protractor & Retractor muscles.

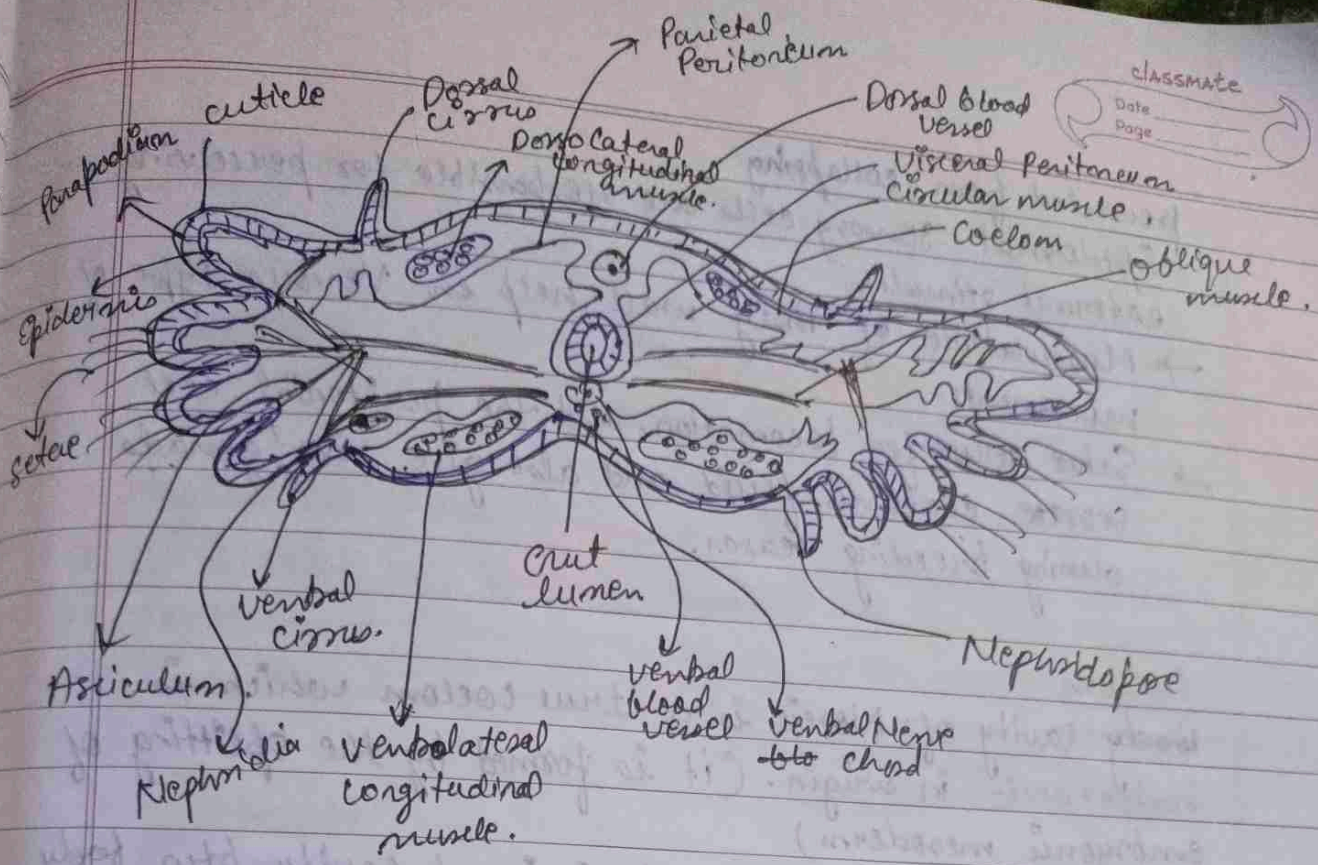
Protractors radiate from the bases of the shaft in to the layer of circular muscles on all sides.

Retractor extends from outer part of the shaft to the dorso-lateral ventral body wall.

Contraction of body muscles make body longer & thinner while the protractors & Retractors causes protraction & retraction of parapodial acetula & lobes.

Longitudinal muscle do not present as a continuous layer but occur in four powerful longitudinal bundles located dorso-lateral and ventro-lateral.





T.S of Body segment

→ Muscles are lined internally by a thin, delicate layer of coelomic epithelium or ~~para~~ peritoneum.
This layer also lines the coelom externally and is thus described as somatic or parietal layer of coelomic epithelium.
It is related ~~c~~ the secretion of coelomic fluid.

Function of Body wall

The body of Nereis performs a variety of functions -
1) cuticle present in the body wall protects the body against the physical ~~dessication~~ desiccation and mechanical injuries.
→ Epidermis of Body wall is a highly vasular layer and serves for respiration.
→ Epidermal glands of Body wall secrete mucous for lining to the burrow so that it can be

prevented from collapsing.
Epidermal sensory cells are responsible for perceiving external stimuli.
→ Musculature of Body wall help in various type of movements
→ Setae serve for locomotion. and the peritonial cell secrete coelomic fluid and also give rise to gonads during breeding season.

Coelom
Body cavity of Nereis is a true coelom which is Schizocoelic in origin. (it is formed by the splitting of embryonic mesoderm)
Coelom forms a spacious perivisceral cavity btw body wall & alimentary canal.
Numerous membranous transverse septa divide the entire coelom into linear series of compartments each corresponding to the segment of the body.
Coelom of each segment is further divided into right and left compartments by dorsal & ventral mesenteries.
→ Coelom is filled c a colourless coelomic fluid containing amoeboid corpuscles and during breeding season it reproduces numerous reproductive cells.
→ Coelomic fluid act as an hydrostatic skeleton for the transportation of digested food, gases and waste material because it facilitate the contraction of various type of muscles which is required for the conduction of these processes.

