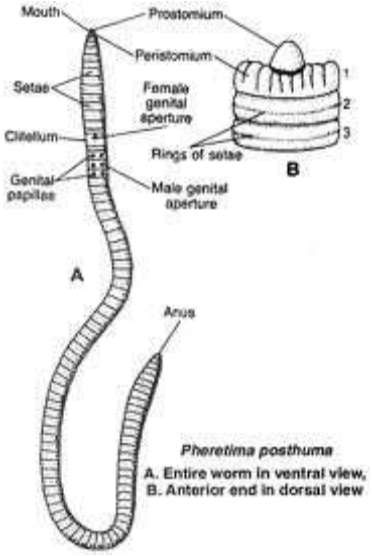
Pheretima posthuma (EARTHWORM)

VSAQ s :



Pheretima posthuma
A. Entire worm in ventral view,
B. Anterior end in dorsal view

1. Distinguish between vermicompost and vermiwash.?

- Vermicompost formed by earthworms is used as manure. It consists of 60% of N, 5.04% of phosphorous and 0.8% proteins and micronutrients.
- Vermiwash is a liquid fertilizer produced by passing water through the columns of vermiculture. It is used as foliar spray.

2. Which are longest and shortest earthworms?

- Longest earthworm is *Megascolides australis* (giant Gippsland earthworm)
- Shortest earthworm is *Chaetogaster annandalei.*

3. Write the names of genera of Indian earthworms.

Pheretima, Plypheretima, Eutyphaeus, Perionyx, Drawida, Megascolex are the names of general of earthworms in India.

4. Why earthworms are considered as friends of the farmer?

- earthworms make burrows in soil and increase the fertility of soil
- burrows increase the soil aeration.
- they bring nutrient rich subsoil to surface in the form of castings.
- worm castings act as good natural manure with nitrogenous compounds

5. List out the 4 types of cells present in epidermis of *Pheretima.?*

4 types of cells present in epidermis are

a) Large glands cells -- mucus secreting cells and albumin secreting cells.

b)Supporting cells

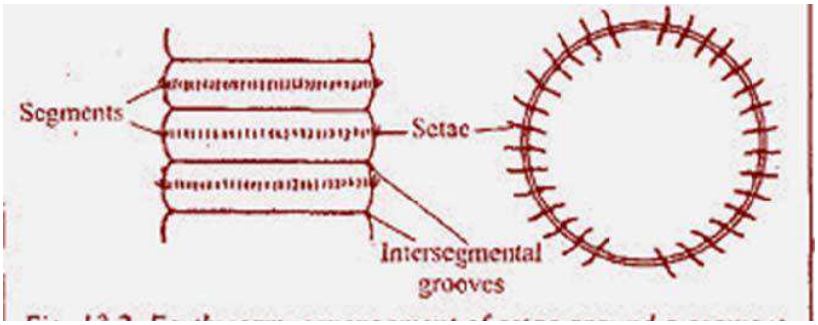
c)Basal cells --- totipotent cells.

d)Receptor cells.

6. Distinguish between perichaetine and octochaetine arrangement.

- Arrangement of setae in earthworms is of two types like peri and octochaetine.
- Perichaetine arrangement: A ring of setae or chaetae is arranged across the middle line of each segment. E.g., *Pheretima posthuma.*

- Octochaetine arrangement: 8 setae are arranged in 4 pairs ventrolaterally of each segment. E.g., *Octochaetus, Lumbricus* .



7. What is true metamerism ?

- Metamerism is the segmentation in the body.
- If the new segments are formed from the posterior part of the body, it is known as true metamerism. E.g., Pheretima.

8. What is clitellum ? Write its significance.

- Clitellum or cingulum is prominent circular band around the segments 14 to 16 in mature *Pheretima.* It helps in the formation of cocoon or egg case.

9. Write any 2 functions of coelom in earthworms.

- Coelom receives sperms.
- Coelom provides space for visceral organs.
- Coelomic fluid increases turgidity which helps in locomotion.

10. What is the significance of coelomic fluid in earthworms?

- Coelomic fluid kills the bacteria which settle on body.
- Coelomic fluid collects excretory substances and excretes them.
- It keeps the skin moist and helps in the exchange of respiratory gases.

11. What are eleocytes ?

Chloragogen cells after loaded with wastes drop into coelomic fluid as free cells known as eleocytes. They are ingested by amoebocytes.

12. Which part of gut in *Pheretima* acts as suction pump? Where is it present?

- Pharynx with the help of radial dilator muscles acts as suction pump in feeding.
- Pharynx extends from middle of 3^{rd} segment to 4^{th} segment.

13. Which part of gut helps in mechanical digestion? Where it is present?

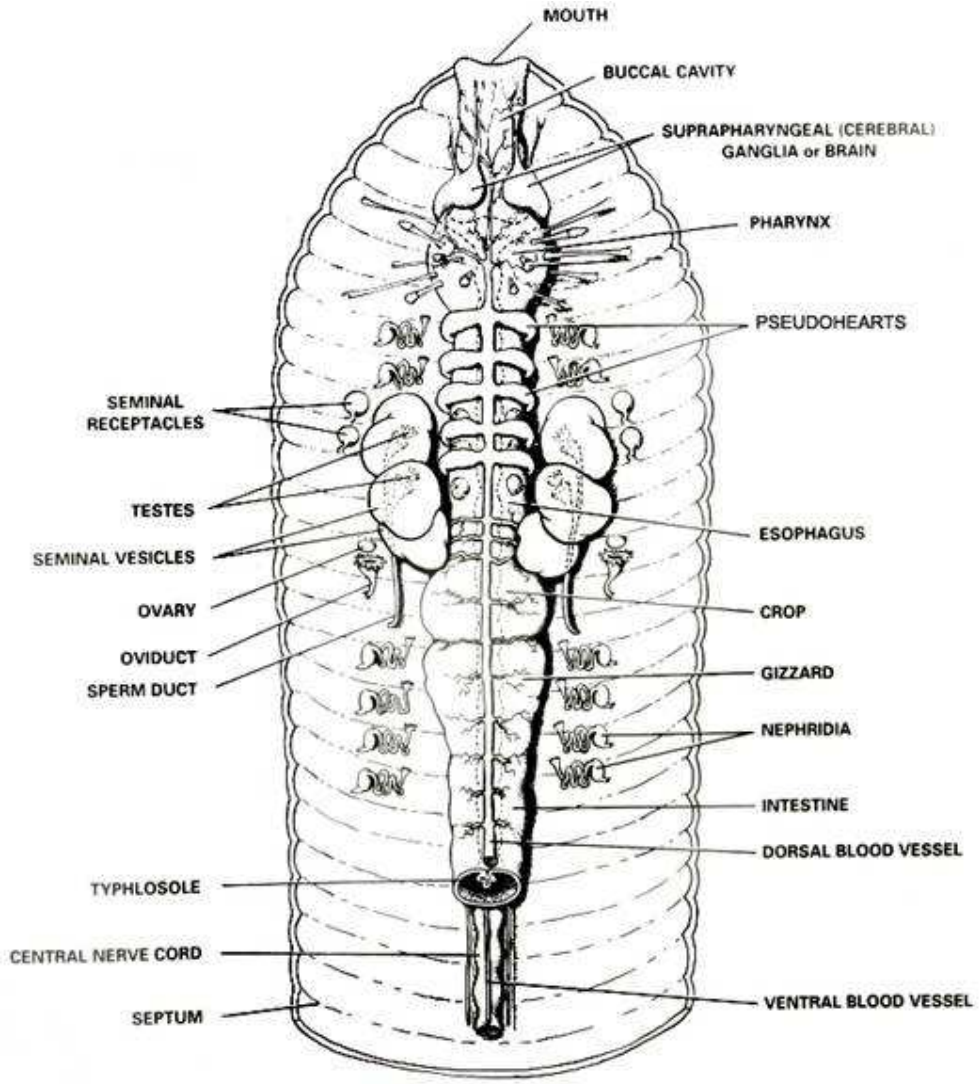
Gizzard helps in grinding. It is present in 8^{th} segment.

