

# Sight ID: *Amyntas agrestis*



Phylum: Annelida

Common name: Alabama jumper & snake worm

Key feature: Clitellum is smooth & white circling completely around body

- DID YOU KNOW THAT: *A. agrestis* is an invasive species of earthworm originally from Korea and Japan.

[Alabama jumper](#)

# Sight ID: *Amyntas agrestis*

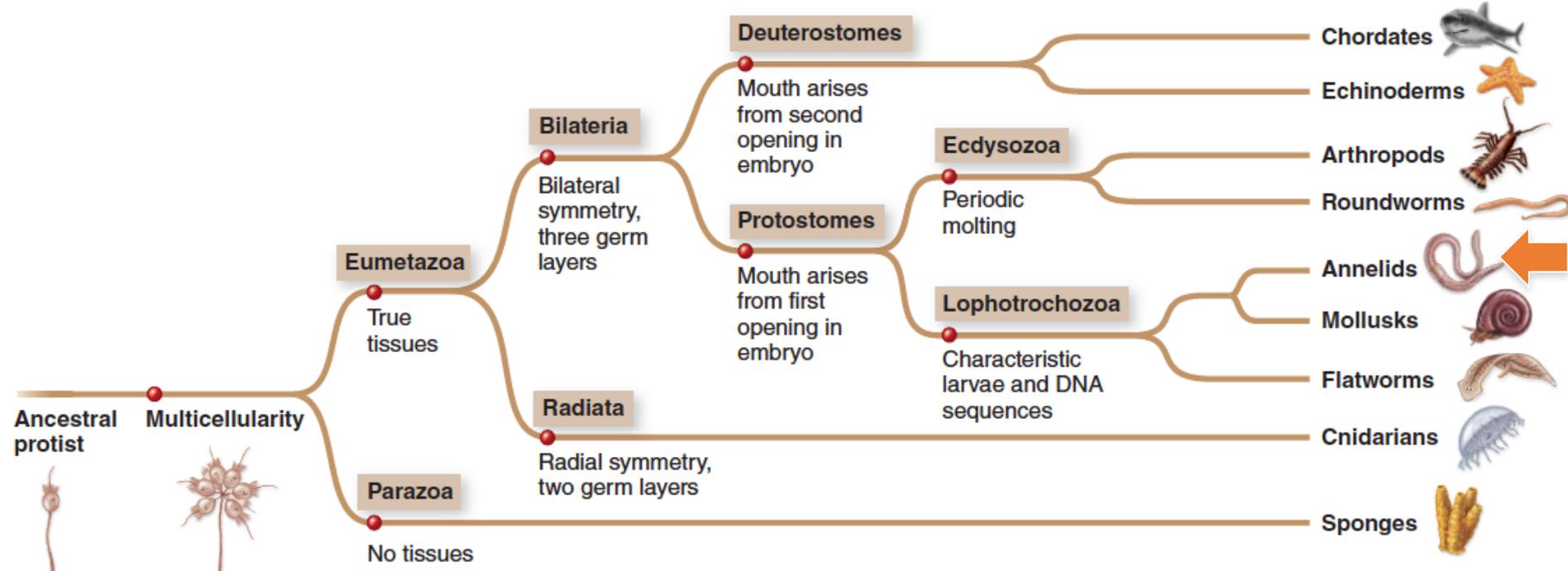


- DID YOU KNOW THAT: *A. agrestis* can decimate the biodiversity of the forest floor .