Physiology –

1) Locomotion
2) Nutrition (Digestive System)
   - Ingestion of food
   - Digestion
   - Absorption of digested food.
3) Respiration. (Respiratory System)
4) Circulation. (Circulatory System)
5) Excretion. (Excretory System).
6) Control and Coordination. (Nervous System & Sensory organs)

Locomotion

(1) Crawling →
(2) Active Swimming →

Nereis can crawl on substratum as well as swim actively on water surface.

Crawling is affected by the activity of parapodia alone while Swimming involves parapodial activity as well as snake like lateral undulations of the body which are brought about by the wave like contractions of longitudinal muscles.

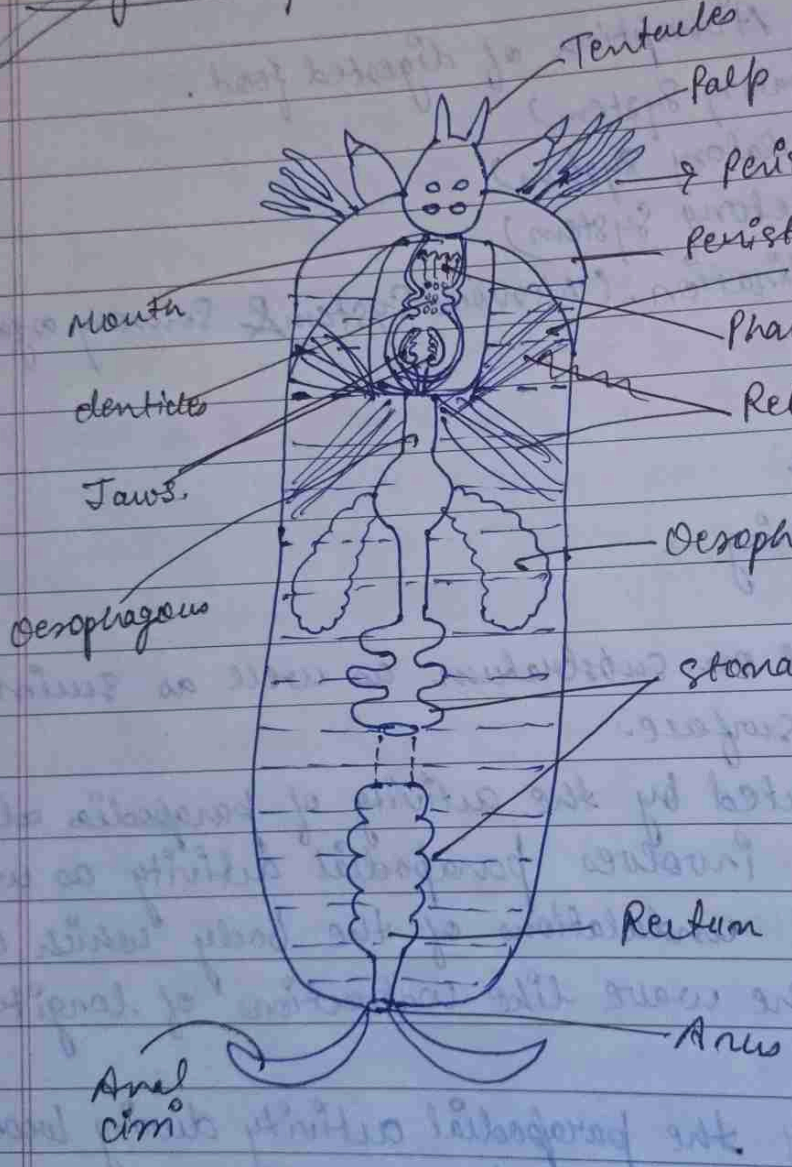
According to Gray the parapodial activity during locomotion in Nereis can be divided into two phases - Effective stroke & Recovery stroke.

According to his observations each parapodium behaves like a miniature paddle alternatively beating backwards (effective stroke) & forwards (recovery stroke).

→ During Parapodial activity opposite parapodia of adjacent segments always perform the same stroke at a time the & opposite parapodia of the same segment performs

Reverse stroke at the same time.
Movements of parapodia are controlled by oblique & parapodial muscles & the help of coelomic fluid.

Digestive System



Digestive System of Nereis

Digestive System of Nereis consists of -
1) Alimentary canal or Gut → site of digestion.
2) Accessary glands → produce digestive enzyme.

Extracellular type of digestion. (In the gut lumen)
Digestive system is complete & two openings.

Alimentary Canal -

1. Mouth
2. Buccal cavity
3. Pharynx
4. Oesophagous.
5. Stomach & Intestine
6. Rectum
7. Anus.

Accessory glands -

1. Oesophagial glands.
2. gland cells present in stomach intestine region.

Alimentary canal

It is a straight tube extending from ~~ester~~ anterior to posterior end of the body, suspended in the body cavity by dorsal mesentary & intersegmental septa. It is open at both ends. the anterior opening is mouth & the posterior opening is an anus. It is distinguished into 3 regions -

1) foregut or ~~Stomodium~~ Stomodaeum
2) Mesenteron or Midgut
3) Hindgut or Proctodaeum.