14. Where are the lymph glands present in *Pheretima* ? What is their function?

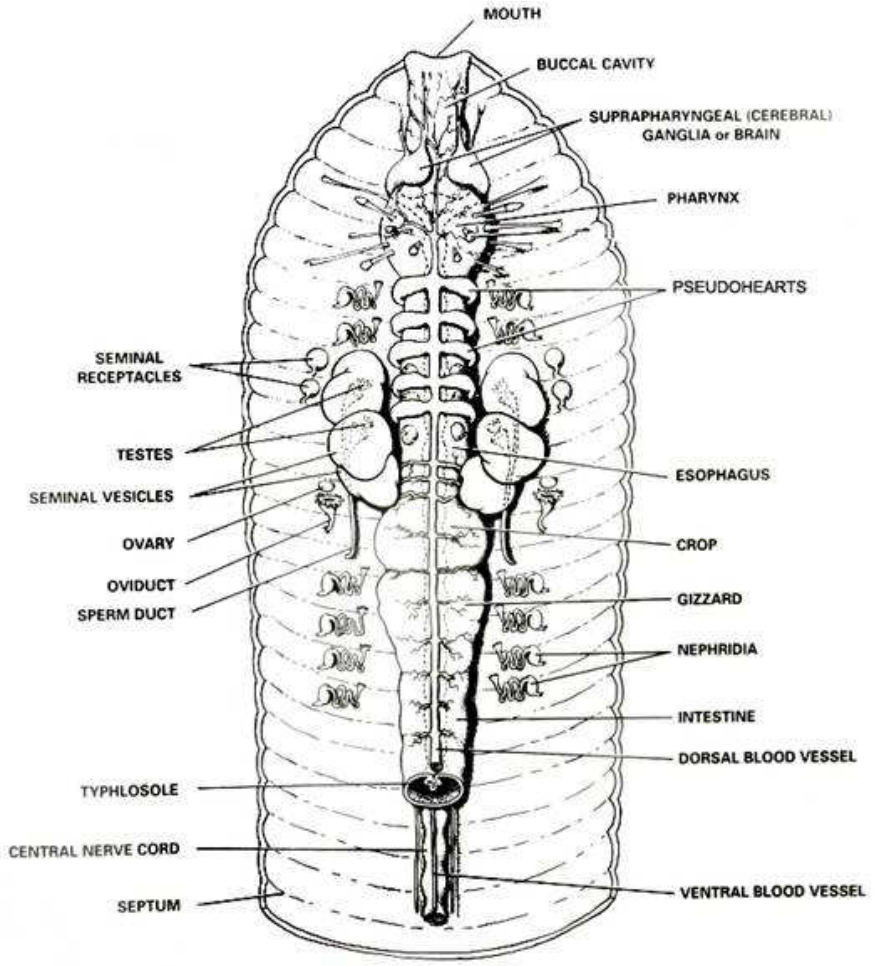
- Lymph glands are present on the dorsal blood vessel from 26^{th} segment to the last segment.
- They secrete phagocytes.

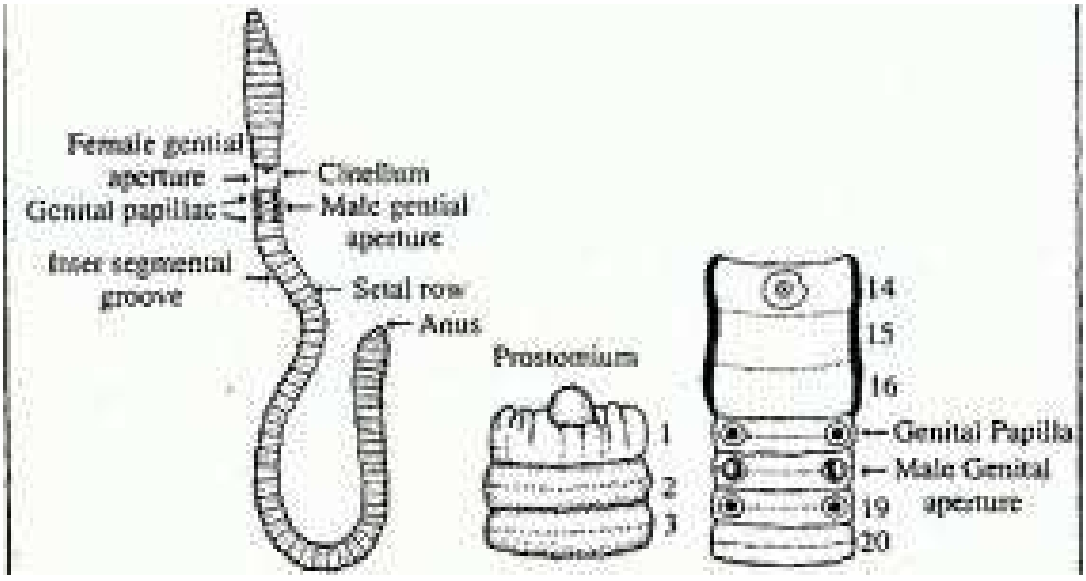
15. Write the functions of intestine in earthworms.

- Intestine helps in digestion and absorption.
- Post-typhlosolar region (rectum) reabsorbs water from undigested food and helps in the formation of faecal matter.

