ASCARIS LUMBRICOIDES

INTRODUCTION — Among the nematode parasites, Ascaris lumbricoides has been undoubtedly the most common parasite in the alimentary canal of the human being since the time immemorial. From the ancient periods of the history to the present days not only adult male and female human beings are suffering from the action of this parasite but the children are also affected in the same proportion. According to the estimation of Stoll (1947) about 644 million human beings suffer from ascaris infection.

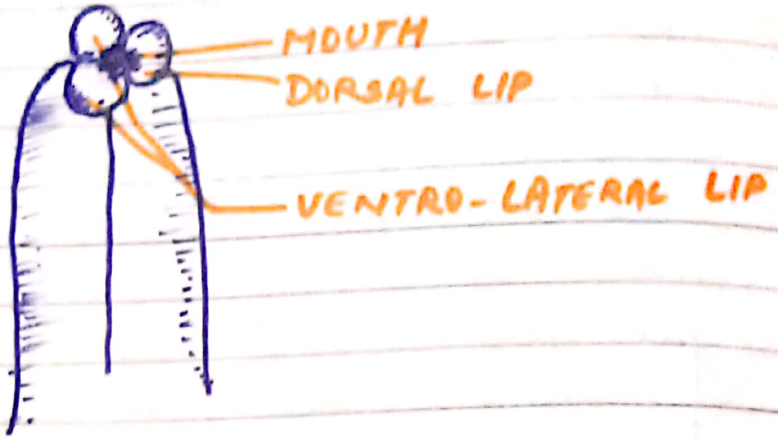
EXTERNAL FEATURES —

(i) The body is elongated, cylindrical, fusiform and tapering at both ends.

(ii) The males are always smaller than the females. The male measures about 15-20 cm. in length.

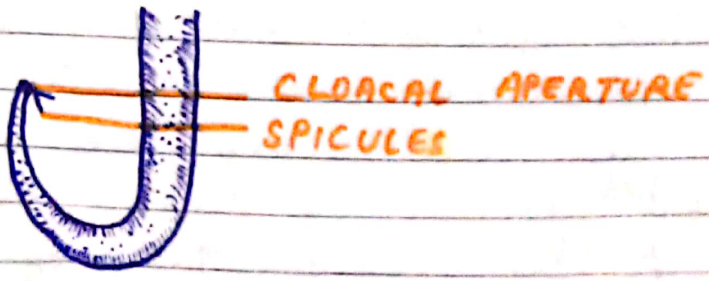
(iii) The anterior end of both the male and female is provided with an oral opening ie. mouth. The mouth is guarded by three lips. The lips are arranged in a definite pattern — one mid-dorsal and two dorso-ventral in position. Lips are provided with sensory papillae. In the ventro-lateral lip in addition to sensory papillae, amphids are present. Amphids are chemoreceptors and papillae

are tango - receptors.



(iv) At the posterior end, the male is ventrally curved where as the tail of the female is straight and pointed. In case of male, there is a cloacal opening situated mid-ventrally. It is the common aperture for the digestive and genital organs from the cloaca, a pair of chitinous spicules of equal size come out.

In case of the female, at the posterior end, there is an opening known as anus which is responsible for the openings of digestive organs.

