Phylum Annelida شعبة الديدان الحلقية

* The term Annelida is derived from the Latin word " annelus" which means a little ring .

General Characteristics of Phylum Annelida :

1- Body segmented or metameric .

2- Symmetry bilateral .

3- Body wall with outer circular and inner longitudinal muscle layers .

4- Epidermis secretes a transparent moist cuticle.

5- Body wall is made of the following layers : Cuticle , epidermis , circular muscles, longitudinal muscles , and peritoneum.

6- Chitinous setae or chaetae often present (absent in some leeches).

7- Coelom true (eucoelom) schizocoelic, well developed and divided by septa except in leeches.

8- Coelomic fluid functions as a hydrostatic skeleton.

9- Circulatory system closed type and segmentally arranged.

10- Respiration through skin parapodia and gills.

11- Digestive system complete and provided with glands.

12- Excretory system paired nephridia for each segment with few exceptions.

13- Nervous system well developed and consists of :

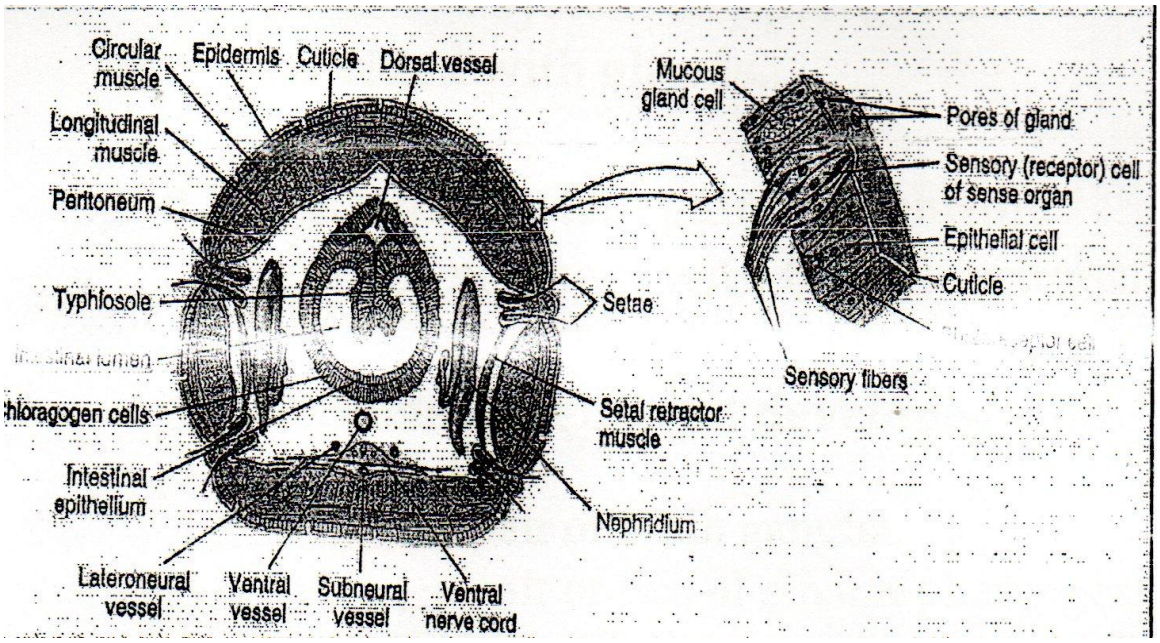
a- a pair of brain ganglia.

b- a pair of two of circum- pharyngeal connectives or commissures around the pharynx.

c- a double ventral nerve cord.

14- Sensory system of tactile organsاعضاء حسيه لمسية , taste buds , statocystsكيس التوازن (in some) , photoreceptor cells and eyes with lenses (in some).

15-Hermaphroditic or separate sexes , larva if present are trochophore typeاليرقه الدولابية , asexual reproduction by budding in some , spiral cleavage and mosaic development.



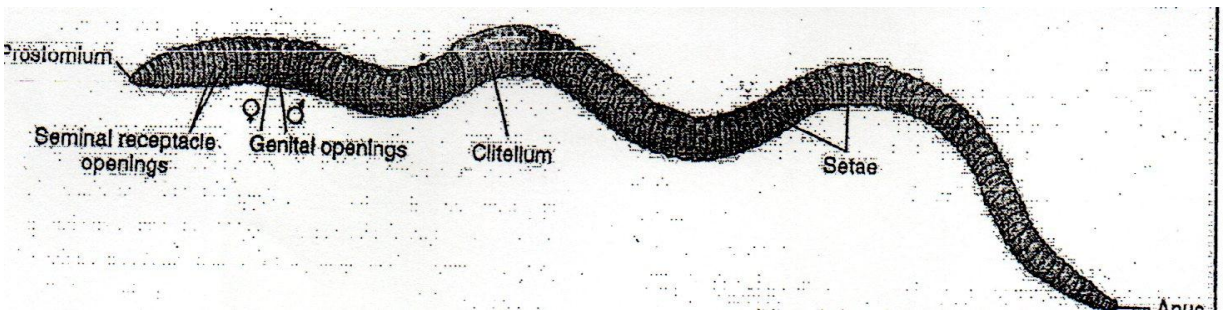
Classification of Phylum Annelida :

*** Classification is generally based on presence or absence of :**

1- Parapodia.

2- Saetae.

3- Clitellum.



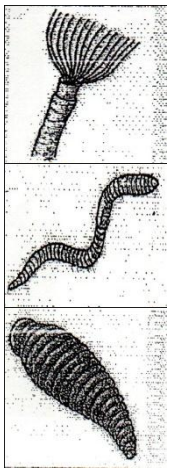
*** Phylum Annelida was previously divided into four classes:**

a. Class Archiannelida. b. Class Polychaeta. c. Class Oligochaeta. d. Class Hirudinea .