Stomodaeum consists of Buccal cavity & Pharynx, Mesenteron comprises Oesophagous & stomach intestine while Proctodaeum is having rectum.

Foregut & hindgut are lined internally by ectodermal epithelium & cuticle which is continous with body wall. The midgut is lined by endodermal epethelium but cuticle is absent.

Alimentary canal starts ē mouth which is a transversally elongated slit opening ventrally below prostomium & bordered by peristomium. The mouth leads to a wide chamber k/a buccal cavity and a highly muscular pharynx. The cuticle lining of buccal cavity is thickened at some places to form denticles or teeth, the no. of denticles & the arrangement of denticles are fixed in different species. the posterior part of the buccal cavity has a thick muscular wall & narrow lumen.

In the wall of posterior lumen a pair of stout, mobile & dark chitinous jaws are embedded laterally, buccal cavity & pharynx are wrapped ~~by a~~ in a common muscular coat & together they can extend upto 4 or 5th body segment. They can be fully ~~?~~ everted to form a proboscis or Introvert, during this process or operation tips of the jaws are exposed for capturing prey.

Pharynx narrows posteriorly to lead into Oesophagous which is a narrow tube extending through (upto) five segments behind pharynx. A pair of long unbranched ~~saculated~~ saculated glandular pouches k/a oesophagial gland or Caeca.

Oesophagial glands open into Oesophagous laterally at the anterior end, the secretion of oesophageal gland have certain type of proteolytic enzymes.

The Oesophagous is followed by stomach intestine. Stomach intestine is a segmentally constricted, straight thin walled tube extending upto the last trunk segment. Epithelial lining of stomach intestine contains scattered gland cells which also secrete digestive enzymes.

Rectum or hindgut occupies the last body segment k/a Pygidium and open to the exterior by a terminal anus.

Food & feeding mechanism

① Carnivorous, Predatory or Raptorial animal. It preys upon small aquatic animal (Crustaceans, worms and larva) which are actively captured by exposed Jaws of proboscis. The worm lives in the burrow & its head protruted and suddenly ~~everts~~ evets its proboscis to capture any minute creature passing by. Jaws cease the prey like a pair of ~~fossils~~ forceps, worm ~~and~~ then ~~mid~~ withdraws into burrows & rebait its proboscis to swallow the helpless prey.

The inversion of proboscis is brought about by special protractor muscles extending btw the wall of peristomeum & that of buccal cavity & Pharynx. Combined action of protractor muscles & the pressure generated by coelomic fluid by the contraction of body wall, musculature forces buccal cavity & pharynx to move out in the form of a proboscis.

Retration of proboscis is brought about by retractor muscles extending backwards from posterior end of the pharynx to body wall. and the relaxation of the body wall musculature.
As the proboscis retracts jaws come closer crossing each other & holding the prey which is always withdrawn inside.

Digestion, Absorption & Egestion

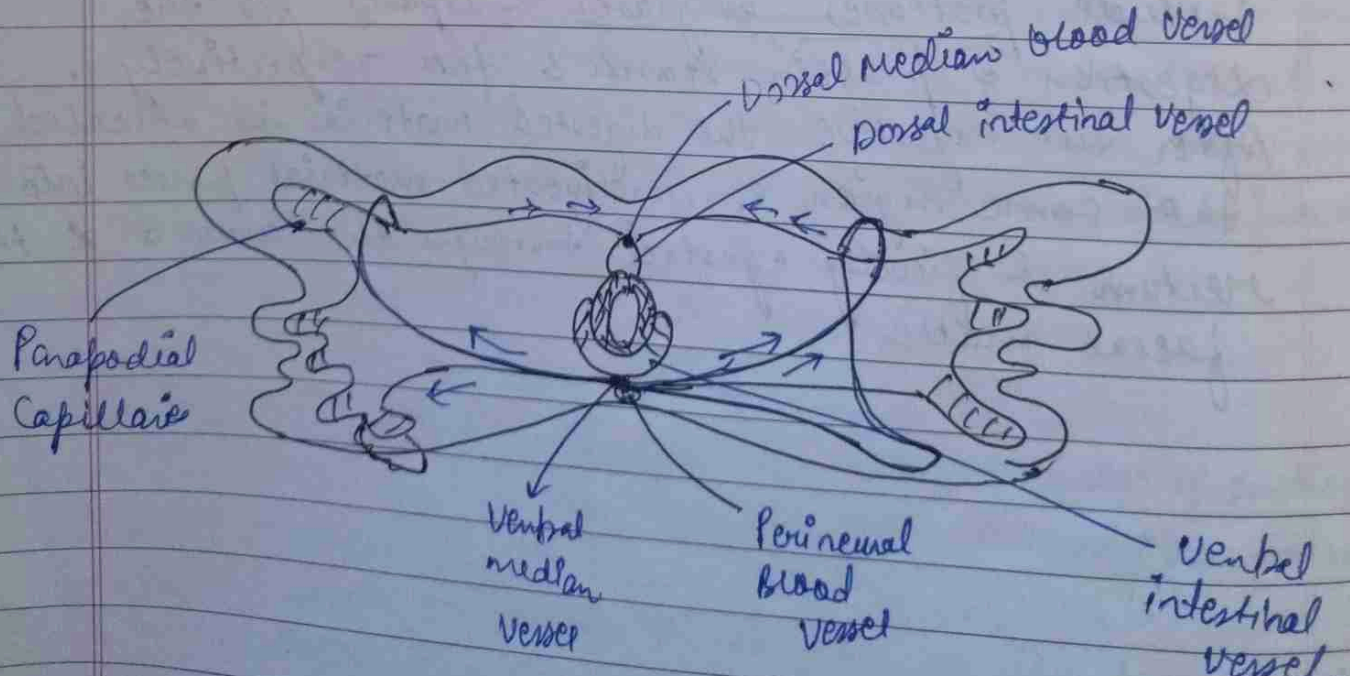
Digestion in Nereis is extracellular bcz it takes place into the lumen of alimentary canal / digestive gut. The engulfed food passes through the stomach intestine region through oesophagous where actual digestion & absorption occurs.
Digestive enzymes are secreted by oesophagial glands & the gland cells of midgut epithelium. The digestive enzyme includes proteases, amylases & lipases for the digestion of protein, starch & fats respectively.
After the digestive the digested material is absorbed in the same region & undigested material passes into rectum & finally egested through the anus as the faecal matter.