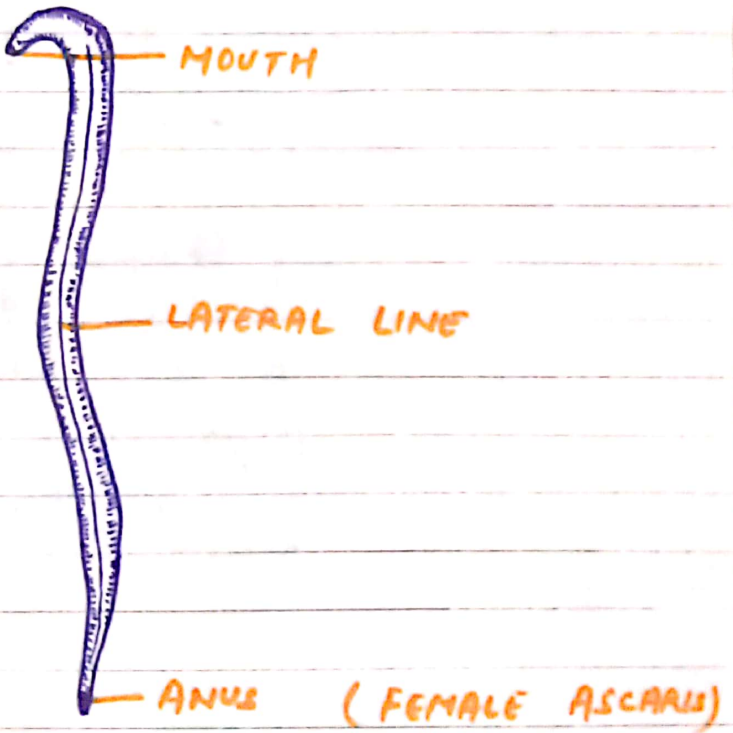


POSTERIOR END OF MALE

(v) In case of male and female both, about 2 mm. away from the anterior end, there is a mid-ventral opening known as the excretary pore.

(vi) At about 1/3 rd of the body from the anterior end in case of female, there is an another mid ventral opening called gonopore.

(vii) On the body of ascaris four longitudinal streaks are clearly marked. They are one mid-dorsal, one mid-ventral and two lateral. The lateral chords are thicker than the dorsal and ventral chords.



(FEMALE ASCARIS)

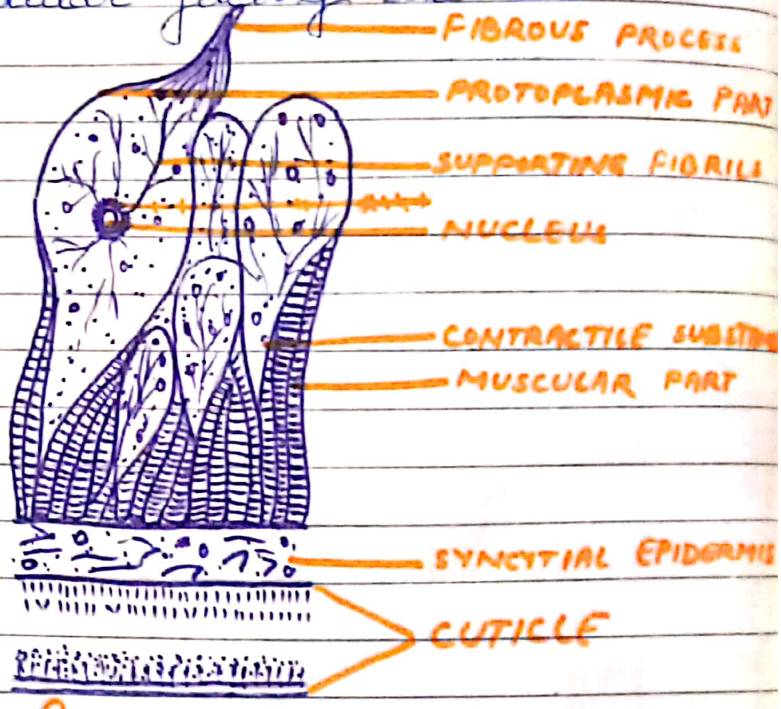
(viii) The whole body of ascaris is covered by cuticle which gives a pseudosegmented appearance.

BODY - WALL — In body-wall of ascaris, three layers are clearly seen as follows —

(i) The cuticle which is secreted by underlined epidermis is divided into cortical layer, matrix, fibre layer and basement membrane.