*** Nowadays, annelid are divided into only three classes:**

a. Class: Polychaeta.

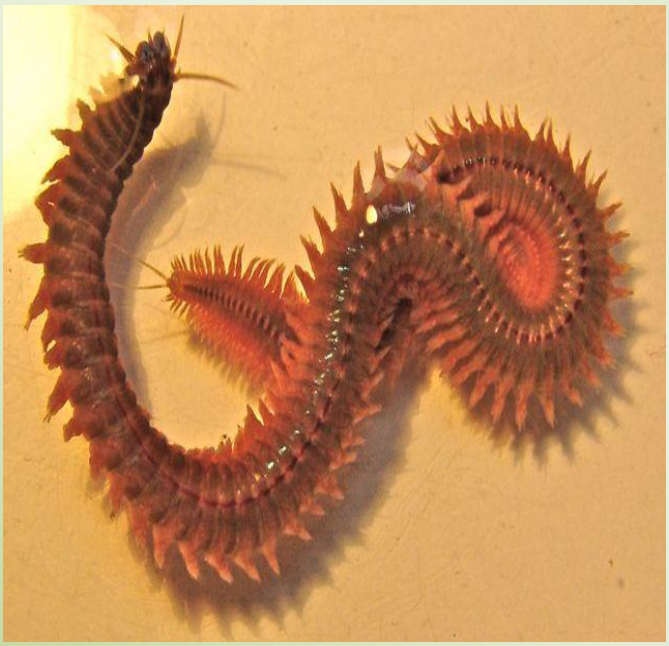
b. Class: Oligochaeta.



c. Class: Hirudinea.

Class Polychaeta

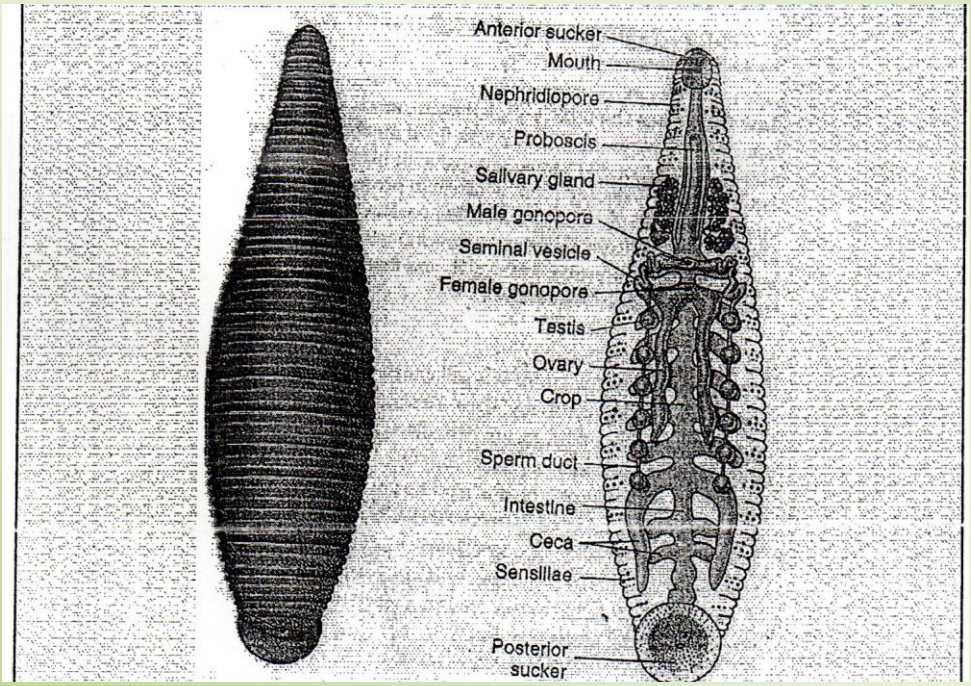
1- mostly marine . 2- head distinct with eyes and tentacles. 3- most segment with parapodia , the lateral appendages. 4- each parapodium with a tuftخصلة (large number) of saetae or chaetae , therefore , these annelid are called Polychaeta. 5- development indirect. 6- no clitellum . ***Ex:*** *Nereis, Aphrodite, Arenicola, Chaetopterus.*



Class Hirudinea

1- body with fixed number of segments. 2- with many annuli per segment. 3- usually with oral (anterior) and posterior suckers. 4- clitelum present. 5- saetae absent except in Acanthobdellida. 6- development direct. 7- coelom closely packed with connective tissues and muscles.

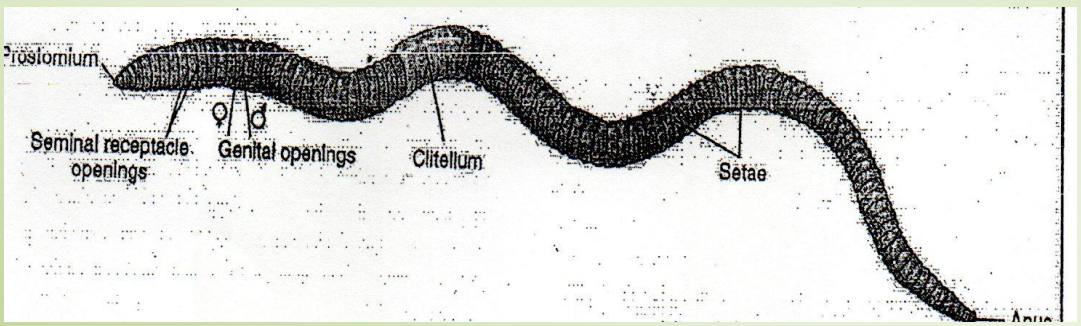
Ex: *Hirudo, Acanthobdella, Theromyzon.*



Class Oligochaeta

1- body with conspicuous segmentation التعقيل واضح . 2- aquatic or terrestrial. 3-few saetae per segment, hence these worms are called Oligochaeta. 4- no parapodia. 5- clitellum present. 6- head not distinct. 7- development direct.