Parapodia perform Locomotion & Respiration, Parapodia are thin walled & supplied to capillaries.

Respiration

In the body of Nereis no specialised organ is present for the respiration so respiration is carried out by the whole body surface but more specially by the thin, flattened lobes of parapodia because they posses extensive capillary network lying very close to the surface, blood running through them gives up CO_2 collected from tissues & receives O_2 dissolved in surrounding, for the purpose of respiration water is ~~gene~~ continuously renewed by gental dorso-ventral undulations of body which cause a steady current of fluid through the burrow.

Blood Vascular System



Lateral commisiural vessel - loop like structure where ventral & dorsal meet

The circulatory system of ₹ Annelids is closed type, in this type of blood Vascular System the blood or fluid connective tissue flows into closed tubes called blood vessels. The blood is a fluid medium having numerous nucleated, colourless, amoeboid cells and dissolved haemoglobin. Due to presence of haemoglobin the colour of blood is bright red. The blood circulates in body throughout the life of animal & brings about transportation of gases, food & excretory materials.

The blood Vascular System of Nereis is very simple & consists of 3 main longitudinal blood Vessels these are-

1) Dorsal Vessel or Dorsal median blood Vessel.
2) Ventral Vessel or Ventral median blood vessel.
3) Perineural blood Vessel.

Dorsal blood Vessel runs above the alimentary canal through dorsal mesentary from hind end to the 5th segment its walls are highly contractile & surrounded by rings of muscles at several places. Strong peristaltic wabe pass from its posterior to anterior end deriving blood to the anterior end. Behind Oesophagous it acts as a collecting vessel receiving blood from body wall, parapodia, Nephridia and alimentary canal.

In the region of oesophagous it bifurcates & each branch.

As it is mainly a collecting vessel, in the region of stomach, intestine, it receives the blood from stomach & intestine by means of two pair of ~~sort~~ short vessel dorsointestinal or in front intestinal in each segment. It also collect the blood from body wall, parapodia and nephridia through the lateral vessel.

In the region of oesophagous it acts as distributing vessel & supplying blood to oesophagous through its branches.

Ventral blood vessel

It is mainly a distributing & non-contractile vessel lying mid ventrally below the alimentary canal to the 5th segment. It carries the blood from anterior end to posterior end. The main function of distributing vessel is supplies the blood specially the stomach & intestine region by a short pair of vessel which is called ventro intestinal or efferent intestinal. This short vessels are found in each segment of the body. The lateral vessel supplies the blood to the body wall, parapodia and nephridial region.

The ventral blood vessel join the dorsal blood vessel by a ring which is called circumrectal ring.

The dorsal and ventral vessel are conducted by a loop like transverse vessel, these vessels are also k/a lateral vessel or commissural vessel, which take the blood from ventral to dorsal but not directly. First they distribute the blood to the body wall, parapodia & nephridia by efferent cutaneous, efferent parapodial and efferent nephridial vessels respectively. They collect blood from these organ by afferent cutaneous, parapodial and nephridial which open into dorsal vessel.

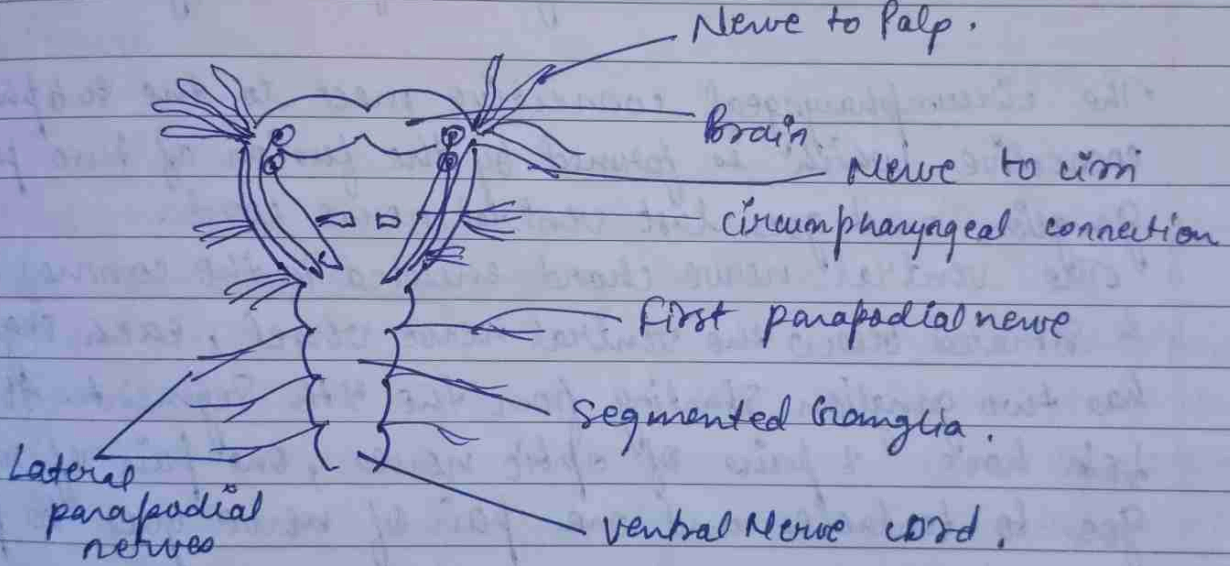
Efferent & afferent vessels jointed by an extensive network of capillaries or plexus and in each segment there is a pair of circum intestinal vessel or ventro intestinal vessel taking blood from ventral to dorsal blood vessel.