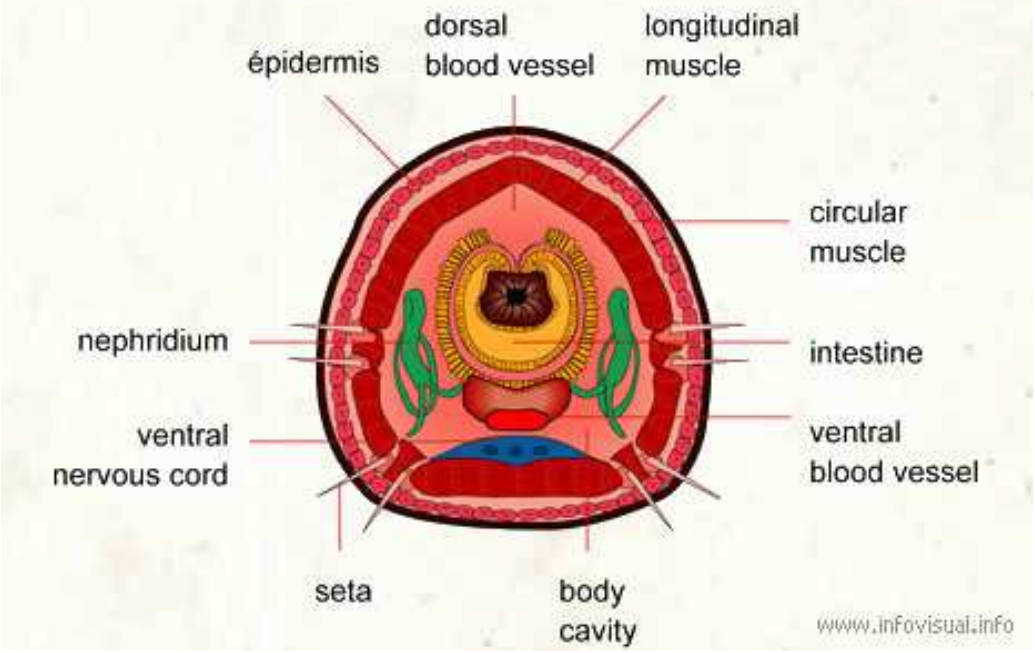


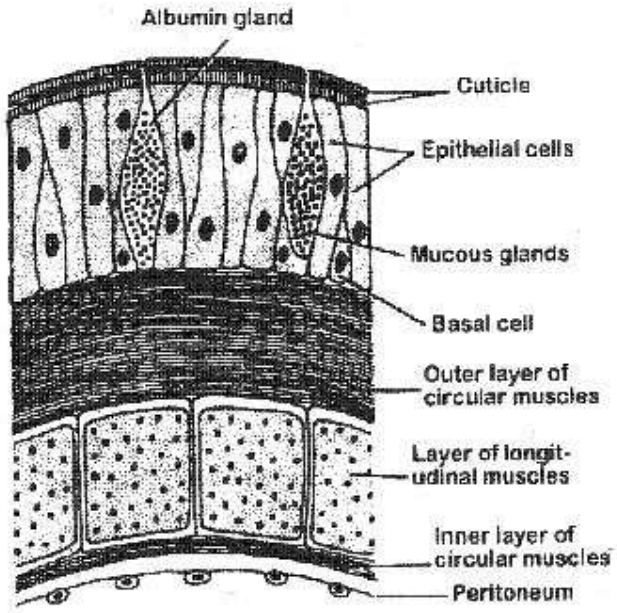
Pheretima: Digestive System


MOUTH
BUCCAL CAVITY
SUPRAPHARYNGEAL (CEREBRAL) GANGLIA or BRAIN
PHARYNX
PSEUDOHEARTS
SEMINAL RECEPTACLES
TESTES
SEMINAL VESICLES
OVARY
OVIDUCT
SPERM DUCT
ESOPHAGUS
CROP
GIZZARD
NEPHRIDIA
INTESTINE
DORSAL BLOOD VESSEL
TYPHLOSOLE
CENTRAL NERVE CORD
SEPTUM
VENTRAL BLOOD VESSEL


Female genital aperture
Genital papillae
Inter segmental groove
Clitellum
Male genital aperture
Setal row
Anus
Prostomium
1
2
3
14
15
16
Genital Papilla
Male Genital aperture
19
20

INTERNAL ANATOMY OF AN EARTHWORM (cross section)





IMPORTANT QUESTIONS :

01. Perichaetine and octochaetine arrangement of setae (March'09)
02. Clitellum and its significance (March'10)
03. Cells in epidermis of Pheretima

SAQ;

1. Locomotion in pheretima (May'07)

Pheretima – Respiratory system and Circulatory system

VSAQ s:

1.What are the advantages does earthworms get when they come out from their burrows during rains ?

- Earthworms come out of their burrows during rainy days to avoid suffocation due to filling of burrows with water.

2. Why earthworms die when the skin dries up ?

- Exchange of respiratory gases does not occur through dried skin.

3. Write any two structural differences between the lateral hearts and lateral oesophageal hearts?

LATERAL HEARTS	LATERAL OESOPHAGEAL HEARTS
1.Present in 7^{th} & 9^{th} segments	Present in 12^{th} & 13^{th} segments
2.Four pairs of valves are present in each heart.	Three pairs of valves are present in each heart.
3.Connect dorsal blood vessel with ventral vessel	Connect dorsal vessel and supra-oesophageal vessel with ventral vessel

4. What is the function of Haemoglobin ? Where is it present in *Pheretima* ?

- Haemoglobin is a respiratory pigment which transports gases like O_2 and CO_2.
- It is present in dissolved state in plasma.

5. Which blood vessels supply blood to intestine and which blood vessels collect blood from it in *Pheretima* ?

- In each segment from 15^{th} onwards …..

  a)one pair of Septointestinal vessels from commissural vessels and one ventro intestinal vessel supply to external intestinal plexus of intestine.

  b)TWO pairs of dorso intestinal vessels collect blood from internal intestinal plexus of intestine and supply to dorsal blood vessel.They have more nutrients

6. Where are blood glands present in *Pheretima* ? What is their function?

- Red colored follicular bodies known as blood glands present in 4^{th}, 5^{th} and 6^{th} segments.
- Blood glands produce the blood corpuscles and haemoglobin.