Ex. *Lumbricus, Allolobophora, Dendrobaena, Aporrectodia, Eisenia.*

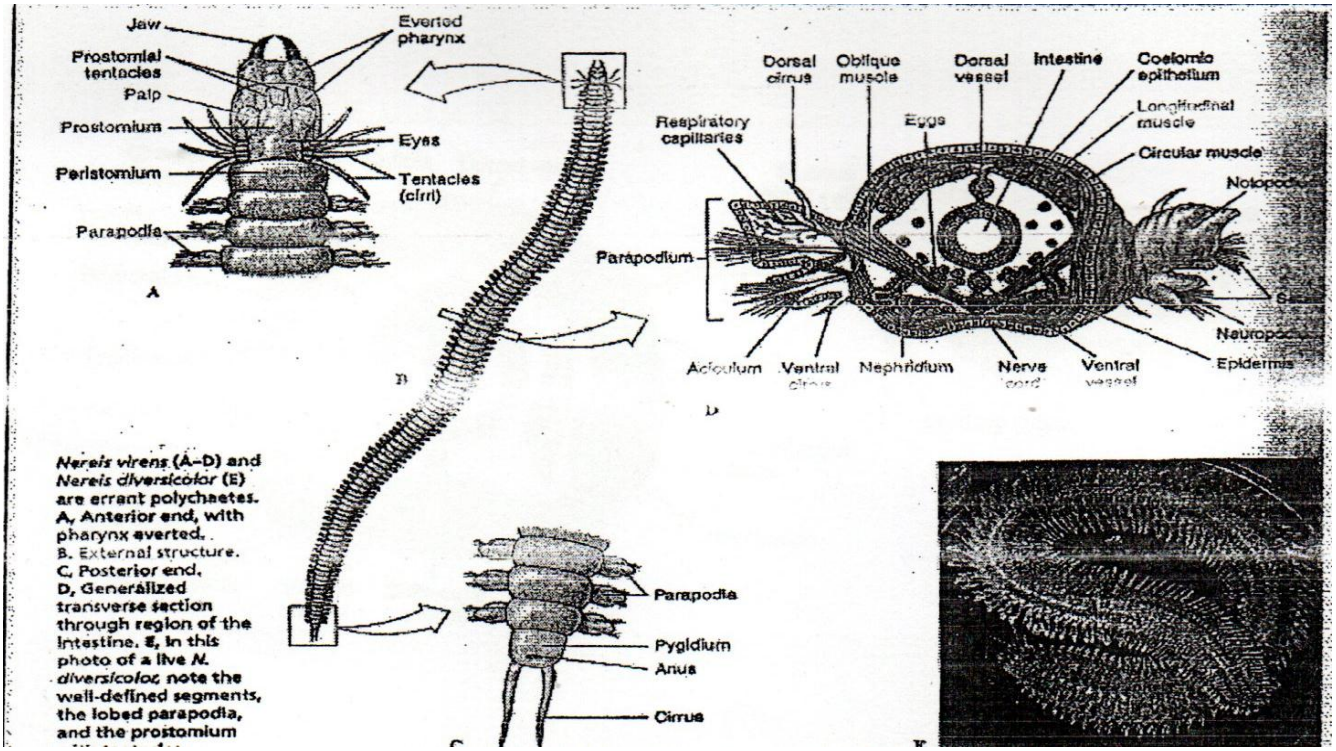


Nereis

1- *Nereis* is called **calmworm** because it is generally found with clams.

2- It is also called **sandworm** as it is observed burrowed in sand in shallow water on the sea sandy shores.

3-This worm is nocturnal , it becomes active at night.



External Features

The worm is :

1- bilaterally symmetrical .

2- dorsoventrally compressed (curved dorsally, flat ventrally) , about 30 cm long.

3- greenish – blue, steel- blue,

greenish- brown in colour .

4- can be divided into **head** and **trunk** .

Head is distinct and consists of two main portions :

a. prostomium:

Is triangular in shape (not considered a segment) and bears :

1- a bilobed brain .

2- a pair of small tentacles.

3- two pairs of eyes (dorsally)

4- one pair of large palps (bilobed)

b. Peristomium:

Is the first segment of the body and has no parapodia , but bears:

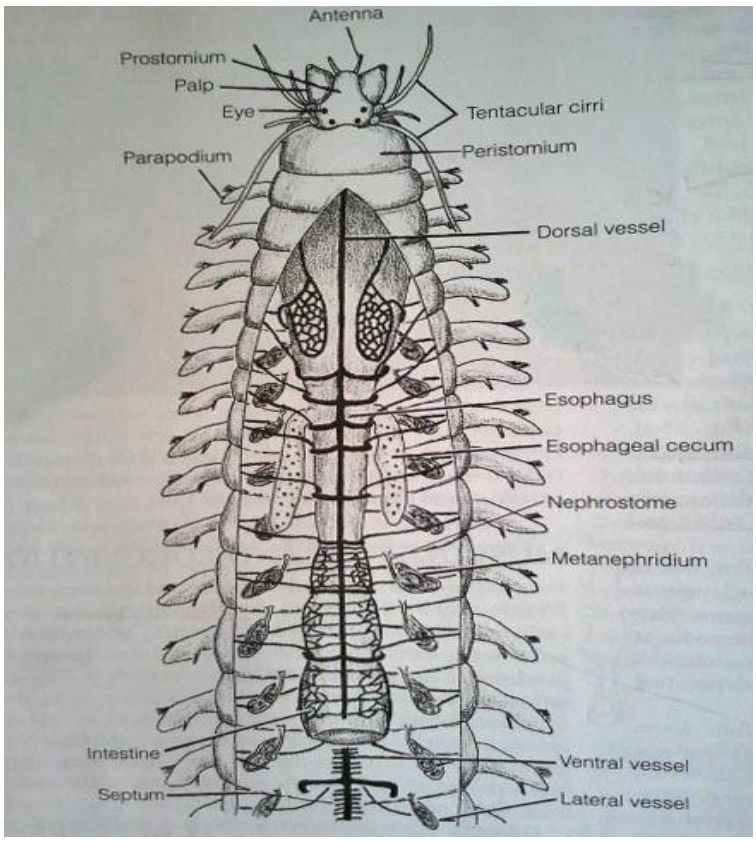
1- the mouth opening (ventrally).