The circum intestinal vessel form a network of capillaries in the stomach & intestinal vessels.

3) Subneural or Perineural vessel

It is found just below the ventral nerve chord & blood flows in this region from anterior to posterior from the lower body wall & supplies blood to the ventral vessel.

Nervous System of Nereis



Nereis have well developed Nervous System and it consists of 3 parts -

1. Central Nervous System (CNS)
2. Peripheral Nervous System (PNS)
3. Visceral or Ventral Nervous System.

① CNS or Brain

It is large bilobed mass situated above the buccal cavity in the posterior region prostomium region. The CNS consists a large no. of neuron & nerve cell or nerve fibre due to active mode of life.

In the middle region of the brain two small lobe is present corpora pendungulata which are the association center & co-ordinate all the nerve impulses coming to the brain. From the brain arise a pair of circum-pharyngeal connectives which encircle the pharynx and meet to the third segment of the body.

The circumpharyngeal connective meet to the subpharyngeal connective which is formed by the fusion of two pairs of ganglion and goes last ventral nerve cord.

The ventral nerve chord enclosed in the common sheath & situated below the ventral nerve vessel, each segment has two ganglion starting from the 4th segment. It brain ~~hen~~ have 2 pairs of optic nerves, one pair of nerve goes to tentacles and one pair of nerve goes to palp.

② PNS

The PNS mainly includes the nerve coming directly from the brain & nerve chord to supply the different region of the body. The brain gives out 4 optic nerves to the eyes, 2 tentacular nerves to tentacles and 2 palp nerves to palp.

~~From the small~~ The nerve arises from small ganglion of circumpharyngeal connective, goes to ventral peristomium region.

From the subpharyngeal ganglion a pair of nerves goes to 1st parapodia and the 3 pair of nerves arise from each ganglion out of which 1st pair i) goes to anterior region of body. ii) goes to body wall iii) to parapodia.

(3) Visceral or Ventral nervous system,
The VNS has 2 main nerves originating from subpharyngeal ganglion & running parallel to the connectives, each of them has dorsal & ventral ganglion.
From the dorsal ganglion two pair of nerves goes to dorsal peristomeium cirri.
~~Funct~~

Function —
The nervous system control & co-ordinate the working of Organism by reflexes of muscles.
There is a co-relation of circular and longitudinal muscle in each segment so that construction of one layer automatically brings about relaxation of other.
There are two adjacent segment if excitation of muscle layer in one segment leads to excitation of same layer in other segment.
The nerves running along the whole length of organism have 2 large lateral fibres, 2 large median fibre & one small fibre. When the fibres join together brings immediate co-ordination of the entire body bec. impulse travel rapidly in them from one end of the body to other & they cause muscle to contract quickly.

Sense Organs

1) Prostomial tentacles
It is a pair of small cylindrical projection from anterior border of prostomium. They are probably tactile, surface of tentacles bear numerous sensory spiral organ each consisting of about 100 photoreceptive cells.
It is spirally arranged within a cuticular pit.

2) Prostomial Palps
These are a pair of stout, highly muscular, two jointed str. arising from each ventro lateral aspect of prostomium.

Proximal or basal joint is large while distal one is small & can be retracted into former. In addition to serving as lateral lips, the palp probably serve as organs of touch, taste & smell

3) Nuchal Organ
These are a pair of small pits on the posterior dorsal surface of prostomium behind eyes. Pits are lined by ciliated epithelium & gland cells. and connected by nerves to the hind part of the brain.
They serve as the organ of smell and chemoreception and help the worm in detecting prey.

4) Peristomial Cirri
These are elongated, slender, unjointed str., two pair on each side of peristomium, it serve as a tactile organ.

(5) Eyes.

Dorsal surface of prostomium bear 4 simple black eyes. Each eye is cup like structure with a pigmented wall consisting of radially arranged tall, narrow and light receptive retinal cells.

Each retinal cell is distinguished into 3 distinct parts –

(i) On outer nucleated part drawn out into a nerve fibre of the optic nerve.