7. What are anterior loops ? Where are they present?

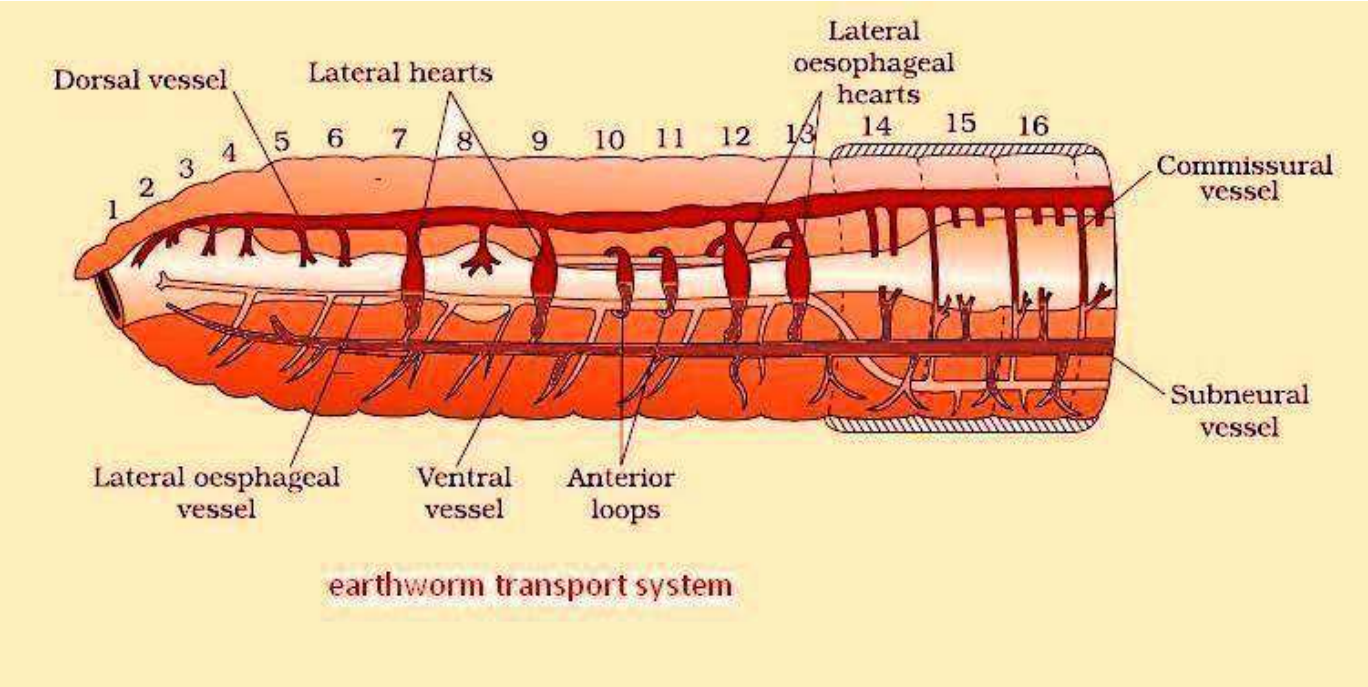
- Two pairs of loop like vessels known as anterior loops present in 10^{th} and 11^{th} segments.
- They connect lateral-oesophageal blood vessels with the supra-oesophageal blood vessel.

8. What are Ring vessels ? where are they present ?

- Ring vessels are present within the muscular coat of wall of stomach.
- They are present in the segments 10^{th} to 13^{th}.
- Each segment has about 12 ring vessels.
- They connect lateral-oesophageal blood vessels with the supra-oesophageal blood vessel.

9.Which blood vessel acts as collecting and distributing vessel ?

- Commissural blood vessel acts as both collecting and distributing vessel.
- They are present from 14^{th} to last segment. Each segment has a pair of vessels.



SAQ s ::

1.Describe the blood vessels present behind the thirteenth segment in *Pheretima.?*

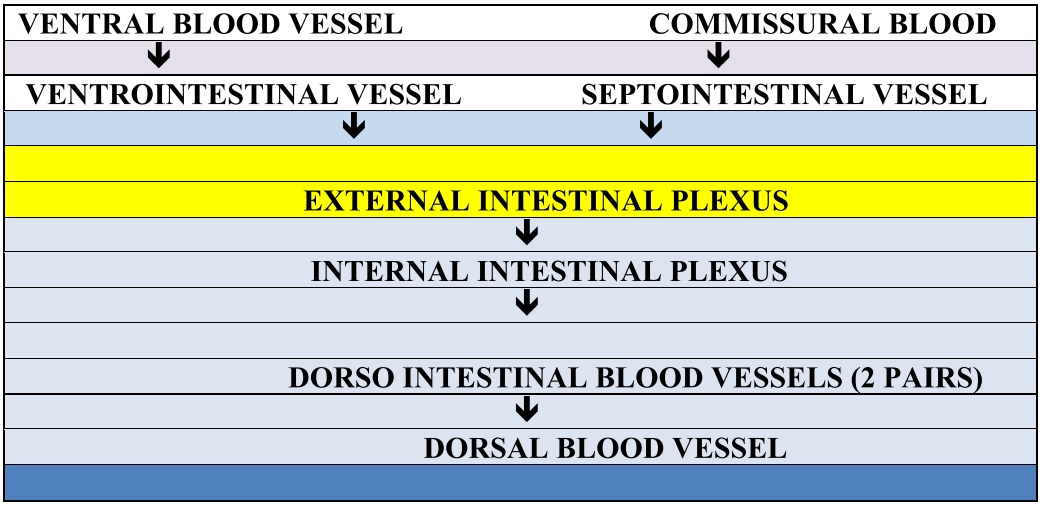
- Dorsal blood vessel, ventral blood vessel and subneural blood vessel are the main longitudinal blood vessels present behind the thirteenth segment.
- **DORSAL BLOOD VESSEL**: It is collecting vessel. It is present along the mid dorsal line above the gut. It collects blood from intestine through dorso-intestinals and from subneural blood vessel through commissural blood vessel with valvular openings.
- **VENTRAL BLOOD VESSEL:** It is the chief distributing vessel. It gives rises to a pair of ventrotegumentary blood vessels and a single Ventro-intestinal blood vessel in each segment. Ventrotegumentary blood vessel supplies blood to body wall, integumentary nephridia, reproductive organs, nerve cord etc. Septo-nephridial blood vessel arises from ventrotegumentary vessel supplies blood to septal nephridia.
  Ventro intestinal blood vessel arises from ventro-tegumentary vessel supplies blood to septal nephridia.
- **SUB NEURAL BLOOD VESSEL** extends from 14^{th} segment to last segment in the mid-ventral line beneath the ventral nerve cord. It is nonmuscular and nonvalvular collecting blood vessel. It collects blood from ventral body wall and nerve cord.
- **COMMISSURAL BLOOD VESSELS**: A pair of commissural blood vessel is present en each segment from 14^{th} to last. They connect subneural blood vessel to dorsal blood vessel. They collect blood from septal nephridia, reproductive organs and body wall from 14^{th} to last segment and send it into the dorsal blood vessel.

- Each commissural vessel gives off a Septo-intestinal branch to intestine.
- Thus it acts as collecting and distributing vessels.

2. Describe the flow of blood to intestine in earthworms?

In each segment from 15th to last segment------

- Ventral blood vessel supplies blood to External intestinal plexus through a single vetro-intestinal blood vessel.
- Both commissural vessels give one septo-intestinal blood vessel each which supply blood to external intestinal plexus.
- Blood reaches into internal intestinal plexus from external plexus.
- Two pairs of Dorso-intestinal blood vessels collect nutrient rich blood from internal intestinal plexus and supply it to dorsal blood vessel.