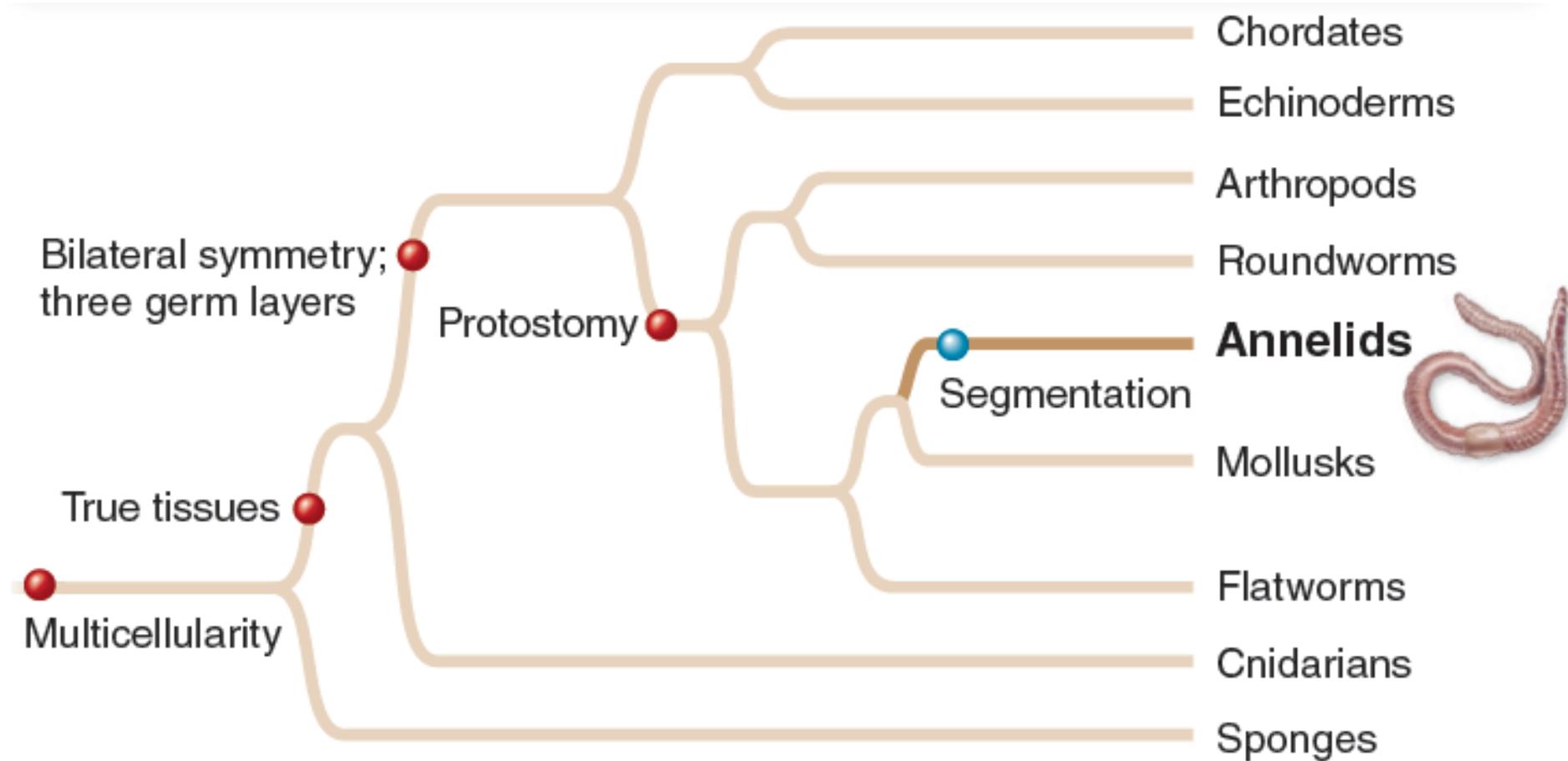
# Annelids Are Segmented Worms

## Phylum Annelida: Earthworms & leeches



# Annelids Are Segmented Worms

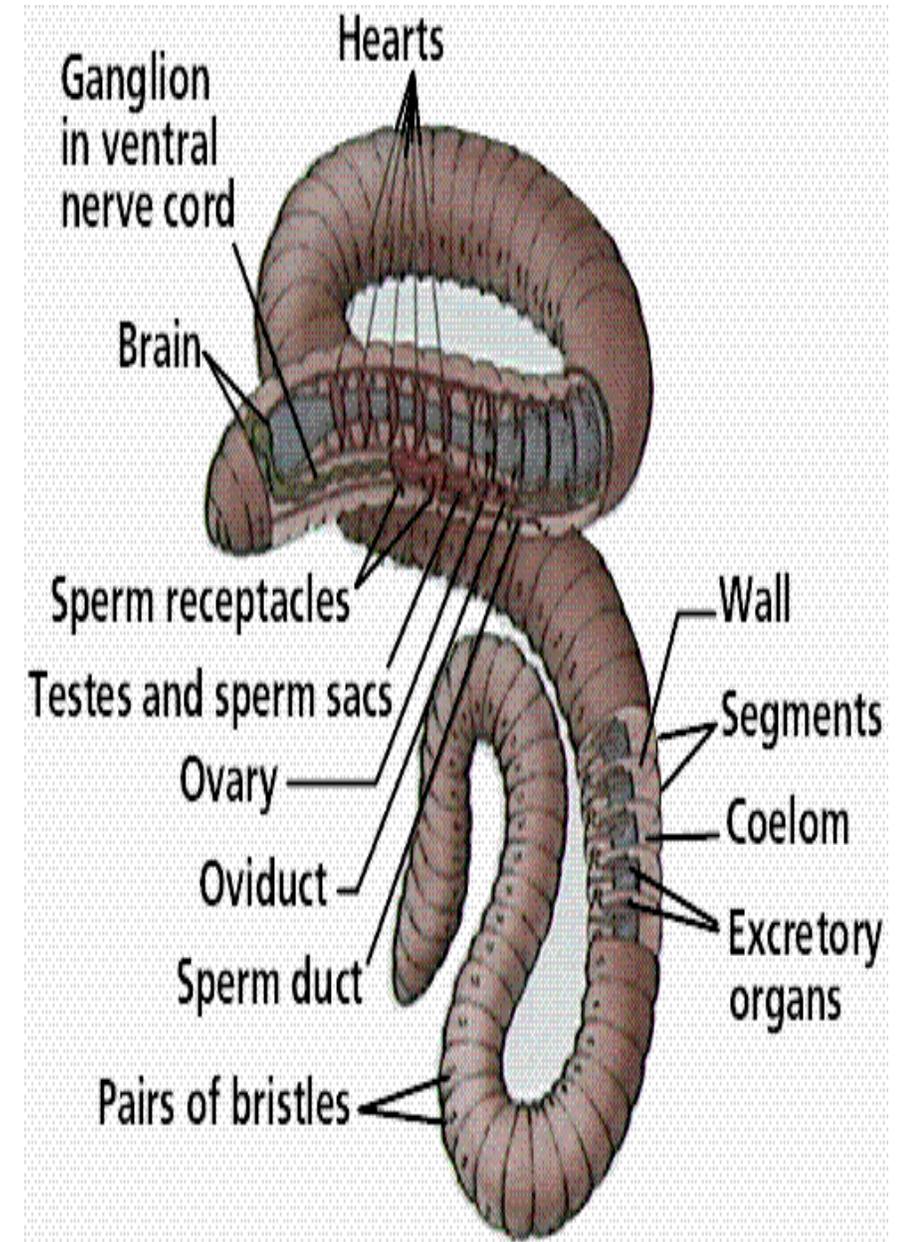
## Key features



# *Annelida*: Segmented Worms

## Characteristics

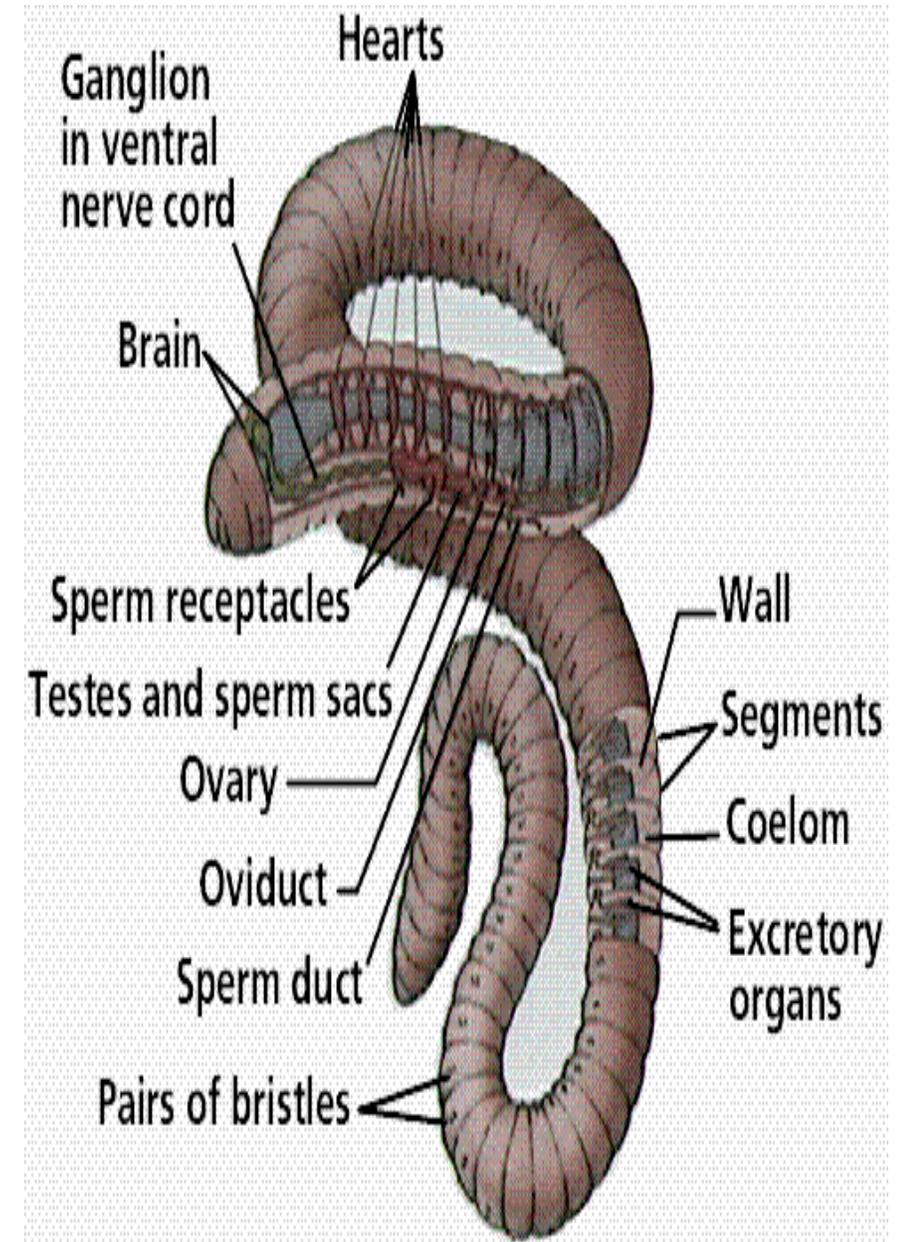
- Have linked segments called **somites**.
- Bilateral symmetry
- Triploblastic
- Coelem divided by **septa** to help serve as **hyrdostatic skeleton**
- Hydrostatic skeleton **provides structure** for muscles to pull against and more individual control over somites
- Thin **cuticle** covers somites and covered in **setae** (bristles) to aid locomotion



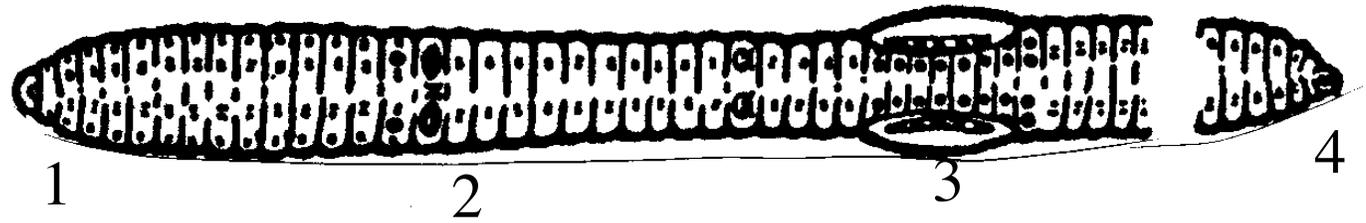
# *Annelida*: Segmented Worms

## Characteristics

- Well developed and organs for various organ systems: Nervous, Excretory, **Circulatory**, Digestive, Reproductive and **Muscular**
- **Closed circulatory system** (blood moves through system via vessels).
- Nerve cords and digestive tube run through their bodies.
- Hermaphrodites- reproduction sexual
- Their castings have **5 x N**, **7 x P**, and **11 x K** than topsoil