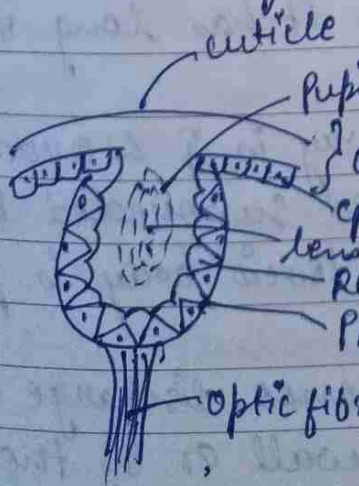
(ii) a highly pigmented middle part or main body.

(iii) An inner part forming a clear hyaline rod projecting toward lens.

Cup is filled c̄ a gelatinous substance forming a lens. According to Andrews it is secreted by retinal cells. Outer exposed surface of eye is covered by a layer of flattened epidermal cells & transparent, protective ~~cuticle~~. cuticular layer together forming the cornea.

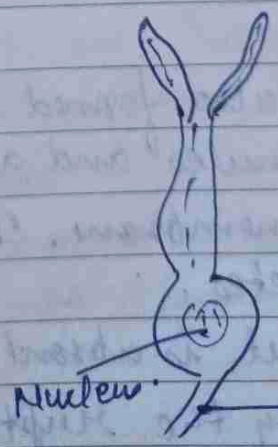
Retinal cells are modified ectodermal cells & become continuous c̄ epidermis at the edges, so that the small opening of cup towards cornea function as a pupil.

Eyes are not image forming but enable the worm to detect changes in light intensity.



(A) Entire Eye (VS)

[V.S of eye]



(B) An isolated Retinal Cell.

Reproductive System of Nereis

Nereis is a dioecious i.e sexes are seperate and the testis & ovary (gonads) are not a permanent or distinct str. They are seasonal & developed during breeding season i.e summer months.

Gonads

The gonads are formed by the proliferation of cell of coelomic epithelium & can be seen as groups of masses of germ cell. This groups of germ cells are found particularly on the ventral side in the coelomic space of nearly all segment except a few anterior segment of body.
In some species of Nereis there is only one pair of testis found in any one segment btw 19 - 25 segment but in N. virens the testis extends in many segments.
In the female the ovary lies in many segment around the blood vessels.
Gonads have no gonoducts.
The Germ cells from the masses in male seperate in the coelomic fluid as sperm mother cell, they keep on floating. Coelomic cell divide rapidly, undergo maturation to form spermatid which transform into sperm. The mature sperm has a rod shaped head & it has long vibrating tail.
Ova is also formed in the same way in ♀ & ovum contains yolk granules and a round shaped surrounded by a certain membrane. The mature Nereis body is packed ē gametes.
Gonoduct is absent in Nereis, hence discharge out either by the rupture of body wall or by the nephridia.

Nephridia

Such type of acting both as excretory organ & as a genital organ are called Meronephridia.

Dorsal Ciliated Organ

A pair of dorsal ciliated organ is found in each segment close to the dorsal longitudinal muscles, each ciliated organ is folded & funnel shaped str. which opens into the coelome, a wide opening but it has no external opening. So it is believed to be the coelome duct of other Polychaetes. There are some opening which open temporarily to the exterior during breeding season performing the function of nonoduct.

The true nature of the ciliated organ is doubtful & controversial.

The colour of N. Virens during breeding season become orange or reddish. The no. of segment increases due to the formation of new segment just anterior to posterior one.

Besides this there may be changes in the shape of parapodia, no. of setae, length of tentacles & the no. & arrangement of tentacles.

Sexually or non-sexually form of Nereis are more or less resemble from many point of view but in some species certain variation and structural modification have been recorded in the body of sexually mature Nereis which are completely lacking in non-mature species.

Such species exhibit two distinct phase in life cycle -

1) Non-Sexual phase - Nereis

2) Sexual phase - Heteronereis

This phenomenon is called epitoky.

Epitoky or Heteronereis

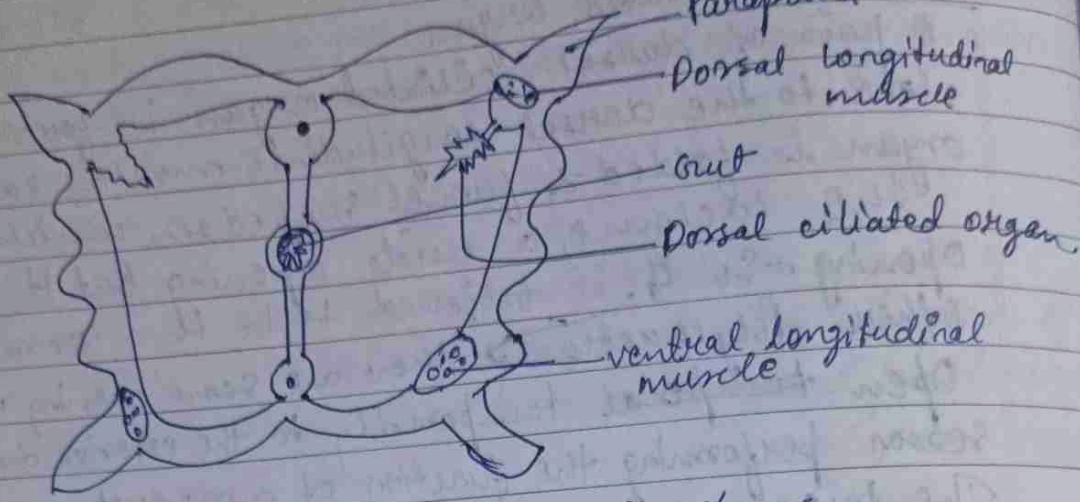


Fig- T.S of a segment of Nereis shows ciliated organ

Epitoke

Epitoke is the specific phenomena & it is specialised feature of Nereis. In the formation of sexual phase the epitoky phenomenon play imp. role & due to the presence of Epitoke it differes from non-sexual phase/atoke. This changes are induced by hormones secreted into the plexus of blood vessel lying below the brain. So the heteronereis consist of 2 phases -