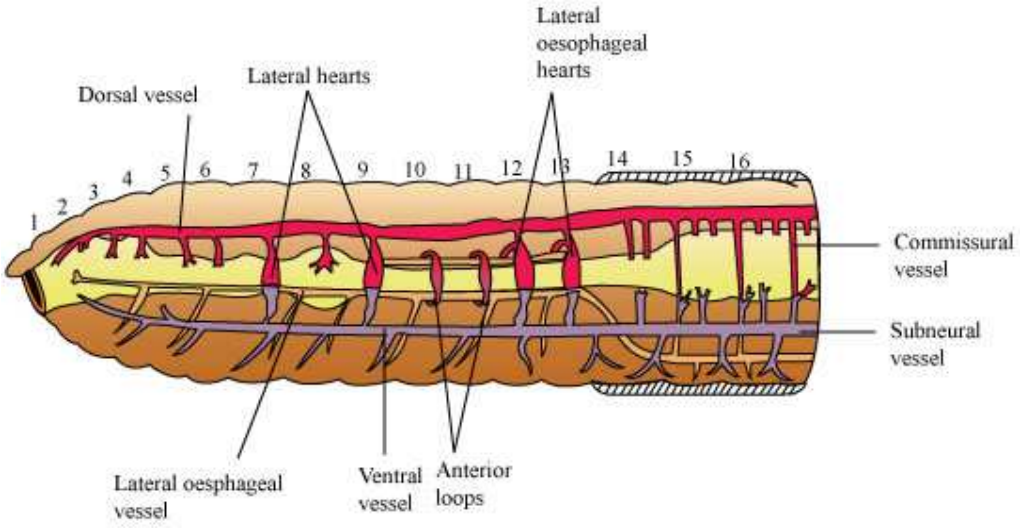
LAQ s:

1.Explain the blood circulation in the first thirteen segments in *Pheretima.?*

- Dorsal blood vessel is a distributing vessel in the first 13 segments. It supplies blood to the anterior part of gut and pharyngeal nephridia.
- Ventral blood vessel is the main distributing vessel throughout the body. It supplies blood to reproductive organs, body wall, and integumentary nephridia through ventro-tegumentary vessels.
- Lateral hearts bring blood from dorsal blood vessel to ventral blood vessel.
- Lateral oesophageal hearts bring blood from dorsal blood vessel and supraoesophageal blood vessel to ventral blood vessel.
- Lateral oesophageal blood vessels collect blood from body wall, septa, nephridia, buccal cavity, pharynx, oesophagus, gizzard, stomach, pharyngeal nephridia and reproductive organs.
- Lateral oesophageal blood vessels supply blood to supra-oesophageal blood vessel through anterior loops and ring vessels.
- Supraoesophageal blood vessel collects blood from the gizzard and stomach also.

2. Describe the blood circulation in *Pheretima* in the intestine –region.?

- ❖ Ventral blood vessel supplies blood to the body wall, septa, integumentary and septal nephridia and reproductive organs through the ventro-tegumentary blood vessels.
- ❖ Ventro-intestinal blood vessels of ventral blood vessel supply blood to the external intestinal plexus of intestine.
- ❖ Blood from body wall, septa, reproductive organs and septal and integumentary nephridia is collected by the commissural blood vessels .
- ❖ Subneural blood vessel collects blood from vental nerve cord and ventral body wall.
- ❖ Commissural blood vessel brings blood from subneural blood vessel to dorsal blood vessel.
- ❖ Commissural blood vessel supplies the blood to the external intestinal plexus of intestine through the septo-intestinal blood vessel.
- ❖ Blood with more nutrients from internal intestinal plexus of intestine is collected by two pairs of dorso- intestinal blood vessels which supply it to dorsal blood vessel.



01. Blood glands in Pheretima? (May'07)

02. Blood vessels that supply blood to intestine?

LAQ :

01. Blood circulation in first 13 segments in Pheretima ? (May '06)
02. Circulation in intestine region of Pheretima?

Pheretima --- EXCRETORY SYSTEM & NERVOUS SYSTEM

VSAQs :

1.What are forests of nephridia ? Where are they present?

- Large number of integumentary nephridia in the clitellar segments is referred to as forests of nephridia.
- They are present in 14^{th}, 15^{th} & 16^{th} segments in Pheretima.

2.Into which parts of alimentary canal of *Pheretima,* pharyngeal nephrdidial ducts open?

- A)Pharyngeal nephridial ducts form 6^{th} segment open in to the buccal cavity.
- B)Pharyngeal nephridial ducts from 4^{th} and 5^{th} segments open in to pharynx.

***3. How alimentary canal in* Pheretima helps in excretion also?**

- Enteronephric nephridia like pharyngeal nephridia and septal nephridia open to alimentary canal and discharge the excretory fluid into the lumen of it.
- Water from excretory fluid is reabsorbed by the wall of post-typhlosolar region. It is an adaptation for water conservation.

4. What do you mean by closed exonephric nephridia ?

- Nephridia without nephrostome are known as closed type.
- Nephridia with nephridiopore open to out side and discharge the contents directly to out side. So they are known as exonephric type.
- Integumentary nephridia in *Pheretima* are CLOSED & EXONEPHRIC TYPE.

5. What do you mean by open enteronephric nephridia ?

- Nephridia with nephrostome are known as Open type.
- Nephridia without nephridiopore which open into the lumen of gut are known as enteronephric type.
- Septal nephridia in *Pheretima* are considered as OPEN & ENTERONEPHRIC TYPE.

6. What is the significance of osmoregulatory nephridia.?

- Enteronephric nehridia like pharyngeal and septal nephridia are osmoregulatory in function. They discharge the excretory fluid into the lumen of gut.
- Water from excretory fluid is reabsorbed by the wall of post-typhlosolar region. It is an adaptation for water conservation.

7. What is Phaeosome ? Where is it present in *Pheretima* ?

- Pheosome is a 'L' shaped optic organelle or lens made with hyaline substance.
- It is present in photoreceptors of *Pheretima.*

8. Which nephridia are known as open and exonephric type ? Which earthworms have them ?

- Typical nephridia are known as Open type due to the presence of Nephrostome.
- They are known as exonephric also as they consist Nephridiopore.
- Typical nephridia are present in earthworms like Drawida grandis.

9. How many giant axons are present in ventral nerve cord of *Pheretim*a ? What is their role ?

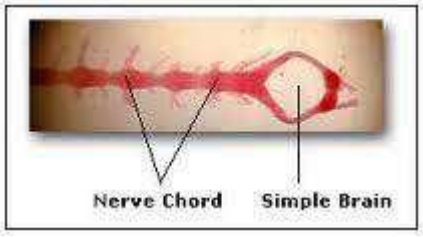
- Four giant axons are present in the ventral nerve cord. They are
  i) one middorsal, ii) two ventrolateral iii) one midventral in position.
- Giant axons provide for a rapid conduction of impulses throughout the whole length of the body of worm.

10. Why nerve cord in *Pheretima* appears as single inspite of the presence of two longitudinal cords ?

- As the two cords are covered by a fold of connective tissue known as Perineurium , it appears as single cord.