2- four pairs of peristomial tentacles or cirri.

* Trunk , the body behind the head consists of about 200 segments :

1- Each segment except the last or anal segment or pygidium has a pair of parapodia.

2- The pygidium bears the anus and a pair of long anal cirri.



*** Parapodium :** Parapodia are paddle- like structures. They are used for locomotion and respiration .

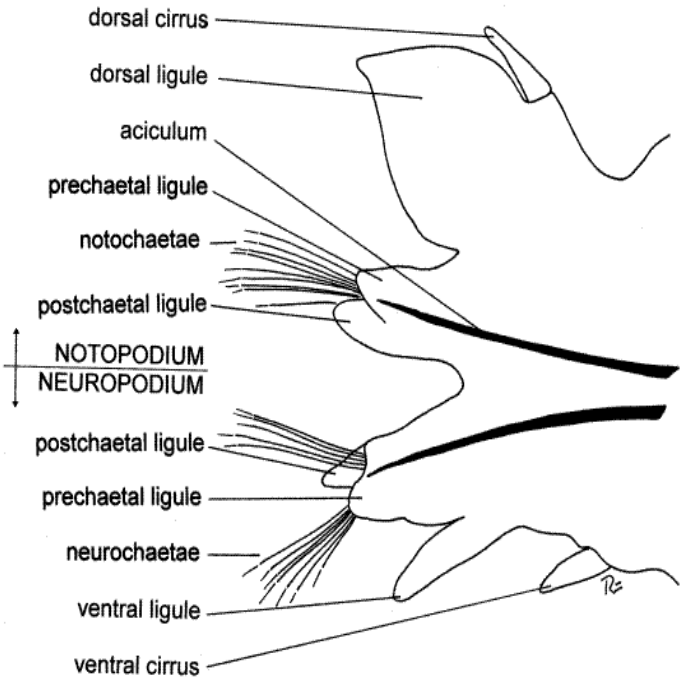
each consists of two main lobes or parts :

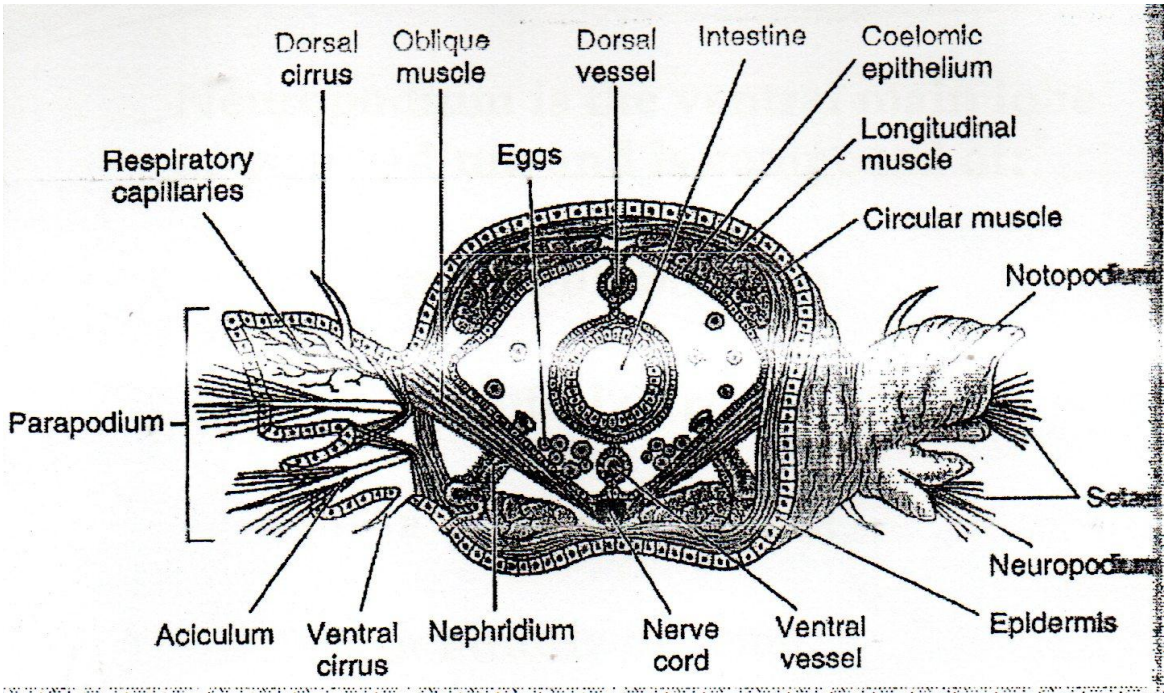
a- Notopodium : is the dorsal main lobe or part hence called notopodium and consists of :

1- Two sublobes. 2- a dorsal cirrus. 3- a dorsal aciculum . 4 - a bundle or tuft of chaetae.

b-Neuropodium: is the ventral main lobe of parapodium and is composed of :

1 - two sublobes also. 2 - a ventral cirrus. 3- a ventral aciculums . 4- a bundle of setae.