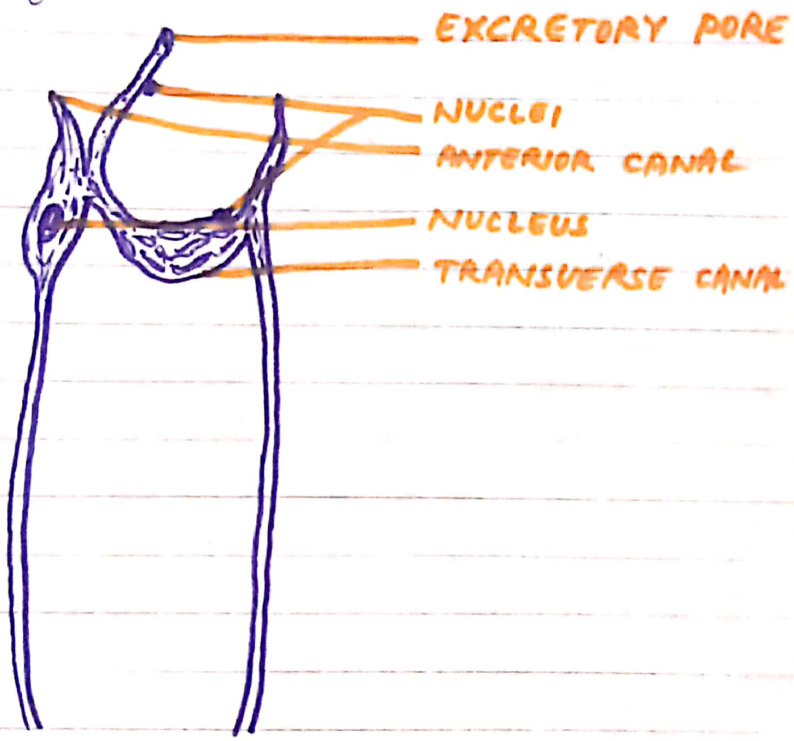
(ii) Below the cuticle is epidermis followed by the muscle layer divided into four quadrants by longitudinal ridges.

(iii) One hundred and fifty (150) muscle cells are present in each quadrant. A muscle cell consists of two distinct regions- muscular near the epidermis and glandular facing inwards.



DIGESTIVE ORGANS — The digestive organs include the mouth, pharynx, oesophagus, intestine and rectum. The alimentary canal is provided with oesophageal glands which help in digestion.

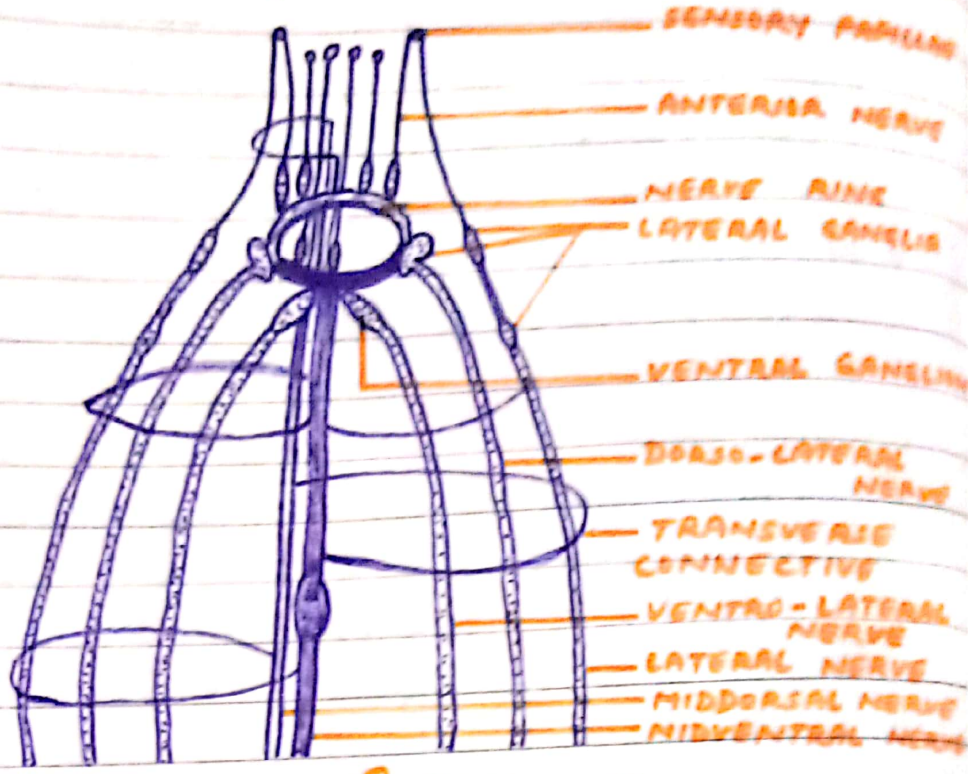
EXCRETORY ORGANS — The excretory organs are in the form of 'H'. It includes two posterior lateral longitudinal canals and two anterior longitudinal canals. Among the anterior canals, the right one ends and the left one opens to the exterior through the excretory pore. The anterior left one is also known as the terminal duct. The anterior as well as posterior canals are joined together at the network of transverse canals.