11. How is nerve ring is formed in *Pheretima* ?

Nerve ring is formed around pharynx in Pheretima by the combination of Supra-pharyngeal ganglia, subpharyngeal ganglia and circumpharyngeal



connectives.

12. Which receptors are tactile in nature in *Pheretima* ?

- Epidermal receptors act as tactile or tango receptors in Pheretima which are sensitive to touch.

13. What is the positional difference between nerve rings of earthworm and cockroach.?

- Nerve ring in earthworm is formed around Pharynx.
- Nerve ring in cockroach is formed around Oesophagus.

14. Which receptors are tactile in nature in Pheretima ?

- Epidermal receptors are tactile or tango receptors in Pheretima.
- They are sensitive to touch.

15. which blood vessels supply and collect blood to open and enteronephric nephridia in *Pheretima ?*

- Septal nephridia are Open and Enteronephric nephridia in *Pheretima.*
- Septonephridial vessel of ventrotegumentary blood vessel of ventral blood vessel supplies blood to septal nephridia.
- Commissural blood vessel collects blood from septal nephridia.

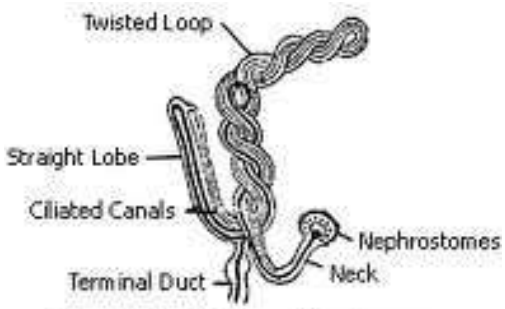
SAQ s:

1. Describe the various types of nephridia in Pheretima.?

Type of nephridia	Location	Nephrostome	Nehridiopore	Described as
1.Pharyngeal	4^{th}, 5^{th} & 6^{th} Segments	Absent	Absent	Closed & Enteronephric
2.Integumentary / Micro	3^{rd} to last	Absent	Present	Closed & Exonephric
3.Septal /Macro	15/16 septum to Last septum	Present	Absent	Open & enteronephric

2**. List out the differences between integumantary and septal nephridia in *Pheretima*.**?

Character	Integumentary Nephridia	Septal nephridia
1.Location	3^{rd} segment to last segment	15/16 septum (11^{th}) to last septum
2.Nephrostome	Absent . So they are closed type	Present. So they are Open type
3.Nephridiopore	Present. Exonephric type	Absent. Enteronephric type.
4.Release the collected excretory products	To outside directly	Into intestine.
5.Collects wastes from	Blood only	Both from blood and coelomic fluid.



Septal Nephridium of Earthworm

3. Write as short note on the structure of the <u>nerve cord</u> in *Pheretima.* ?

- Nerve ring is present around the pharynx in Pheretima. It is formed by brain or supra-pharyngeal ganglia, sub-pharyngeal ganglia and circum-pharyngeal connectives.
- Ventral nerve cord which extends from subpharyngeal ganaglia and present along the mid ventral line of the body.
- Ventral nerve cord is formed by two longitudinal cords. But it appears as one as it is covered by a fold of connective tissue known as perineurium.
- Four giant axons are present in the ventral nerve cord. One is middorsal, two are dorso lateral and the other is mid ventral in position.
- Giant axons provide for a rapid conduction of impulses throughout the length of the body.

- In each segment behind the 4th, each segment has a pair of segmental ganglia.
- Paired segmental ganglia from 5th segment to last segment give off 3 pairs of nerves. They supply to gut wall, body wall and the internal organs.

4. Describe the Receptors in *Pheretima?*

Character	Epidermal	Buccal	Photoreceptors
1.Location	More on ventral and lateral sides.	In the wall of buccal epithelium.	Epidermis on dorsal side. More on peristomium. Absent on ventral side.
2.Nature of cells	Group of tall cells with supporting cells	Tall cells with supporting cells	Single cell with nucleus and a 'L' shaped optic organelle(lens) (Pheosome)
3.Sensory hair	Free ends with hair like processes	Well developed sensory hairs	Sensory hairs are absent. Detects intensity of light
4.Role	Tactile(tango) & Chemo receptors	Olfactory(smell) & Gustatory (taste)	

5. Describe the physiology of excretion in *Pheretima.?*

- Earthworms mostly excrete urea as excretory product and are described as Ureotelic.
- The chief nitrogenous compounds are ammonia, urea and creatinine. They are present in blood, coelomic fluid and excretory fluid.
- All types of nephridia are able to collect wastes from blood.
- But septal nephridia are the only nephridia which can collect wastes from coelomic fluid also as they have nephrostomes.
- Septal nephridia collect eleocytes from the coelomic fluid.
- Urine is hypotonic both to blood and to the coelomic fluid.
- Enteronephric nephridia help in osmoregulation also.
- Enteronephric nephridial system discharges excretory fluid into the lumen of gut which is an adaptation for conservation of water.

6. Describe about Septal nephridia in *Pheretima.?*

- Septal nephridia are present on the intersegmental septum between 15 & 16 segments to the last septum.
- Except the 15th segment and last segment, remaining segments have 80-100 septal nephridia each.
- Septal nephridium consists of a funnel known as Nephrostome followed by neck and body.
- Body consists of a short straight lobe, a long spirally twisted loop with a narrow apical part and terminal duct, which joins the septal excretory canal.
- Terminal ducts of all nephridia at each septum open into a pair of Septal excretory canals which run parallel ad internal to commissural vessels.
- Septal excretory canals open dorsally into a pair of Supra intestinal excretory ducts.

- Supra intestinal excretory ducts are present side by side on the mid dorsal line above the intestine and beneath the dorsal vessel from 15th to last segment.
- They open into lumen of intestine through narrow ductules. These openings are provided by sphincter.
- Waster products collected by septal nephridia are discharged into the lumen of intestine. Hence they are known as enteronephric nephridia.

IMPORTANT QUESTIONS:

01. Nephridial forests . Where are they present ? (June'10 ; May'07)
02. Closed exonephric and open enteronephric nephridia?

LAQ :

01. Excretory system in Pheretima ? (March '08 ; March'04 ; May'05)

PHERETIMA - REPRODUCTIVE SYSTEM & DEVELOPMENT

VSAQs :

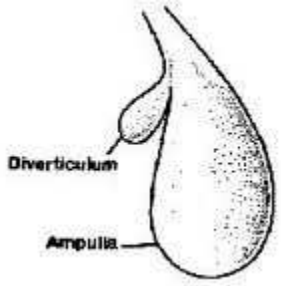
1. **What are septal pouches in Pheretima? What is their function?**

- ❖ Seminal vesicles present in 11th and 12th segments in Pheretima are septal pouches. They develop from the septa.
- ❖ Spermatogonia develop into spermatozoa by maturation in these pouches.