Body Wall

Body wall is somewhat thick and consists of :

a. Cuticle is :

1- secreted by the epidermis.

2- perforated by gland cells openings.

3- a thin outermost layer of the body.

4- protective in nature.

b. Epidermis is :

1- one cell- layered of simple epithelial tissue.

2- composed of supporting cells , glandular cells and sensory cells.

3- thin dorsally and thick ventrally.

c. Muscles :

Can be divided into three groups :

1- Circular muscles : just inner to the epidermis , arranged in a layer.

2- Longitudinal muscles: inner to the circular arranged in four longitudinal groups two dorsolateral and two ventrolateral.

3- Oblique muscles : two pairs in each segment near the base of parapodia extending from median ventral line of the body.

d. Peritoneum: a layer of coelomic epithelium (parietal epithelium).

Coelom

1- true coelom of mesodermal origin.

2- schizocoelic type.

3- Lind with peritoneum.

4- wide perivisceral cavity.

5- filled with fluid, amoeboid cells , reproductive cells or gametes during breeding season.

6-divided transversely by septa into chambers or compartments (segments).

7- septa are perforated just below digestive system (intestine) , thus , the whole coelomic compartments are connected to each other

8- helps in distribution of dissolved gases and food.

9- serves as a hydrostatic skeleton and helps in locomotion.

10- absobs external shoks .

11- removes the excretory waste products.

Nutrition and Digestive System

* Food :

1- *Nereis* is carnivorous .

2- feeds on small crustaceans, mollusks , sponges and other animals using its مقلوبه everted jaws and denticles.

3- catches its preys at night (nocturnalليلي)

* Digestive system Consists of :

1. Mouth : is an opening which lies on the ventral side of the peristomium.

2. Buccal Cavity: a large sac- like structure . **مجهز**equipped with small chitinous denticles تراكيب مسننه صغيره تدعى(paragnathsاشباه الفكوك).

3. Pharynx : highly muscular structure .قابل للبروز protrusible through the mouth forming خطمproboscis supplied with a pair of powerful serrated hook- like jaws يحمل زوج من الفكوك قويه مسننه تشبه المخالب.

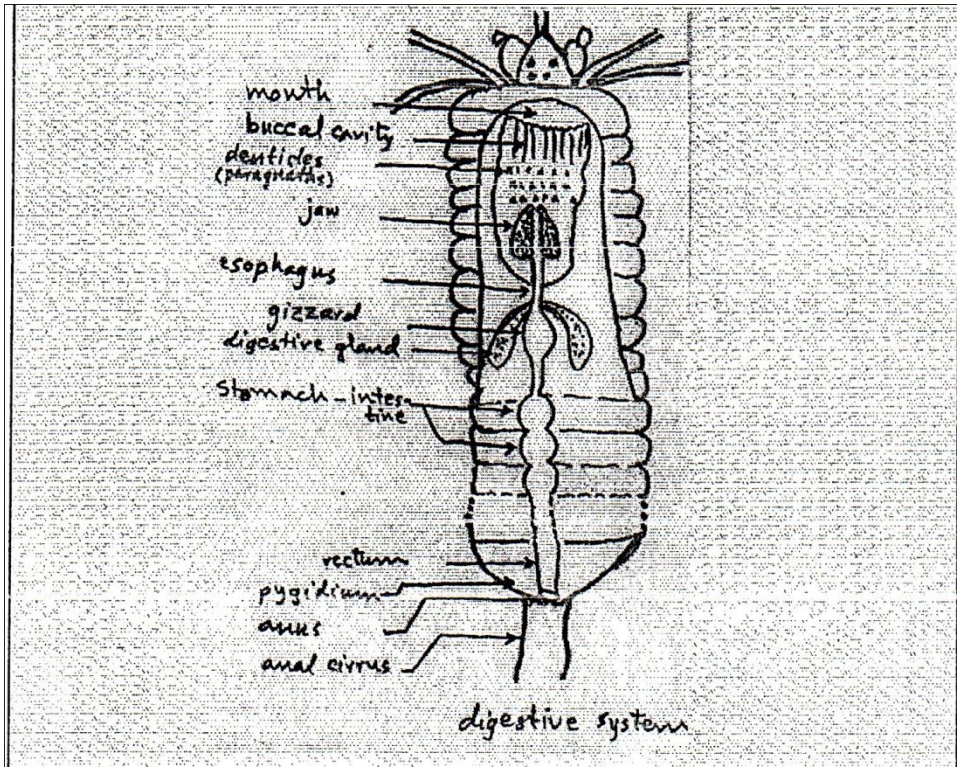
4. Oesophagus : slander narrow tube which connects phrynx with stomach- intestine. supplied with a pair of digestive glands.

5. Gizzard: highly muscular sac- like structure.

6- Stomach- intestine: wide, long, straight tubular structure.تتخصر constricted by intersegmental septa حواجز بين حلقيه . supplied with secreted gland cells.

7 - Rectum: the last part of the digestive system. short tube situated in pygidial segment.

8- Anus : the terminal opening of the digestive system at the end of rectum at the pygidium الحلقه الاخيره منصهره مع الذيل تدعى.



Circulatory System :

1- well developed.

2- closed- type, blood circulates in a system or network of blood vessels

3-No blood sinuses.

4- circulatory system consists of :

a. Blood: Is a colourless plasma fluid.

b. Respiratory Pigment : Is haemoglobin, red pigment dissolved in plasma.