RESPIRATORY & CIRCULATORY ORGANS —
Due to the endoparasitic mode of life these organs are completely absent.

NERVOUS SYSTEM — In general, the nervous system in ascaris is ill developed. In the form of sense organs, Tango

and chemoreceptors are present.



REPRODUCTIVE ORGANS —

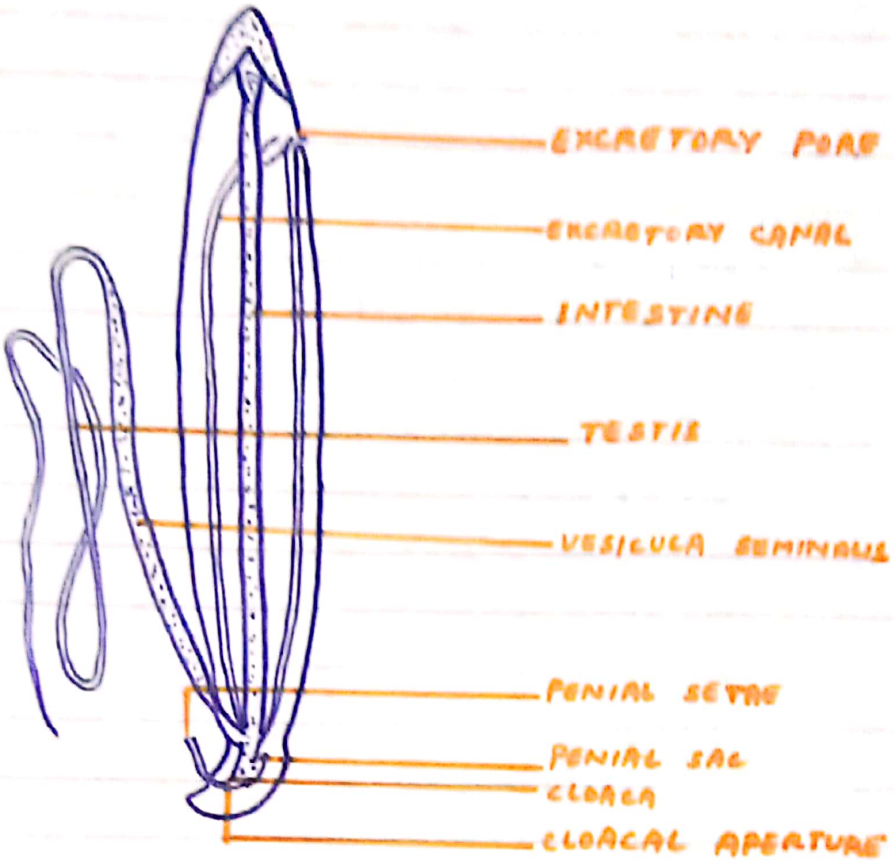
MALE REPRODUCTIVE ORGANS - In male the condition is monarchic and the organs are the following —

(i) **Testis** — It is single, thread like, long and much coiled in structure. The testis leads into a vas deferens.

(ii) **Vas deferens** — It is similar to testis in diameter. The differentiating point from the testis is the lack of central rachis. It leads into seminal vesicle.

(iii) **Seminal vesicles** — The vas deferens dilates to form a muscular tube, the seminal vesicle.

(iv) **Ejaculatory duct** — The seminal vesicle opens into a short, narrow and muscular ejaculatory duct which joins with cloaca.



(v) **Cloaca** — The cloaca contains dorsally a pair of spicular pouch from which two spicules originate. The spicules help in transference of sperm during copulation.