1) Sexual phase (Epitoke)
2) Non-Sexual phase (Atoke)

→ ### Features of Heteronereis

It leaves the burrow, comes up at the surface of water and lead an active free swimming life, the eye become much more prominent greatly enlarged & highly sensitive to light. The peristomial cirri become longer, the parapodia of epitoke region become enlarge, develop additional foliaceous outgrowth

setae becomes oar shaped and highly vasularised. Intestine in epitoke region become compressed due to development of gonads & finally it becomes functionless. The sensory papillae develop in the last segment.

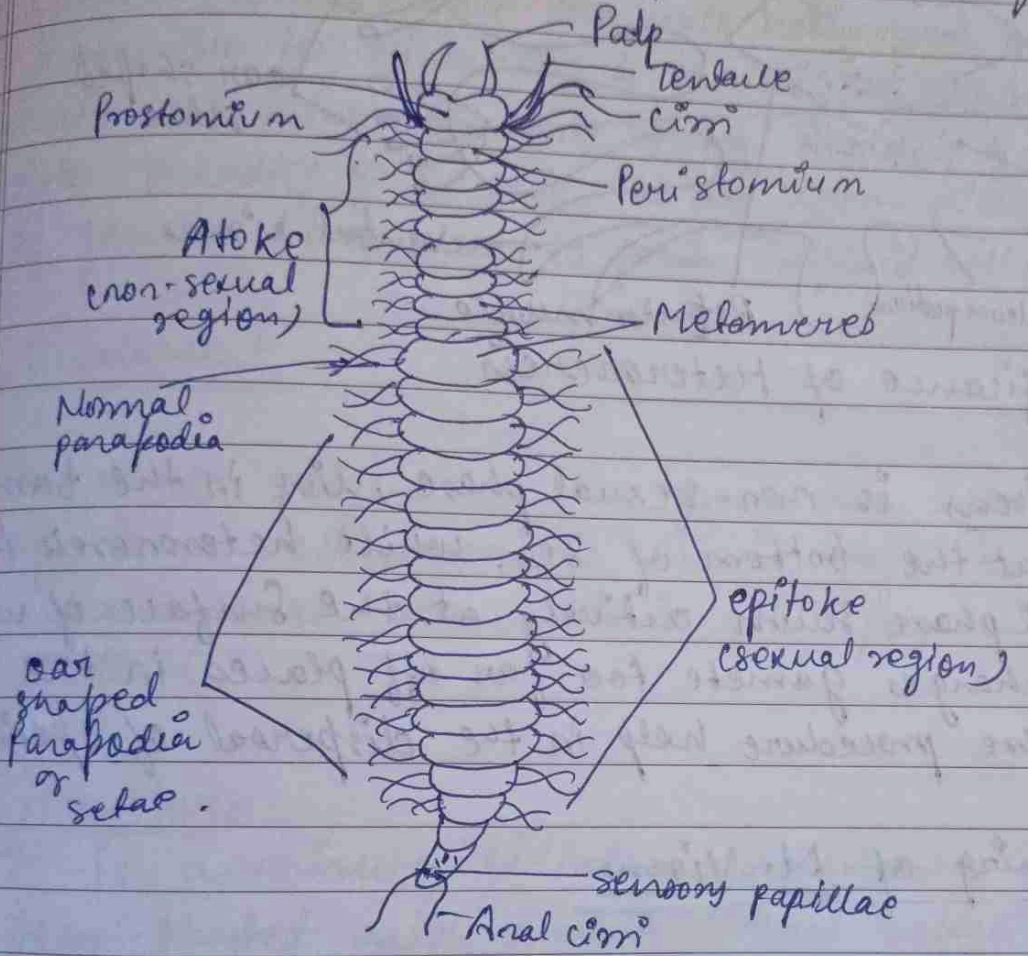
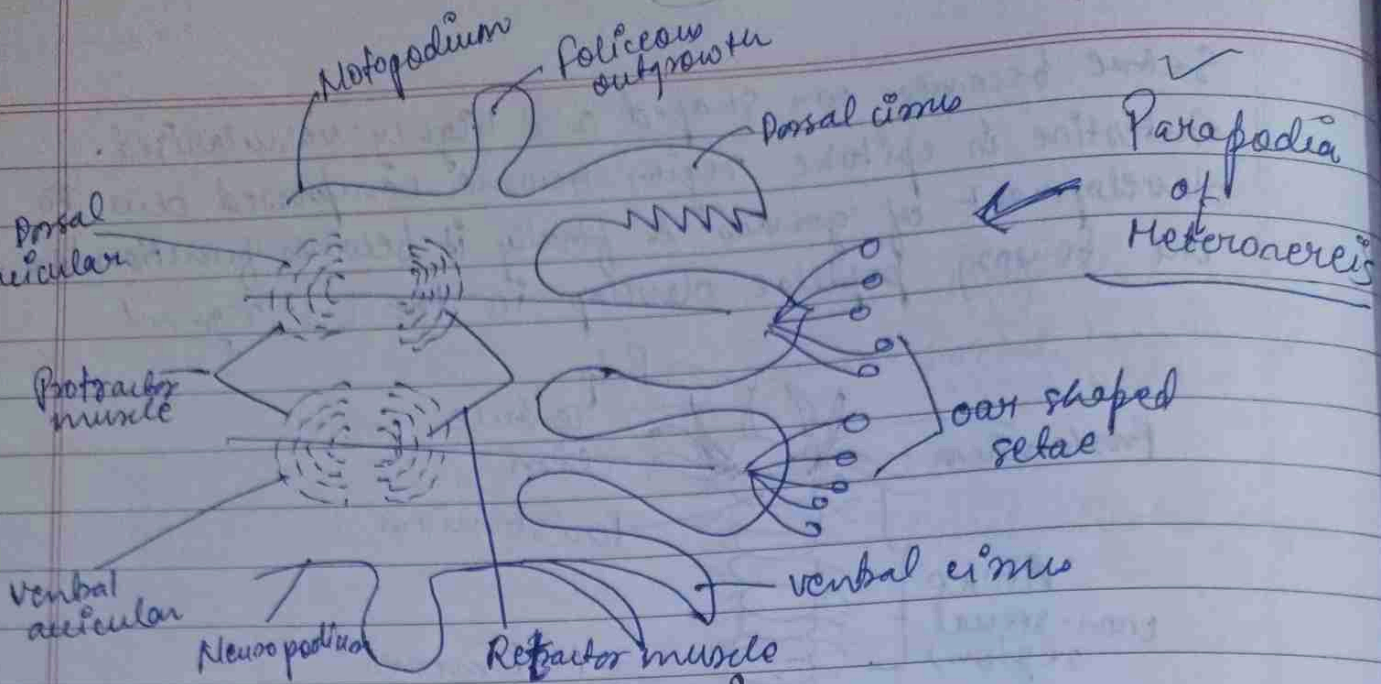