# Basic Earthworm Anatomy



1: mouth

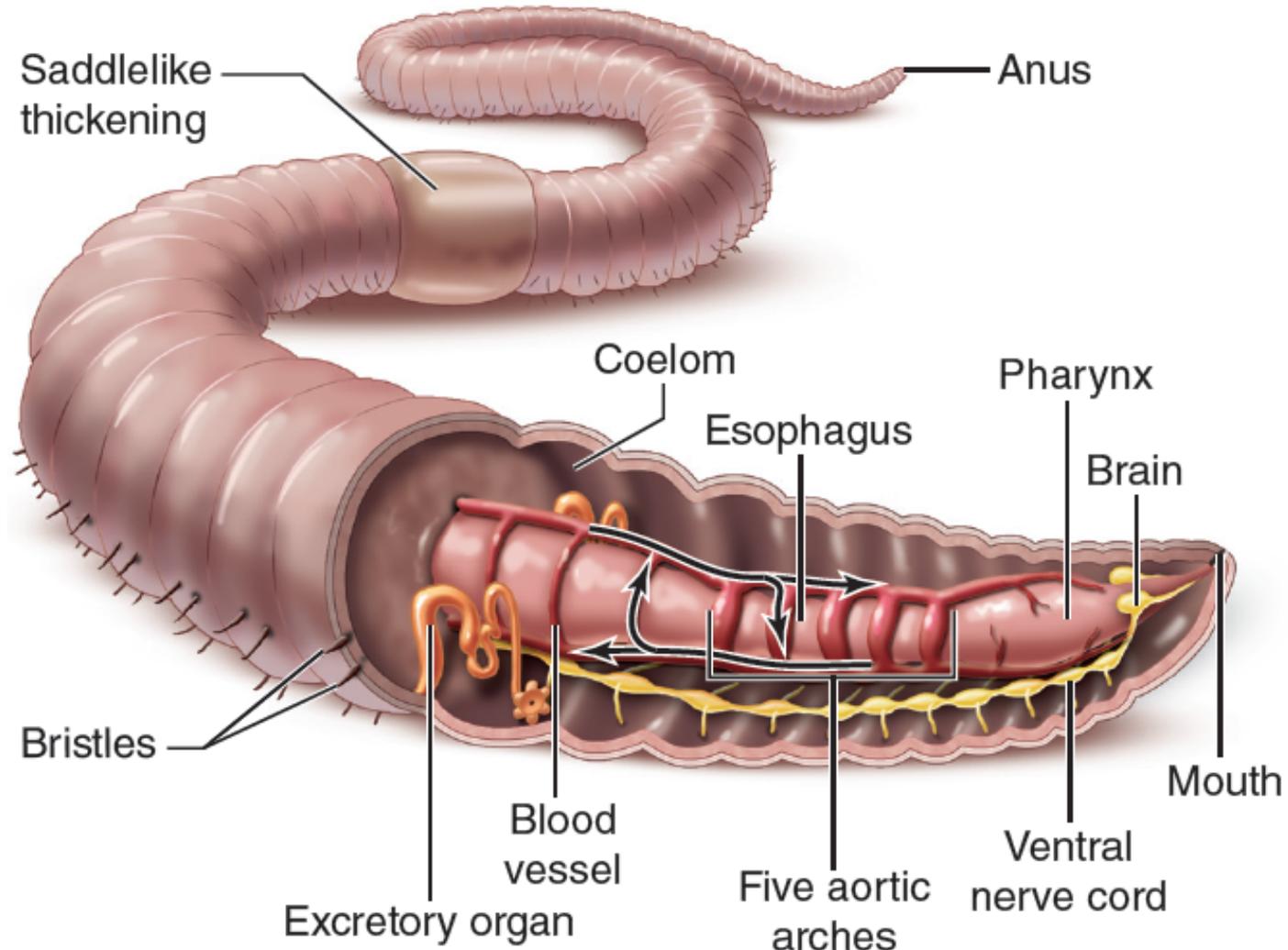
2. Segments

3. Clitellum

4. Anus

# Annelids Are Segmented Worms

## Anatomy

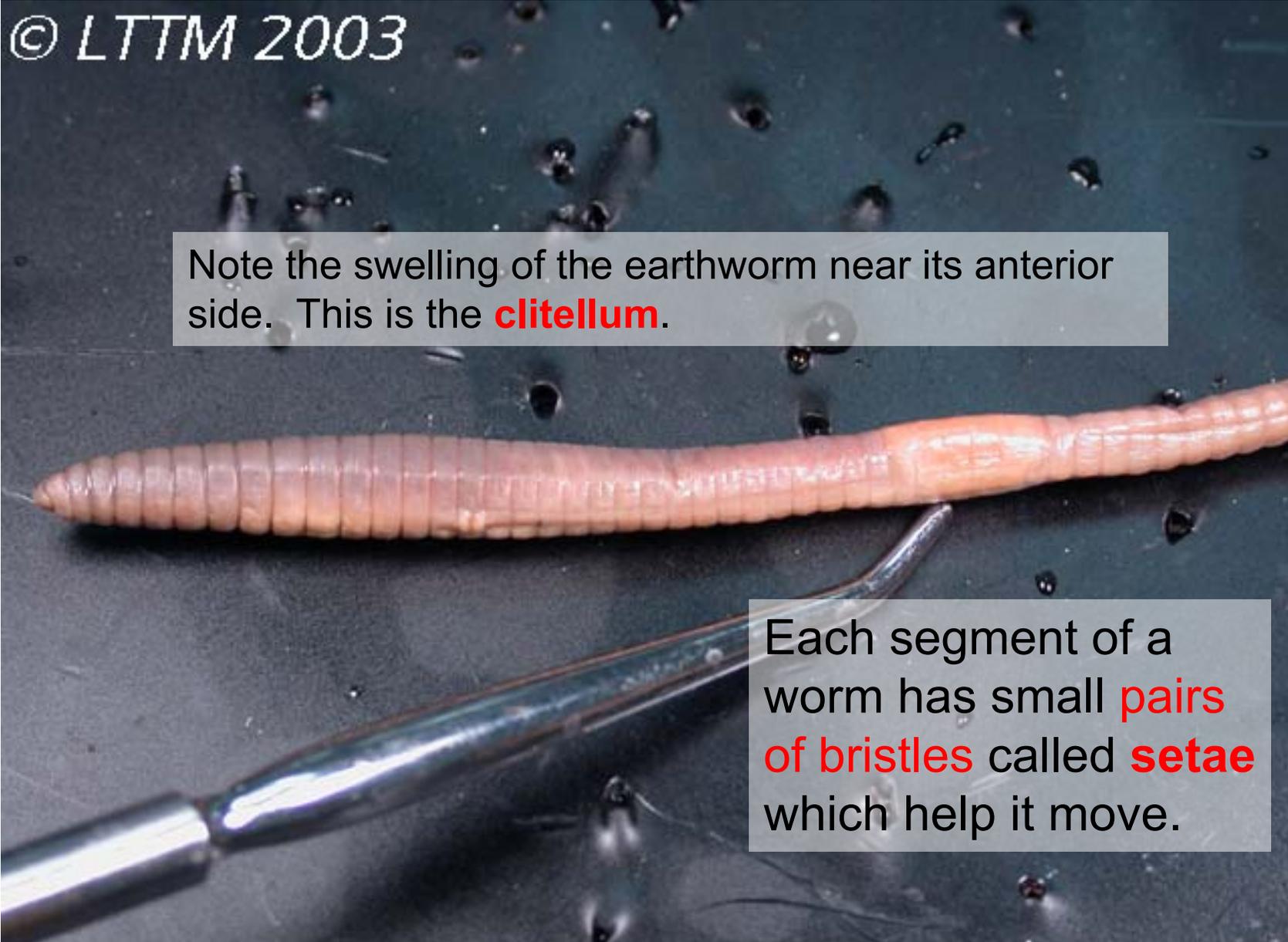


# External Anatomy: Clitellum

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Note the swelling of the earthworm near its anterior side. This is the **clitellum**.

Each segment of a worm has small **pairs of bristles** called **setae** which help it move.