FEMALE REPRODUCTIVE ORGANS — In female, the condition is dioecious. The following organs are found —

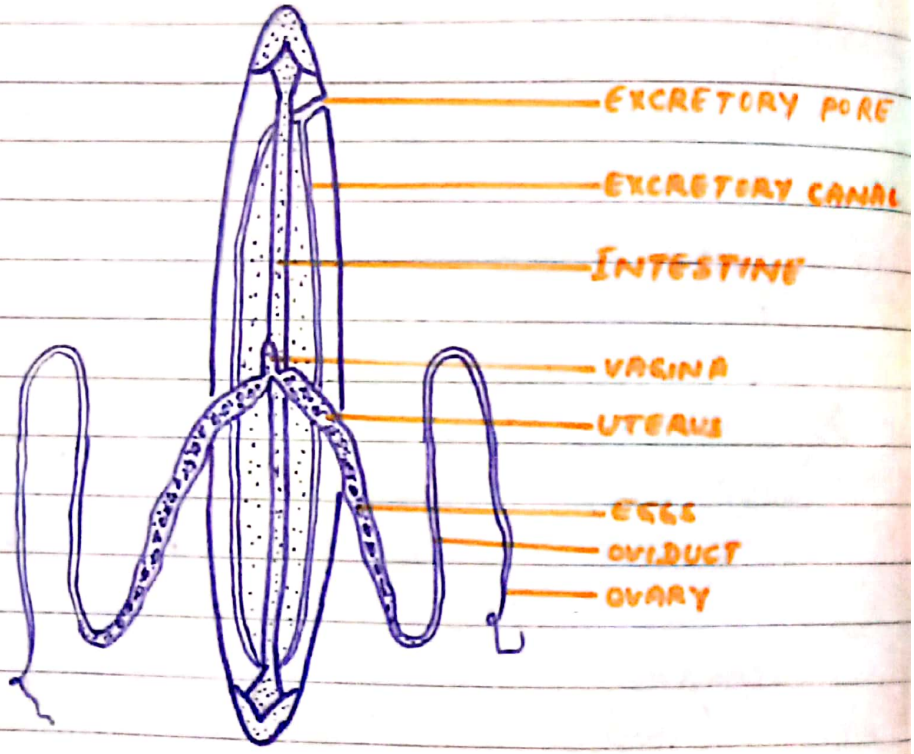
(i) **Ovaries** — The number of ovaries are two. They are long, thread like and slender. The central part is occupied by cytoplasmic rachis among which young eggs are aggregated

(ii) **Oviducts** — The ovaries lead into oviducts which are slightly wider. There is absence of rachis.

(iii) **Uteri** — The oviducts join the uteri. The

uteri are composed of muscle layers including circular and oblique layers. Each uterus contains fertilized eggs with shell.

(iv) Vagina — In the posterior side the uteri join together and form a common muscular vagina which opens to the exterior by vulva or gonopore. It lies on the ventral surface and at the junction of posterior one third surface of the body.