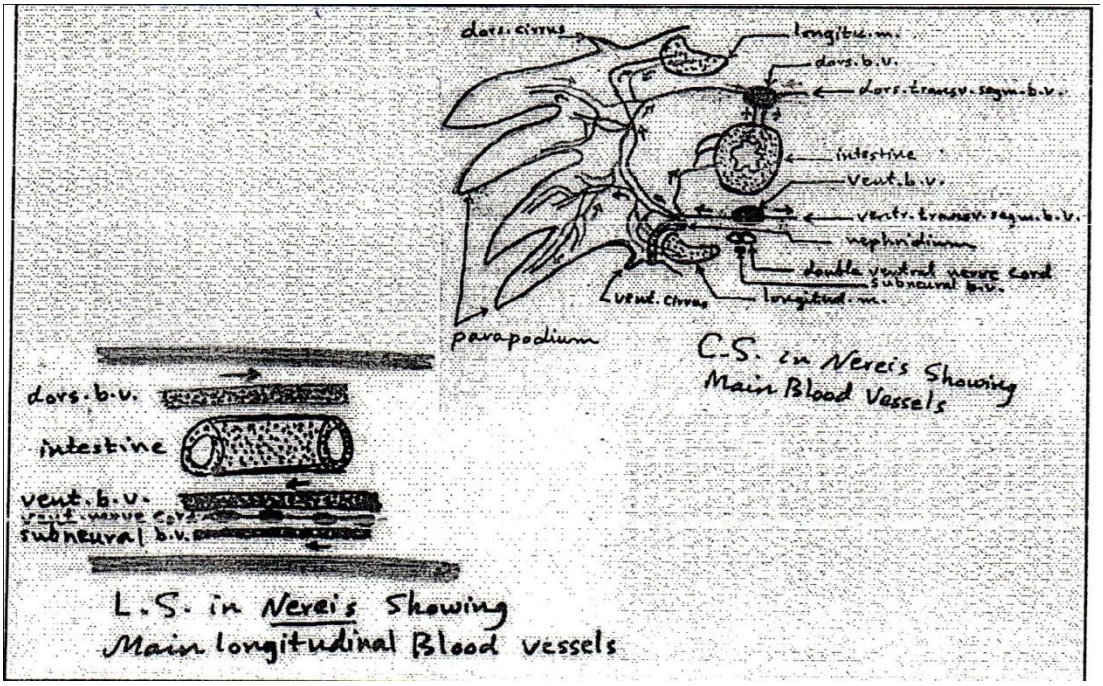
c. Main Blood Vessels :

1- Dorsal Blood Vessel : longitudinal blood vessel . lies dorsally above the intestine. collects the blood (collectorجامعه) but becomes distributor anteriorly. blood flows inside it from posterior to anterior end.

2- Ventral blood Vessel: longitudinal blood vessel. lies below the intestine. distributes the blood (distributorموزعه) become collector anteriorly. blood flows inside it from anterior to posterior end.

3- Transverse Segmental Blood Vessel: there are two pairs (a dorsal and a ventral) in each segment except 4 or 5 anterior ones. the dorsal pair is connected to the dorsal blood vessel but the ventral pair is connected to the ventral blood vessel. the ventral pair distributes blood to intestine , longitudinal muscles , nephridia and parapodia , where as the dorsal pair connects blood from these organs.

4- Subneural blood vessel : lies just below the ventral nerve cord. collects blood from body and supplies the ventral blood vessel with it. direction of blood flow is from anterior to posterior.



Respiration

1- Exchange of dissolved gases takes place by diffusion and through the general body surface, particularly at the surface parapodia , which is richly supplied with a network of blood vessels.

2- the respiratory pigment in plasma is haemoglubin, which help in transferring gases. It is red in colour and contains iron.

Excretion

1- Excretion takes plaace via paired nephridia.

2- In each segment, except the first and the last ones, there is a pair of nephridia . Each nephridium extends in two segments.

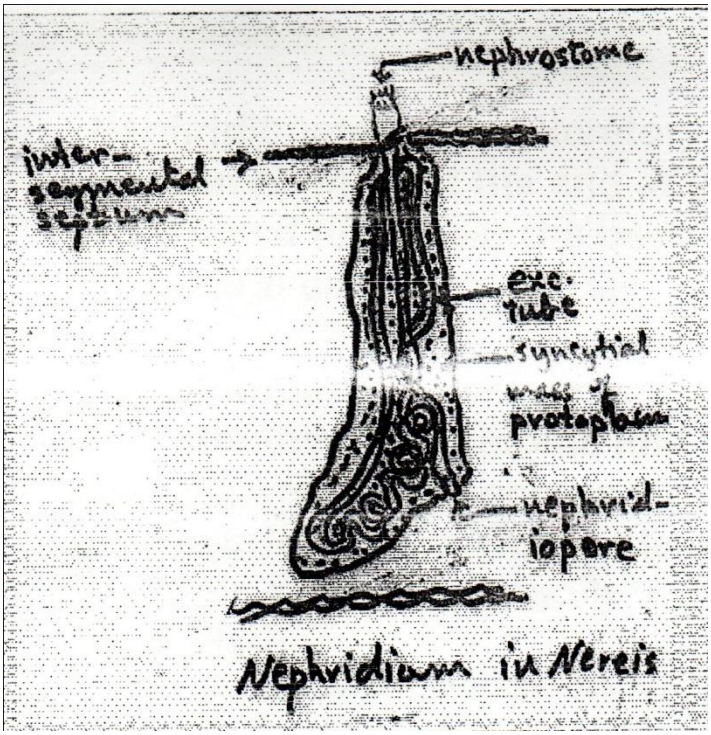
3- Each nephridia consists of :

a- Nephrostome : a ciliated funnel which opens in the coelom of a preceding segment.

b- Convoluted tube : which penetrates the intersegmental septum. It is ciliated at places, and embedded in a syncytial mass of protoplasm. This tube, except the neck region is located in the segment next to that in which nephrostome is situated.

c- Nephridiopore or the excretory pore : an opening at the end of the convoluted tube, near the base of the ventral cirrus.