# CIRCULATORY SYSTEM

- The circulatory system is the body's **transportation system.**
- It transports the **oxygen and nutrients** that the cells need and **carries the wastes** that are left.
- It's like a super highway with "red" Porsches being the **oxygen carrying Hemoglobin** and garbage trucks carrying the waste products.

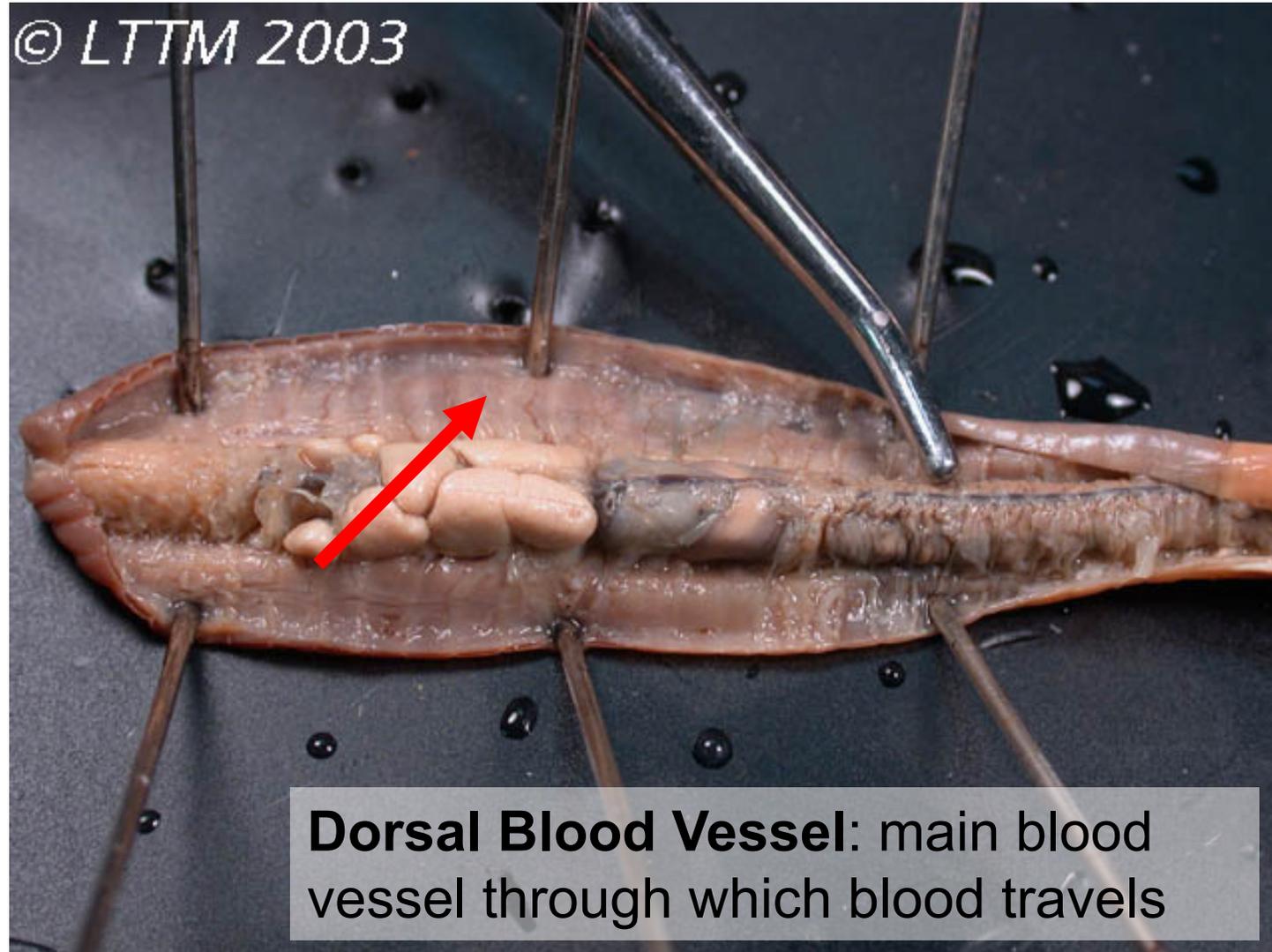
# Earthworms do have blood,

- and in fact it's very similar to humans because it contains Hemoglobin (which bonds and carries the oxygen to the cells).
- The earthworm also has **2 blood vessels** which are responsible for carrying the blood out to the different parts of the worm.

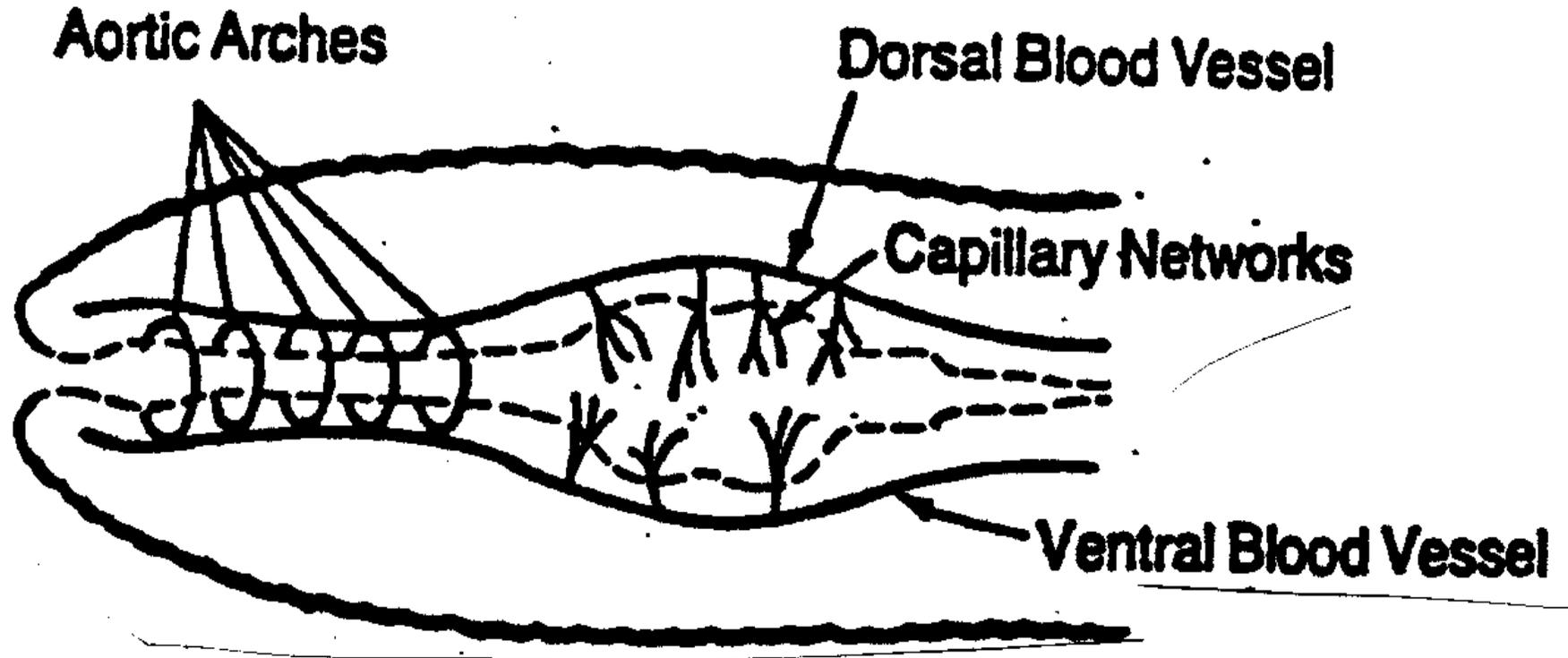
# CIRCULATORY SYSTEM

- The top vessel is the dorsal blood vessel,
- the bottom is the ventral blood vessel.