Fig - A Heteronereis

Parapodia of Heteronereis

Parapodia of epitoke region differ from parapodia of atoke region. The parapodia of Heteronereis is large, foliaceous, it develop additional lobe; dorsal & ventral cirrus are highly enlarge, setae become oar shaped and arranged in fan like manner. It becomes highly vasularised.

Date
Page



Significance of Heteronereis

N. Virens is non-sexual phase, live in the burrow or creep at the bottom of sea. while heteronereis in sexual phase swim actively at the surface of water, it discharges gamete too far off places in the sea so these procedure help in the dispersal of species.

Swarming of N. Virens

The fully sexually mature Nereis leave their burrow in groups & come on the surface of sea water to swim freely, it is called swarming.
This phenomenon probably occurs to facilitate fertilisation and form Nuptial dance in which male & female swim rapidly in small circle. Mostly swarming occurs at night.

Fertilisation

Fertilisation is external and takes place in open sea water. during swarming the ♀ heteronereis produce substance called fertilizin / fertilium which attract the male heteronereis & it is responsible for stimulating & shedding of sperm by the male that inturn stimulate ♀ for shedding of ova or egg. After shedding of gamete the ♂ worm dies and the fusion of gametes takes place to form diploid cell (fertilised egg)

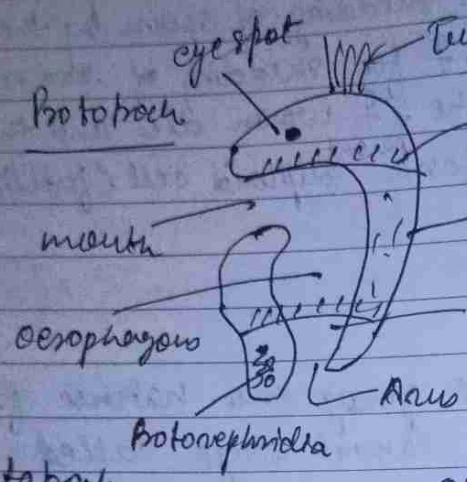
Development

In some polychaetes the young one hatches from egg in a characteristic larval stage called trochophore also occurs in other polychaetes & Mollusc.

Structure

→ It is a minute, ciliated, unsegmented and almost pear shaped with oral & aboral surface.
→ It is a fully grown trochophore, there is a sensory apical organ or plate bearing tuft of cilia.
→ Brain rudiments as a ganglion present below the apical plate.
→ The characteristic feature is preoral band is present called prototroch
→ Digestive tract is complete.
→ A post oral band or metatroch lies behind the mouth in some cases there is also a telotroch just in front of anus is found
→ Gut is differentiated into Oesophagous, stomach & intestine.

→ Excretory organ is protonephridia.
→ Coelom is absent.
→ space enclosed btw gut, endoderm & ectoderm is called blastocoel.



Structure of Trochophore Larva

Metamorphosis

→ It is a pelagic creature inside the sea
→ Metamorphosis results in immediate termination of or loss of larval structure such as protonephridia, prototroch, mesotroch.
→ Cell of apical plate form prostomium & brain
→ Formation of body segment is marked externally by the development of ventral setal sac & setae
→ Larva gradually grows in length & the formation & development of trunk segment in front of the terminal pygidium
→ Mouth region fuses with 1st trunk segment to form the peristomium without setae

Phylum Arthropoda

Significance

- The Trochophore larva serves for the dispersal of the species.
- Trochophore larva appears in the form of animal belonging to several phyla such as annelida, Molluscaetc.