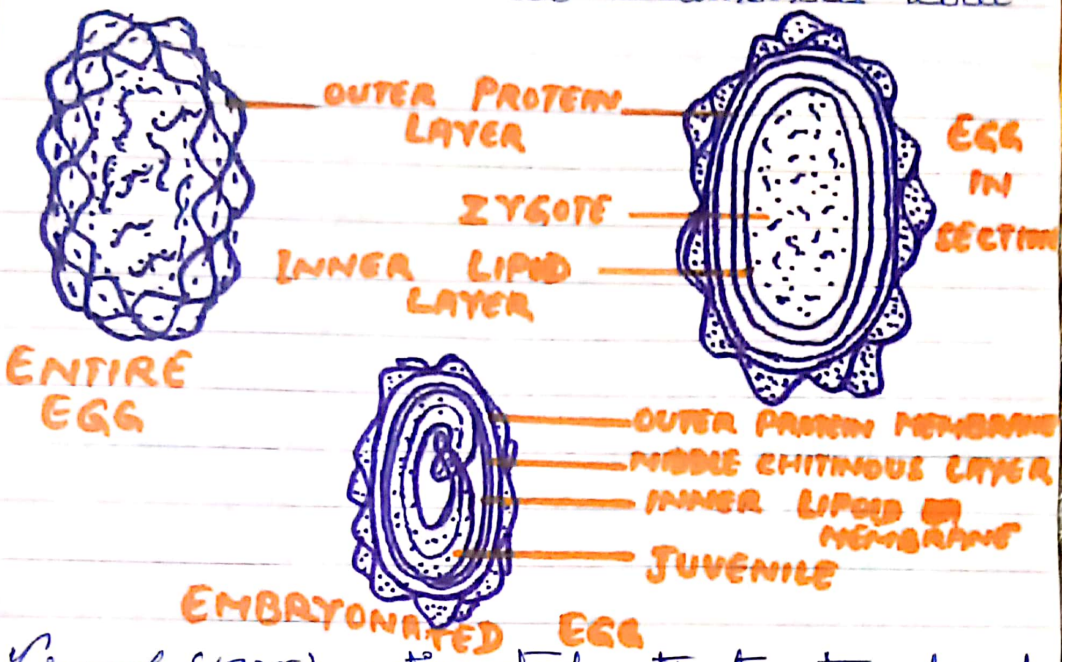
LIFE CYCLE — In the life-cycle of ascaris, only one host is required i.e. man. Before starting the life cycle of ascaris it is necessary to know about the structure of the fertilized egg which will begin the next cycle.

Structure Of Fertilized Egg —

(i) These are round or oval in shape.

(ii) The egg measures 60-75 μm in length by 40 to 50 μm in breadth.

(iii) It is surrounded by thick smooth shell with an outer albuminous coat.



Grassi (1925) estimated that the female ascaris produces 27000000 eggs and the daily production is about two lakhs.

In the life cycle of this parasite the following stages have been recognised —

STAGE I - The fertilized eggs pass out with the faeces.

STAGE II - Development in soil.

For development, the egg requires a temperature between 60° and 98° F which is lower than the human body temperature. The development ceases at temperature

below 60°F and egg disintegrates above 100°F.

Under normal condition, the eggs develop in moist soil in the presence of O_2 within 10 to 14 days and active larva is formed within the egg. This first larva is known as rhabditiform larva which moults within the egg and transforms into the second stage larva having power to infect human being.

STAGE III — Infection and liberation of larva. After ingestion with food or drink, the embryonated eggs pass to the duodenum where by the action of digestive juices, the egg shells weaken and the enclosed larvae are stimulated. After the splitting of the egg shell, the infective larvae come out. It measures 0.25 mm in length by 14 mm in breadth.

STAGE IV — Migration of larvae.

Stewart (1916) discovered that the larvae do not develop directly to maturity in the intestine but go on a 10 days tour.

The larvae actively burrow through the intestinal lining and are carried to liver via the mesenteric veinule. From the liver the larvae are transported to the right side of the heart and from here are transported to lung via pulmonary artery. Before

entering into the air sac, the larvae grow in size upto 2mm and moult twice (first on sixth day and 2nd after 10th day). Now they reach the alveoli. The total time required during this migration is about 10 to 15 days.

STAGE II – Re-entry into the alimentary canal.

From the lung alveoli, the larvae reach to the epiglottis via bronchi and trachea. Due to their crawling movement they again come out after coughing and are passed to intestine via oesophagus and stomach. Again moulting occurs here between 25th and 29th days from the time of oral ingestion of the eggs.

STAGE III – Sexual maturity.

The larvae that have successfully completed the 4th moulting in the intestine can attain sexual maturity in about 6 to 10 weeks. The female becomes fertilized and starts egg laying. Thus the life cycle is repeated again.

Intestine (4th moulting) ← Male – Sperm, Female – Ova → Zygote → outside with host faeces

Stomach

Oesophagus

Swallowed back into gullet

Pharynx

Trachea

Branches

Branchioles

Alveoli

Lung (2nd and 3rd moulting)

Larva (1st moulting)

Rhabditiform larva (L1-L2)

Swallowed by new host

Intestine of new host larva hatches out

Bores intestinal wall

Reaches hepatic portal vein

Liver

LIFE CYCLE OF ASCARIS LUMBRICOIDES

Life Cycle of Ascaris Lumbricoides