# Circulatory System: Dorsal Blood Vessel



# CIRCULATORY SYSTEM ANATOMY



# CIRCULATORY SYSTEM

- This type of circulatory system **is called a “closed” system**
- because the blood is moved and contained in **special vessels,**
- rather than the **“water balloon”** type circulatory system called and **“open” system.**

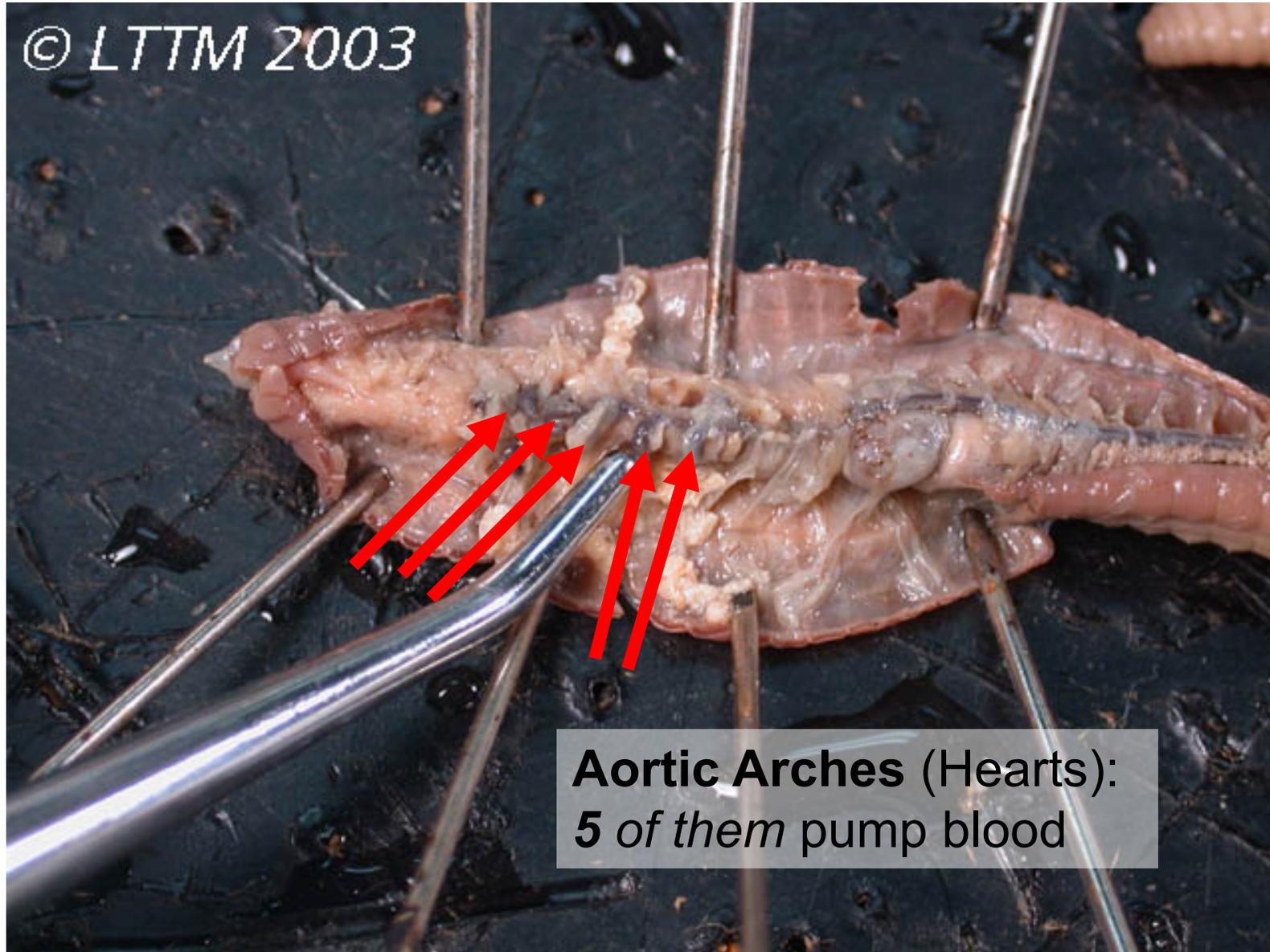
# CIRCULATORY SYSTEM

- Lions, tigers and bears (oh my!) earthworms and humans all have closed systems (just to name a few!).
- You'll find open circulatory systems in grasshoppers and clams. Open systems simply "bathe" the organs in blood, sloshing around like a water balloon.

# CIRCULATORY SYSTEM

- Worms also have special vessels called **"aortic arches"**.
- **These are the hearts** of the earthworm and these 4-5 pair of hearts perform the same job that a human heart does...

# Circulatory System: Aortic Arches



# CIRCULATORY SYSTEM

- **it pumps the blood of the worm.**
- **Worms DO have a pulse** and you can actually see and count the pulses.
- **The pulse rate can also change.**

# REGULATION SYSTEM

- **What makes up the regulation system?**

# REGULATION SYSTEM

- a) The nervous system (for nerve control)
- and the endocrine system (for chemical control).

# REGULATION SYSTEM

- **These are the life functions by which organisms control and coordinate their other life functions to maintain life.**

# REGULATION SYSTEM

- The purpose of the **nervous system** is to **regulate the body's activities**.
- Nervous **responses are very rapid** in the rate of response and are of very short duration.

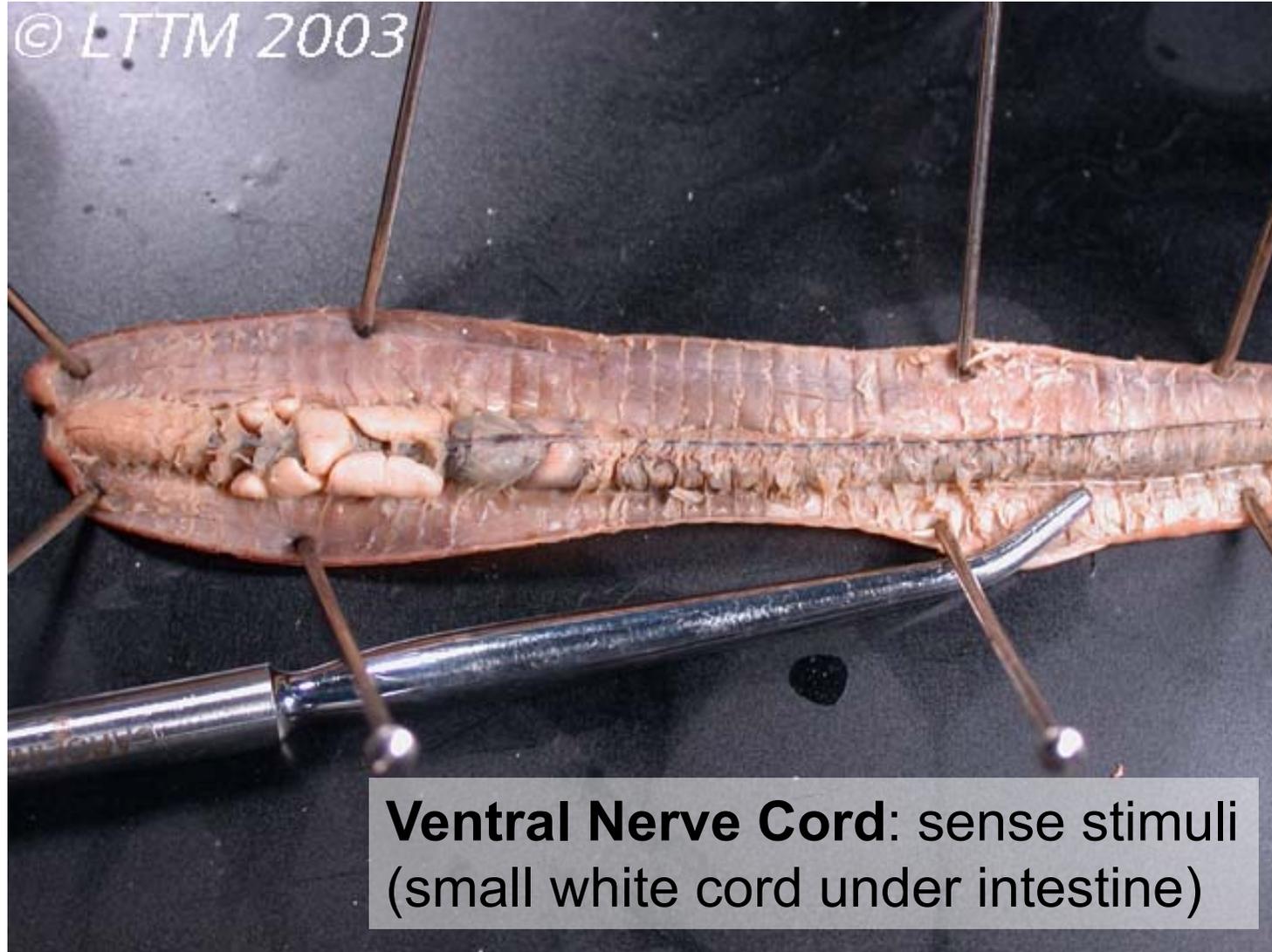
# REGULATION SYSTEM

- The earthworm's nervous system consists of a **primitive, 2 lobed brain** (yes, they have one!!)
- which is really fused ganglia, **and a nerve cord** which is located on the ventral side of the body.