4- Waste products enter with coelomic fluid into the nephrostome and selective resorption انتقائي ارتشاف occurs along the nephridial duct. The waste products are thrown out via nephridiopore.



Nervous System

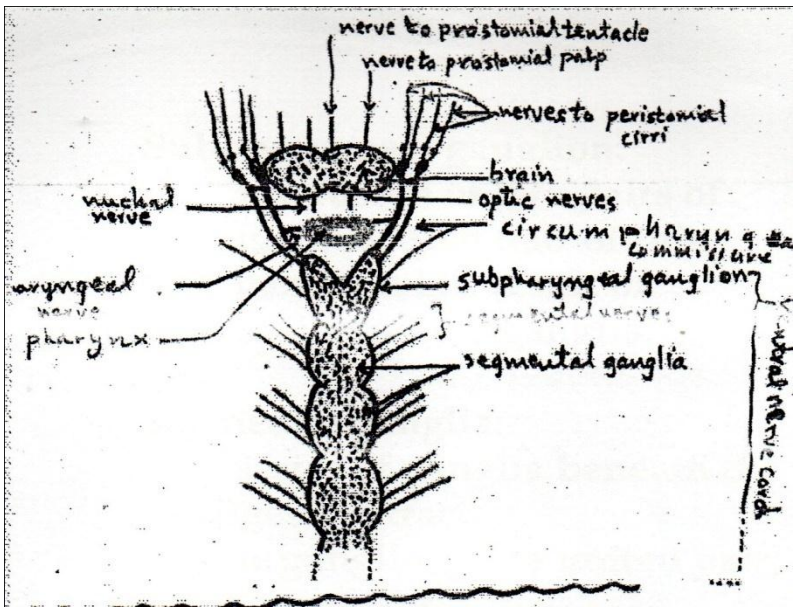
1- Nervous system of *Nereis* is well developed.

2- It is bilaterally symmetrical and metameric.

3- Nervous system can be divided into two main parts :

a. Central Nervous system (CNS).

b. Peripheral Nervous system (PNS) .



Central Nervous system (CNS)

CNS consists of :

1- Brain of two cerebral or suprapharyngeal ganglia : located in prostomium just below the eyes.

2- Circumpharyngeal connectives or commissures : two pairs , one pair on either side of pharynx connecting brain with ventral nerve cord.

3- Ventral Nerve Cord :

It consists of :

1- Subpharyngeal ganglion : Is a fusion of two pairs of ganglia each half of this ganglion is a result of fusion of two ganglia. located in segment 3 تقع بالحلقه الثالثه

2-Segmental ganglia: a series of ganglia beneath the digestive tract. one ganglion (one united pair) per segment started in segment 4 تبدا بالحلقه الرابعه.

Peripheral Nervous system (PNS)

PNS consists of:

1-Paired nerves arising from the brain , two pairs of commissures and ventral nerve cord ganglia , i.e., from CNS.

2- These nerves are One pair to the prostomial tentacles, another one to the prostomial palps four pairs to the peristomial cirri, a pair to the nuchal organ two pair to eyes (ocelli) (all these originate from brain) , a pair to pharyngeal wall forming vegetative nervous system (VGNS).

Sense organs

***Nereis* possesses several sense organs :**

1- Prostomial Tentacles: one pair, tactile.

2- Prostomial Papls: one pair tactile , smelling , tasting.

3- Peristomial Cirri or Tentacles: four pairs, tactile sensitive to touch.

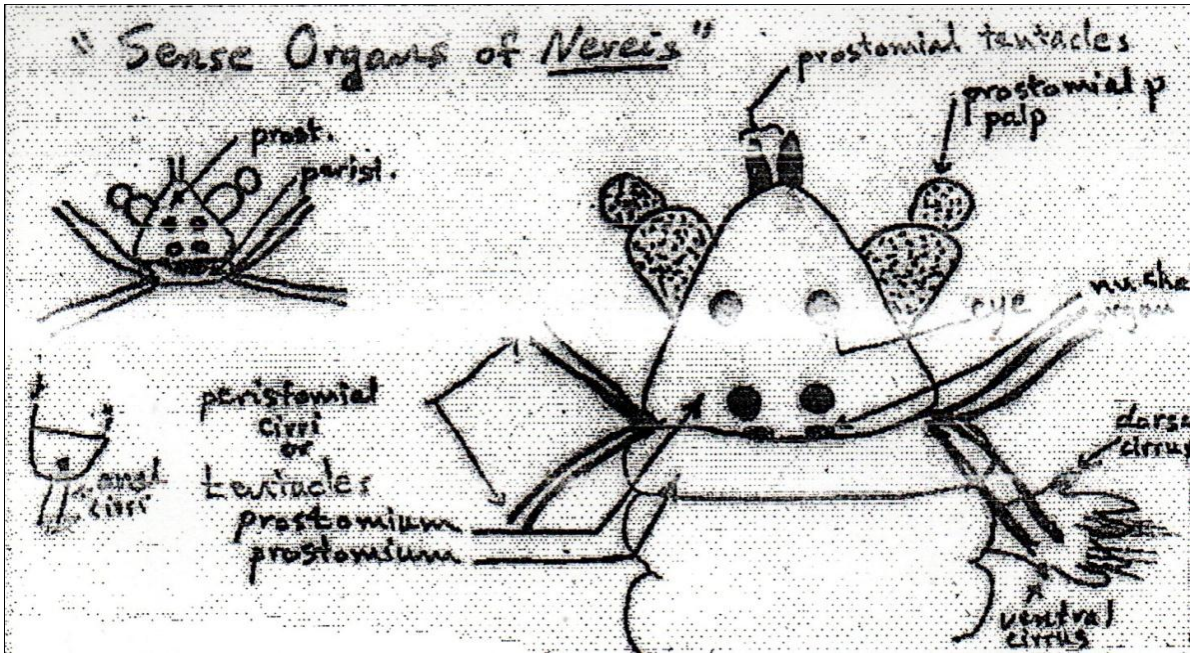
4- Eyes : Two pairs, sensitive to light.