2**. What are the parts of spermatheca ? What is their role?**

- ❖ 4 pairs of Spermatheca or seminal receptacle are present in 6th, 7th, 8th and 9th segments of Pheretima.
- ❖ Each spermatheca has two parts… They are

a)pear shaped AMPULLA --- provides nutritive substances to spermatozoa.
b)small DIVERTICULUM ---- stores spermatozoa.



3. Write the names of any two systems in *Pheretima t*hat are derived from the ectoderm of embryo.?

- ❖ Ectoderm gives rise to epidermis, the nervous system, stomodaeum, the proctodaeum, the excretory system and setal sacs.

4. What are spermatogonia ? Which part secretes them?

- ❖ Spermatogonia are sperm mother cells which are in diploid condition.
- ❖ They are produced by testes.
- ❖ They are collected by septal pouches or seminal vesicles and convert them into haploid spermatogonia by maturation.

5. What are accessory glands in *Pheretima* ?

- ❖ Two pairs of accessory glands , one pair in each 17th and 19th segments.
- ❖ They are present at the bases of genital papillae.
- ❖ Their secretions help in attachment of two worms during copulation.

6. What is protandrous nature?

- ❖ Maturation of male reproductive organs early than female reproductive organs in a bisexual animal is known as protandrous.
- ❖ It is seen in *Pheretima, Taenia solium*.

7. Write about primary germ layers in Pheretima.?

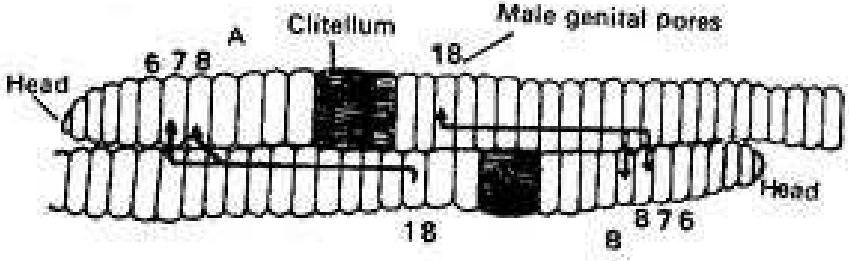
PRIMARY GERM LAYER	DERIVED FROM	DERIVATIVES
1.Ectoderm	Micromeres	Epidermis, nervous system, stomodaeum, proctodaeum, excretory system, seta sacs.
2.Endoderm	Macromeres	Inner epithelium of gut, digestive glands
3.Mesoderm	Mesomere	Muscles, coelomic epithelia, septa, blood vessels, reproductive organs.

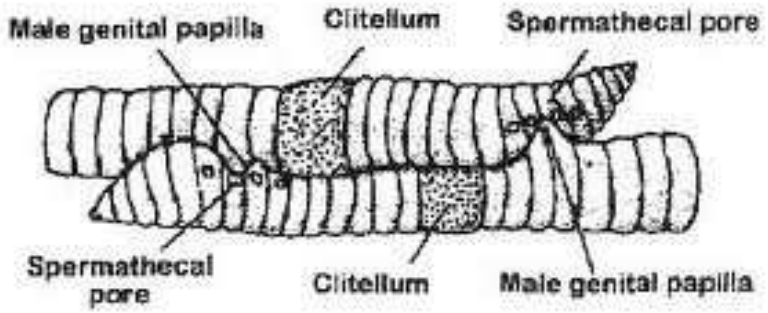
SAQ s:

1.Write a short note on cocoon formation in *Pheretima.?*

- ❖ After copulation, cocoons are formed in both the earthworms which participate in copulation.
- ❖ Clitellar glands secrete a membranous girdle. This girdle becomes hard on exposure to air. The worm gradually pulls itself out of it.
- ❖ As the girdle passes over the oviducal and spermathecal openings, it receives first the ova and then the pserms and also some albumin.
- ❖ Its two ends are closed down after its release from the worm.
- ❖ Cocoons are about spherical shape with olive or light yellow in color.
- ❖ Many cocoons are formed in succesion after each mating .
- ❖ Fertilization occurs in cocoon.

(1) Earthworm :





LAQ :

1.Give an account of the reproductive organs in Pheretima. Draw a neat labelled diagram of reproductive system.?

❖ Earthworm is monoecious or bisexual or hermaphrodite with both male and female reproductive systems are present in same individual.

MALE REPRODUCTIVE SYSTEM :

Male Reproductive system consists of testes,testis-sacs, seminal vesicles, spermiducal funnels, vasa deferentia, prostate glands, prostte ducts, accessory glands, copulatory papillae and genital pores.

a) TESTES : Two pairs of testes are present in 10^{th} and 11^{th} segments. They are small digitate bodies with a compact base. They arise from pareital coelomic epithelium. They produce diploid Spermatogonia.

b)TESTIS SACS :

- Two testis sacs are present in 10^{th} and 11^{th} segments. They are closed sacs of coelom present below stomach.
- Testis sac of 10^{th} segment encloses testes nd spermiducal funnels.
- Testis sac of 11^{th} segment is large and encloses testes, spermiducal funels and seminal vesicles.

c)SEMINAL VESICLES :

- Two pairs of seminal vesicles present laterally in 11^{th} and 12^{th} segments.
- These are septal pouches as they develop from septa.
- They convert spermatogonia into haploid spermatozoa by maturation.

d)SPERMIDUCAL FUNNELS :

- Two pairs of ciliated spermiducal funnels present behind teses in 10^{th} and 11^{th} segments. They collect spermatozoa.

e)VASA DEFERENTIA :

- Each spermiducal funnel leads into a spermatic duct or vas deferens.
- Two vasa deferentia of each side run closely side by side as slender ducts from the 12^{th} to 18^{th} segment.
- These are lined by ciliated epithelium.

f) PROSTATE GLANDS or SPERMIDUCAL GLANDS :

- A pair of large solid white irregular prostate glands present on each side of gut from 16^{th} or 17^{th} segment to 20^{th} or 21^{st} segments.
- Each prostate gland consists of a large glandular and a small nonglandular parts. Glandular part has many lobules with secretory cells.
- Nonglandular part consists of small ductules which unite to form the prostatic duct.
- Prostatic duct and two vasa deferentia of each side join in 18^{th} segment to form a common prostatic spermatic duct. These three ducts are enclosed in a muscular sheath. They remain separate in sheath and open separately through male genital opening on the ventral side of 18^{th} segment.

- Male genital pore is a group of three openings, a large prostatic opening and two small openings of the two vasa deferentia.

g)ACCESSORY GLANDS :

- 2 pairs of accessory glands are present in 17^{th} and 19^{th} segments at the bases of genital papillae.
- Their secretions help in attachment of two worms during copulation.

h)GENITAL PAPILLAE :

- Two pairs of genital or copulatory papillae are present on the ventral side of 17^{th} and 19^{th} segments.