# REGULATION SYSTEM

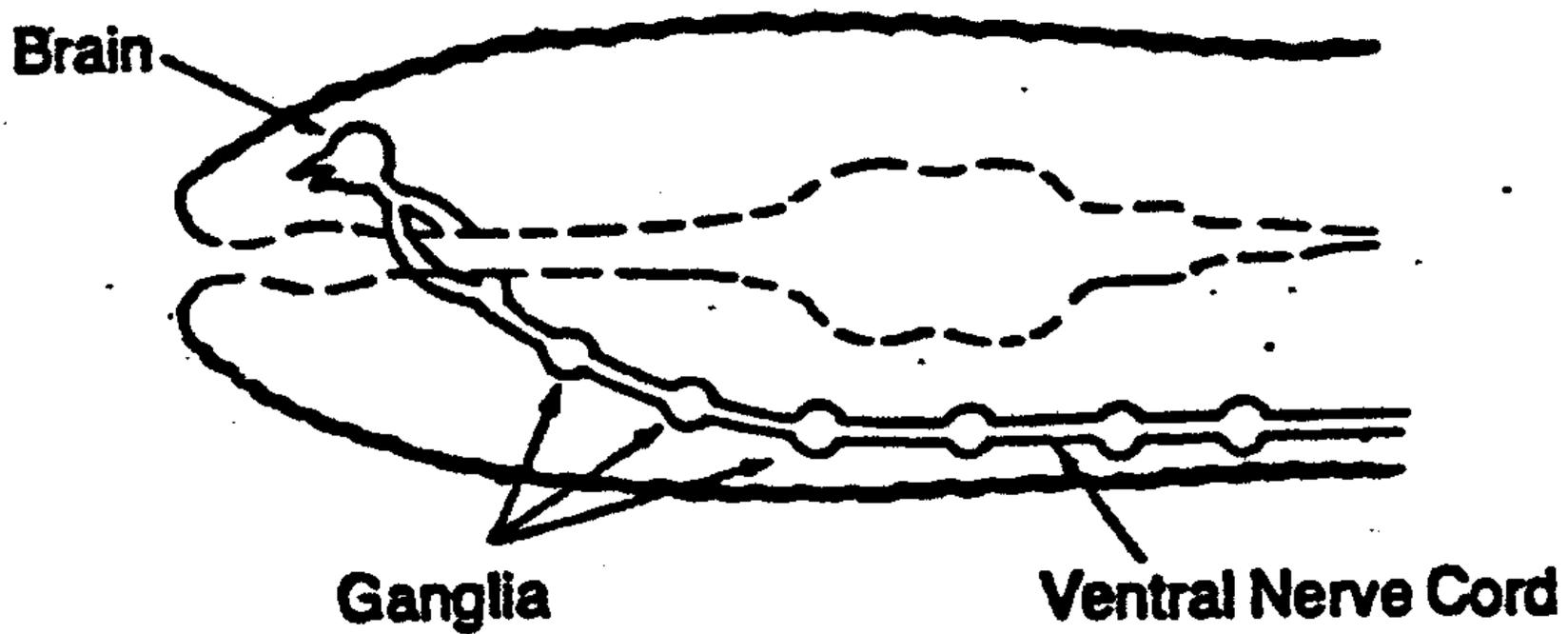
- Ganglia (bunched nerve cells) located in each of the body segments serve to connect the nerve cord with the peripheral nerves, which branch out to remote areas of the earthworm.
- This aids in the process of regulation, since the nerve impulses are directed in specific pathways from the receptor organs to the central nervous system and back to effector organs.

# Nervous System: Ventral Nerve Cord



# REGULATION SYSTEM ANAT.

## Nervous System



# CHEMICAL CONTROL

- **Chemical control is done by hormones** secreted in specialized tissues known as **endocrine glands.**
- The role of these hormones **regulates growth, reproduction and general metabolism.**

# Gas Exchange:

- Do worms breath?? What is breathing??
- For our purposes, breathing is the **process of a gas exchange** between the environment and the cell.
- It is the **molecular oxygen coming into the cells and the carbon dioxide going out** of the cells.

# Gas Exchange:

- The earthworm contains many cells that are not in direct contact with the environment
- **The worm uses its moist skin** as a surface through which it absorbs oxygen and releases carbon dioxide.

# Gas Exchange:

- The moistness of the skin is maintained by a “mucus” produced by specialized glands in the skin, along with the behavioral adaptations that keeps worms in moist soil.
- To transport absorbed oxygen to all cells, the earthworm utilizes the blood fluid system (hemoglobin!).

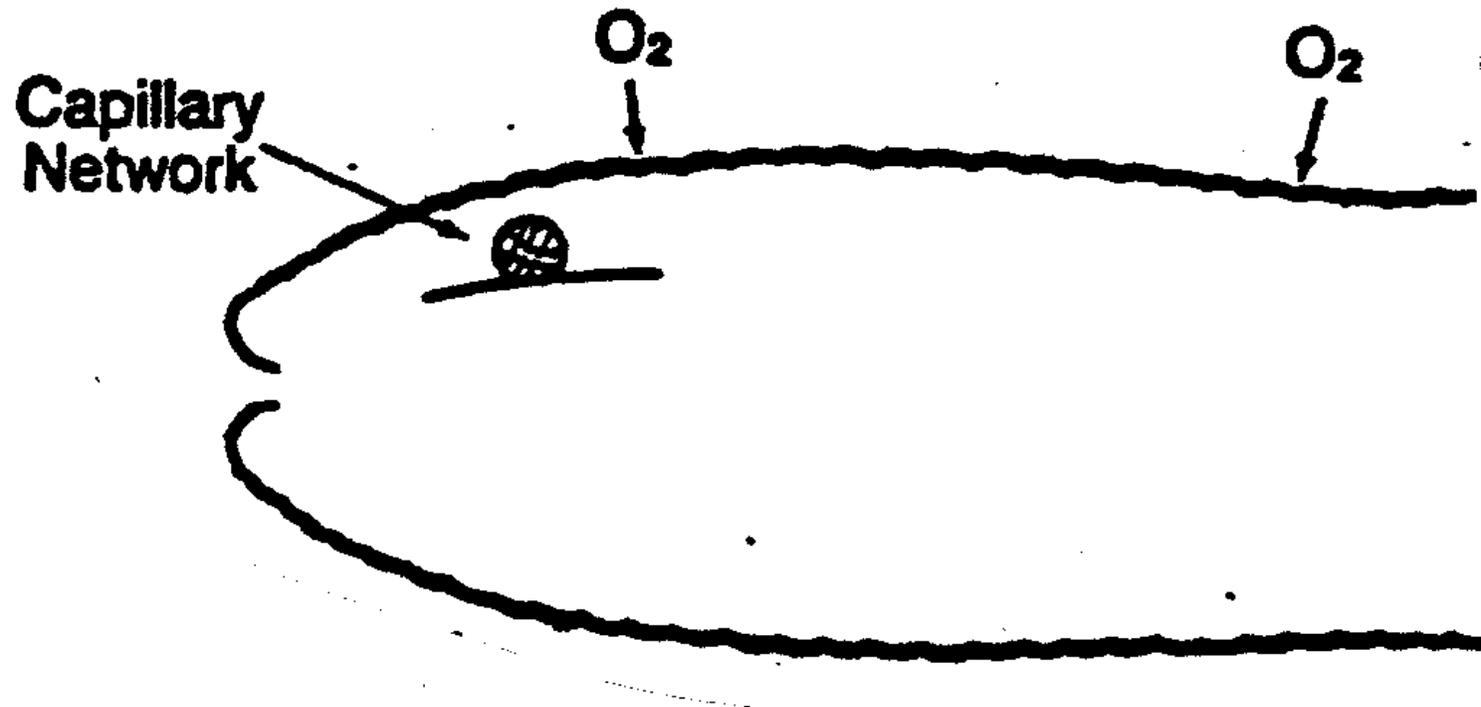
# Cuticle



**Cuticle:** outer protective covering

# Gas Exchange Anatomy

- Oxygen is absorbed through the moist skin and carried to the cells via the bloodstream



# EXCRETION

- Excretion is the process by which the cell's **liquid and gas wastes are removed** from the worm and released into the environment.