5- Nuchal Organs: One pair , two small depressions on the posterodorsal side of prostomium just behind the posterior pair of the eyes act as chemoreceptors (detect food).

6- Parapodial Cirri (Dorsal and Ventral): tactile

7- Anal or Pygidial Cirri : One pair tactile.

* In addition to all these sense organs epidermal sensory cells are present on the whole body surface.



Reproduction and Reproductive

1- Sexes are separate, i.e., *Nereis* is unisexual or dioecious.

2- No definite reproductive organs and ducts are there.

3- Gonads are temporary and are formed as swellings from the ventral septal coelomic or peritoneal epithelium, just bellow the digestive canal.

4- Testes are formed in all segments except the few anterior ones. Usually the posterior segment are involved in formation of gonads.

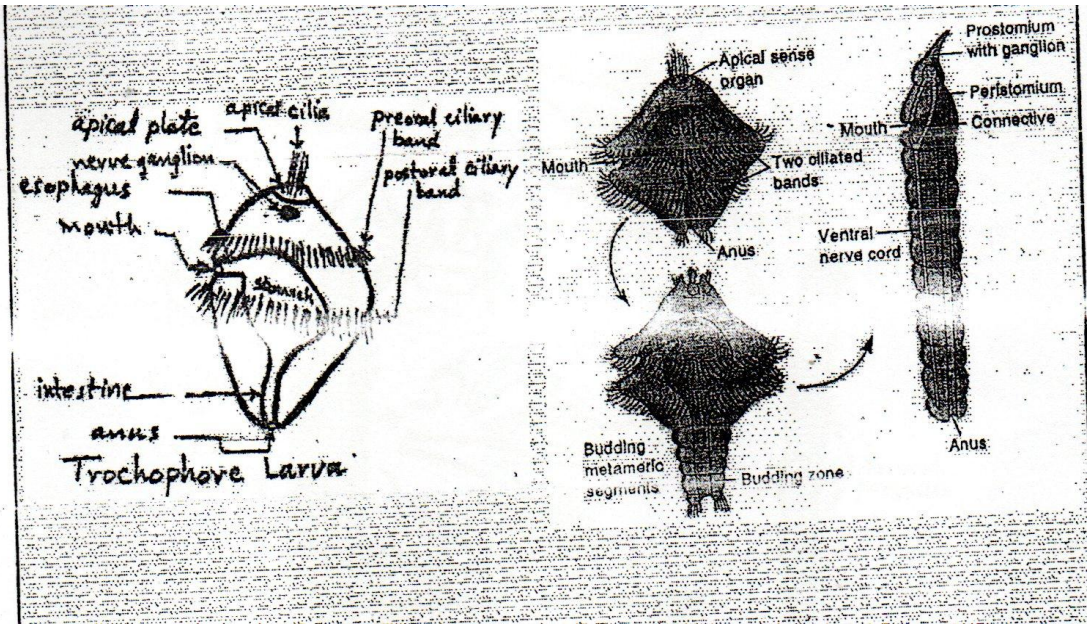
5- Ovaries are formed in many segments.

6- Sex cells or gametes are discharged into the coelom and they mature there in the coelomic fluid.

7- Gametes are discharged out of the coelom either via nephridla or through body wall ruptures.

8- Fertilization occurs in the sea water (externally).

9- Development indirect, trochophore larvae are formed.



Epitoky :

1- At breeding seasons, the sexually mature worms, males and females, swim in groups, to the surface of the sea water, far from the sea shores in order to shed their gonads (sperms or ova).This behaviour is called swarmingيحتشدون.

2- In breeding season, some species of *Nereis*, such as *N. virens*, *N. pelagic* and *N. irrorata* are externally differentiated into two distinct regions:

3 - an anterior atoke or asexual or asexual region without gonads.

4- a posterior epitoke or sexual region containing gonads or gametes.

5- Parapodia undergo great morphological and anstomical *changes*. *these are the sighns of reproduction*.

6-The phenomenon involving transformation of non- sexual individual into sexual individual is referred to as **epitoky**.

7- These changes that occur during the reproductive period include as we mentioned above, both morphological and anatomical and are observed in :

a- Head region b- Parapodia of epitoke region. c- Pygidium

a - In the head region, only few changes occur:

1- eyes enlarge so that the two eyes on each side of the prostomium contact each other.

2- Prostomial tentacles and palps shorten.

3- peristoial cirri undergo great enlargement.

b- parapodia of epitoke region undergo great morphological and anatomical changes :

1- formation of two foliaceous lobes one before each of the dorsal and ventral cirri.

2- dorsal cirrus enlarges and becomes serrated.

3- ventral cirrus also enlarges and becomes bilobed.

4- notopodium and neuropodium both greatly enlarge.

5- the lanceolate setae are lost and oar- shaped ones are formed.

6- new strong and effective muscles are formed to help moving the greatly enlarged parapodia.

c- In the pygidium the changes are :

1- the two anal cirri also undergo enlargement.

2-sensory papillae develop on anal segment.

* Zoologists for many years thought that this changed *Nereis* was a new genus. They named it as ***Heteronereis*.**