FEMALE REPRODUCTIVE SYSTEM :

It consists of a pair of ovaries, oviducts, 4 pairs of spermathecae and female genital aperture.

a)OVARIES :

- A pair of ovaries are attached to posterior face of the septum (8^{th}) present between segments 12 & 13.
- Each ovary has digitate processes with ova in diffdrent stages of development.

b)OVIDUCTS :

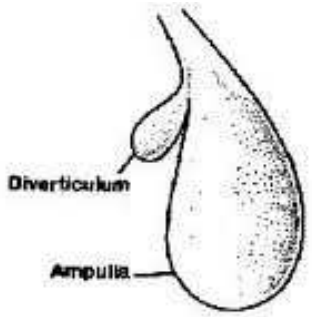
- Each oviduct is a short tube with a broad oviducal funnel opens into coelom.
- Both oviducts penetrate the septum between the segments 13 and 14. (10^{th}) and converge to meet in the body wal benath the nerve cord.
- Oviducts are ciliated along their length and open externlly through a single median Female genital paerture on the ventral side of 14^{th} segment.

c)SPERMATHECAE OR SEMINAL RECEPTACLES:

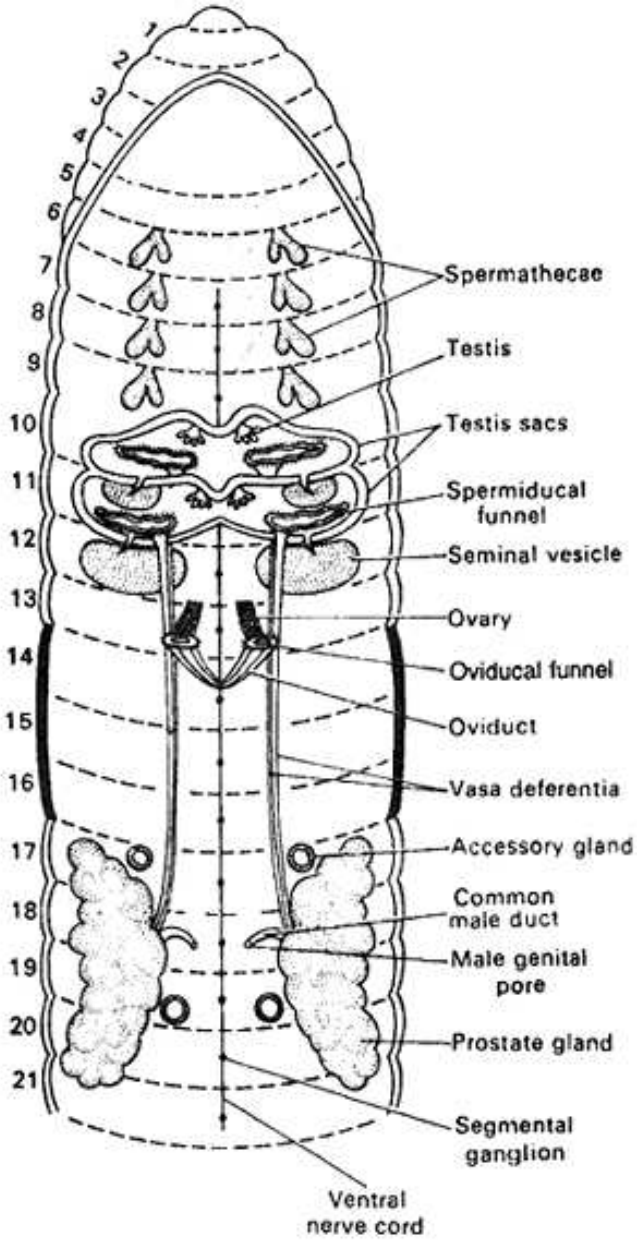
- 4 pairs of spermathecae are present in 6^{th},7^{th},8^{th} & 9^{th} segmets.
- Each spermatheca has two parts… They are

a) Pear shaped AMPULLA --- provides nutritive substances to spermatozoa.

b) Small DIVERTICULUM ---- stores spermatozoa.



- Spermathecae open vnetrolaterally through the spermathecal openings present on intersegmental grooves of 5/6, 6/7, 7/8 & 8/9 segments.
- Female genital pore is present on midventral side of 14^{th} segment.



Pheretima. Reproductive system

2. EXPLAIN THE DEVELOPMENT OF PHERETIMA

- Fertilization occurs inside the cocoon but outside the body. So it is external type.
- Development from fertilized egg up to the formation of young worm takes place in cocoon. It direct and without any larval stage.
- Cleavage is holoblastic, determinate, spiral and unequal type.
- Micromeres and macromeres are formed. Micromeres form the ectoderm, macromeres form the endoderm.
- Micromeres are present at animal hemisphere and megameres are present in vegetal hemisphere.
- A hollow blastula is formed with blastocoel or segmentation cavity.
- Two large cells known as mesoblastic pole cells are formed near the equator region. They give rise to two rows of cells by divisions.
- Pole cells together with the two rows of cells form the mesoblastic bands which form the future mesoderm.
- Spherical blastula becomes flattened and s forms a solid oval structure with small cells on upper surface and large columnar cells on its lower surface.
- Lower portion of embryo invaginates to form the gastrula.
- Invagination gives an elongated groove on the lower surface. It leads into cavity lined by original megameres.
- Archenteron or primitive gut is formed. It has blastopore to outside.
- Blastopore develops into mouth. So Pheretima is protostomous animal.
- Tall ciliated cells of ectoderm which surround the mouth grow inwards to form stomaodaeum. Stomodaeal canal leads into the archenteron.
- Embryo starts feeding on the albumin of cocoon after the formation of stomodeaum.
- Two mesodermal bands are present parallel to each other. Each band divides in antero-posterior axis into mesodermal somites
- Coelomic cavities are formed in somites. Later somites grow upward and downward on either side between ectoderm and endoderm.
- Outer layer si applied to ectoderm to form Somatopleure ad inner layer which applied to endoderm to form Splanchnopleure.
- Somatic mesoderm forms the muscles of the body wall and parietal peritoneum.
- Splanchnic mesoderm forms the visceral peritoneum and muscles of the alimentary canal.
- Transverse partitions between the somites form intesegmental septa.
- Ectodermal invaginatiion of last segment fuses with enteron to form proctodaeum
- Primary embryonic layers give rise to the body structures in the following manner.

PRIMARY GERM LAYER	DERIVED FROM	DERIVATIVES
1.Ectoderm	Micromeres	Epidermis, nervous system, stomodaeum, proctodaeum, excretory system , seta sacs.
2.Endoderm	Macromeres	Inner epithelium of gut, digestive glands
3.Mesoderm	Mesomere	Muscles, coelomic epithelia, septa, blood vessels, reproductive organs .

IMPORTANT QUESTIONS

01. Two parts of spermathecum and their role in Pheretima ? (May'09)

02. 2. Septal pouches in Pheretima and their role?

LAQ :

01 **Reproductive system in Pheretima?**

(June'10 ; March'09 ; March'07 ;May'04 ; March'06)

01 **Development in Pheretima?**