# EXCRETION

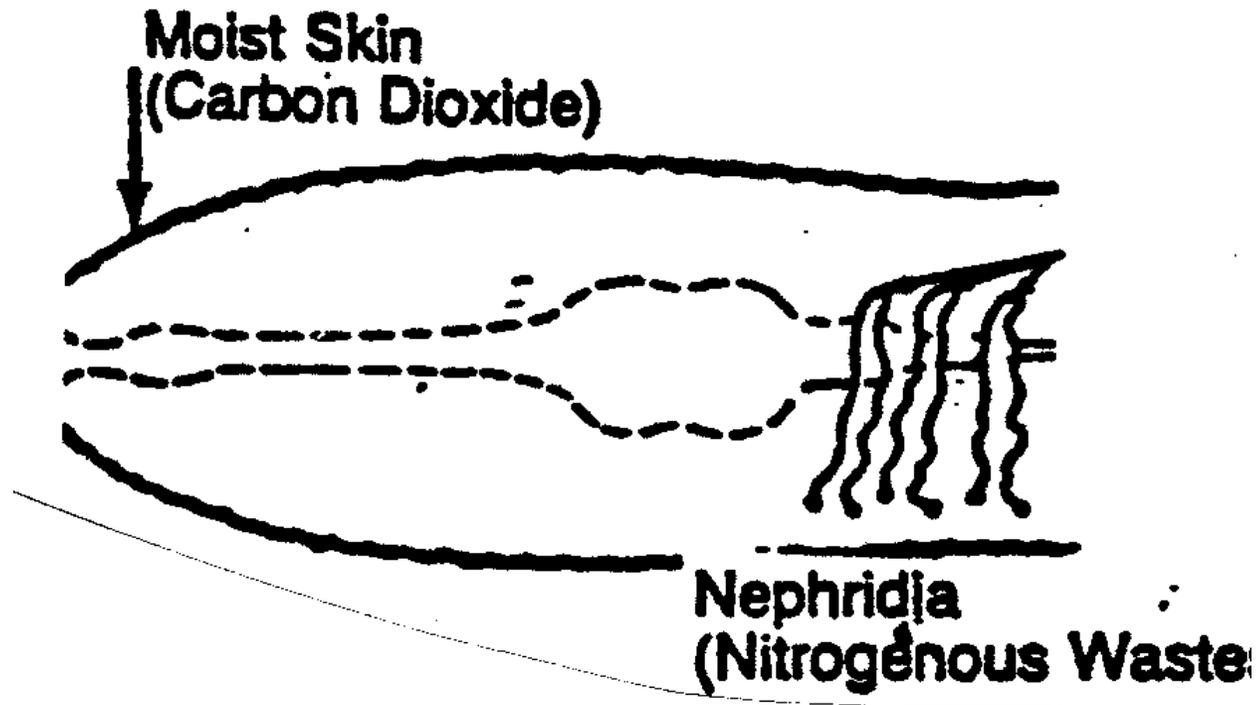
- The end products of this waste are carbon dioxide, water, mineral salts and nitrogenous wastes such as ammonia, urea and uric acid.
- The worm has a special, complex system for excretion.
- The moist skin of the earthworm serves as a respiratory surface for releasing carbon dioxide gas from the blood.

# EXCRETION

- The nitrogenous wastes, salts and water are collected in specialized organs known as **nephrida**.
- A pair of these are located in each of the earthworm's body segments.
- Once concentrated in the nephrida, these wastes are released into the soil through small pores in the earthworm's skin.

# EXCRETION ANAT.

- While the oxygen is absorbed through the moist skin, the carbon dioxide is released through the moist skin. Other liquid wastes are collected in the nephridia and released through the nephridiopore



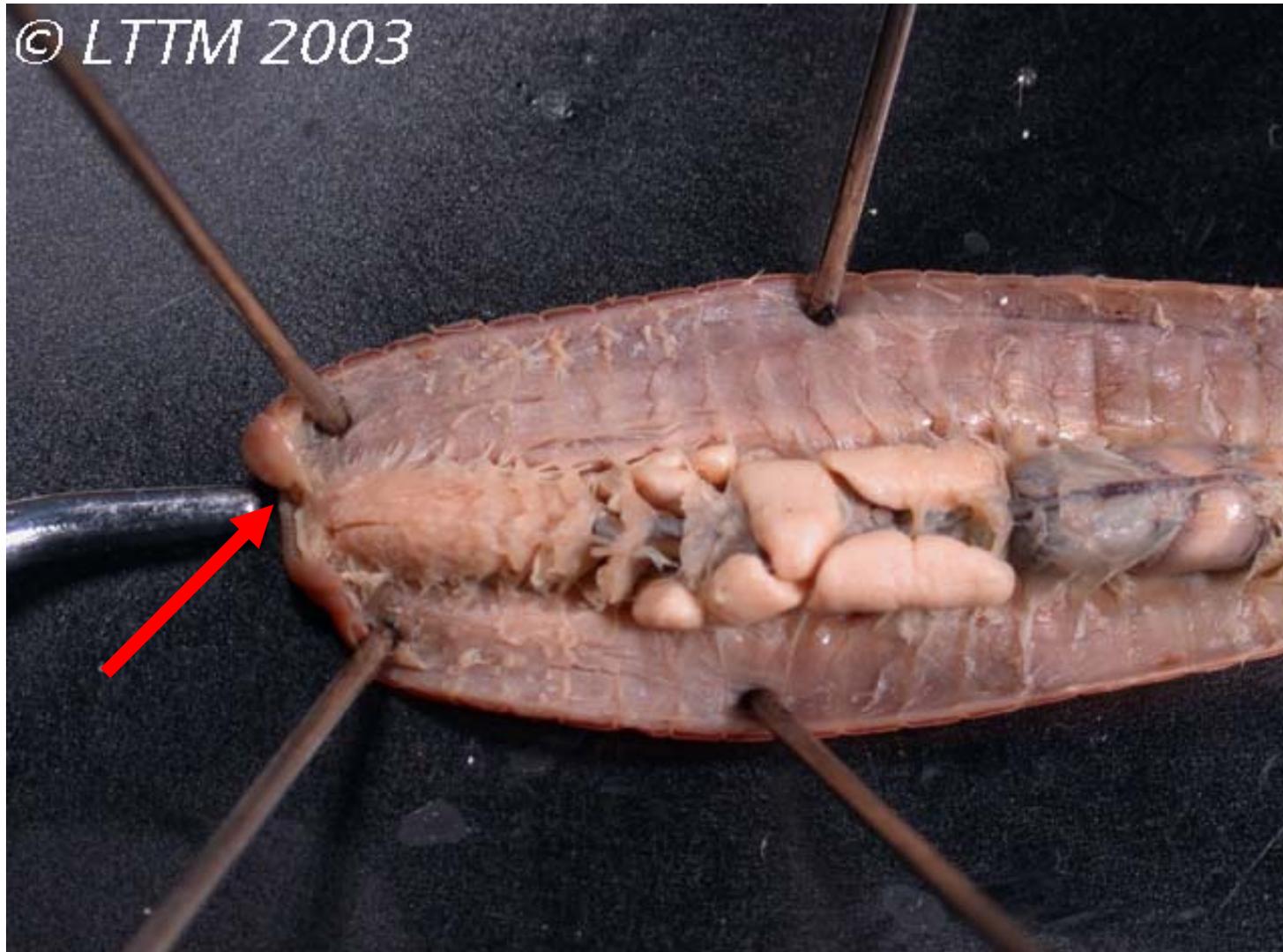
# DIGESTION

- Earthworms or “segmented worms” have a digestive system that is **tubular**. What this means is that there are openings at each end.

# DIGESTION

- The earthworm's **mouth is used for ingestion (eating the soil)**
- and as the food passes through the digestive tube it is gradually digested in specialized areas of the tube as follows:

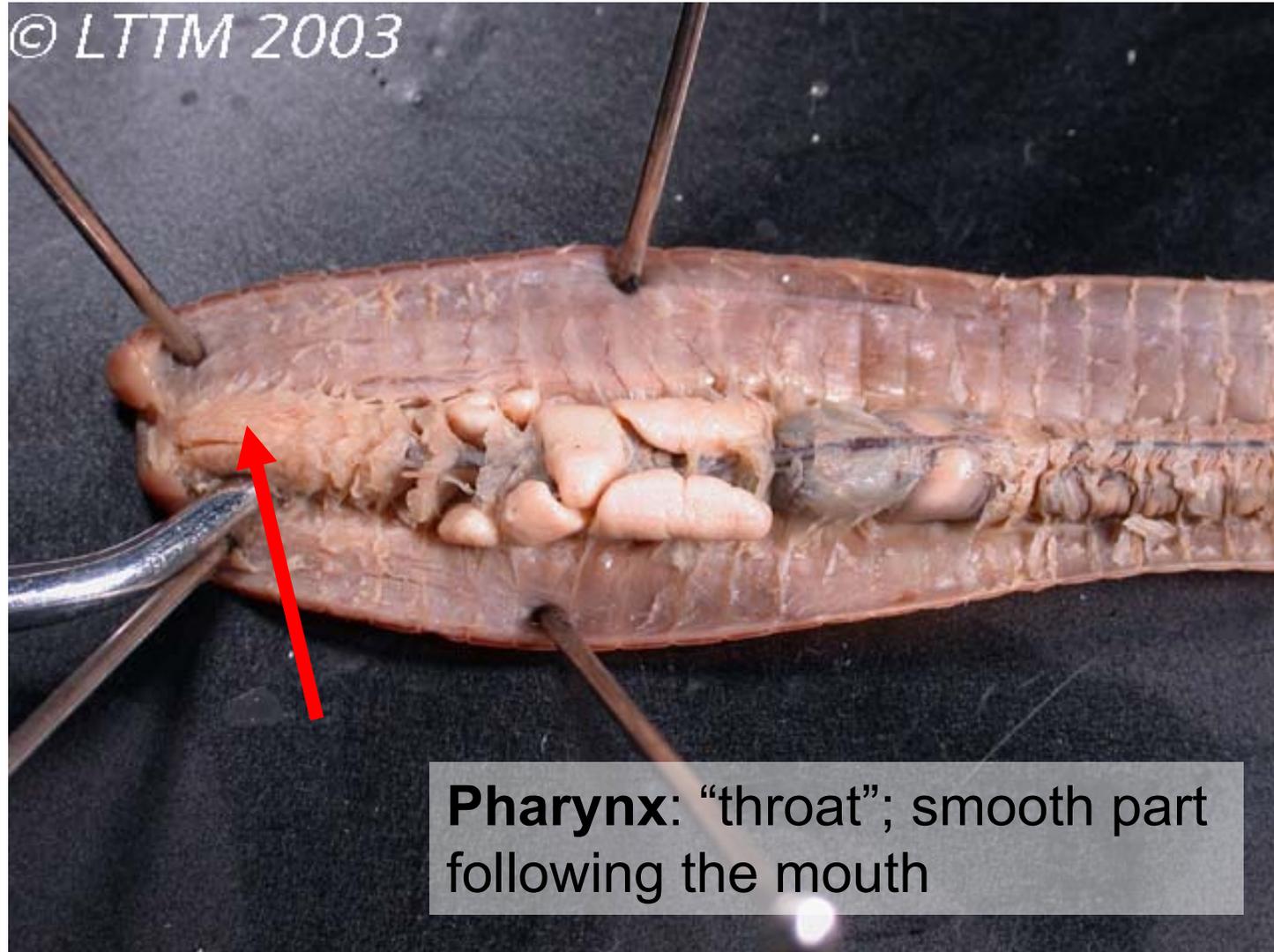
# Digestive System: Mouth



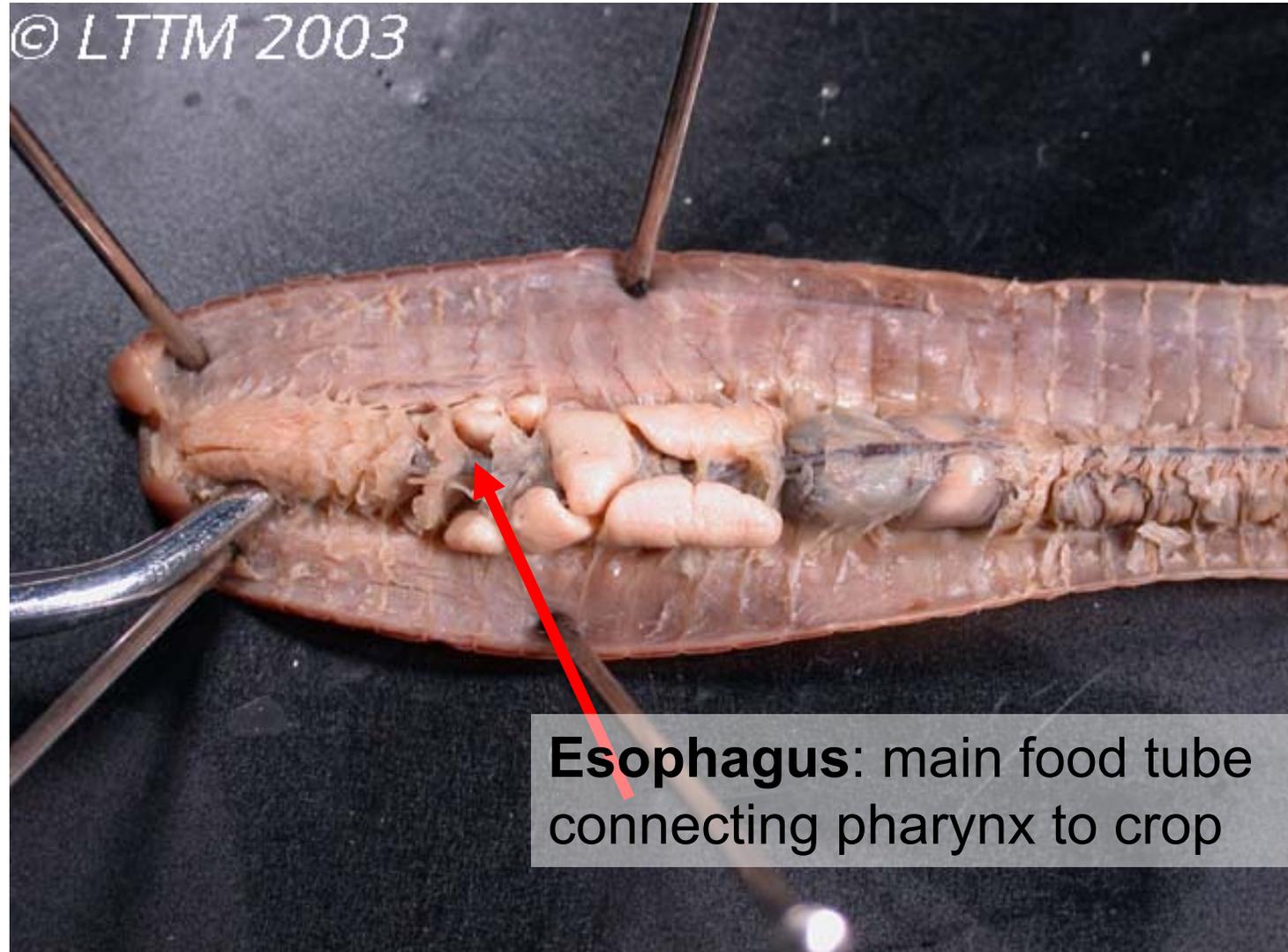
# DIGESTION

- **a) Pharynx:** a muscular organ for temporary storage of the food/soil mixture before processing
- **b) Esophagus:** the portion of the food tube that transports the food/soil mixture from the pharynx to the crop

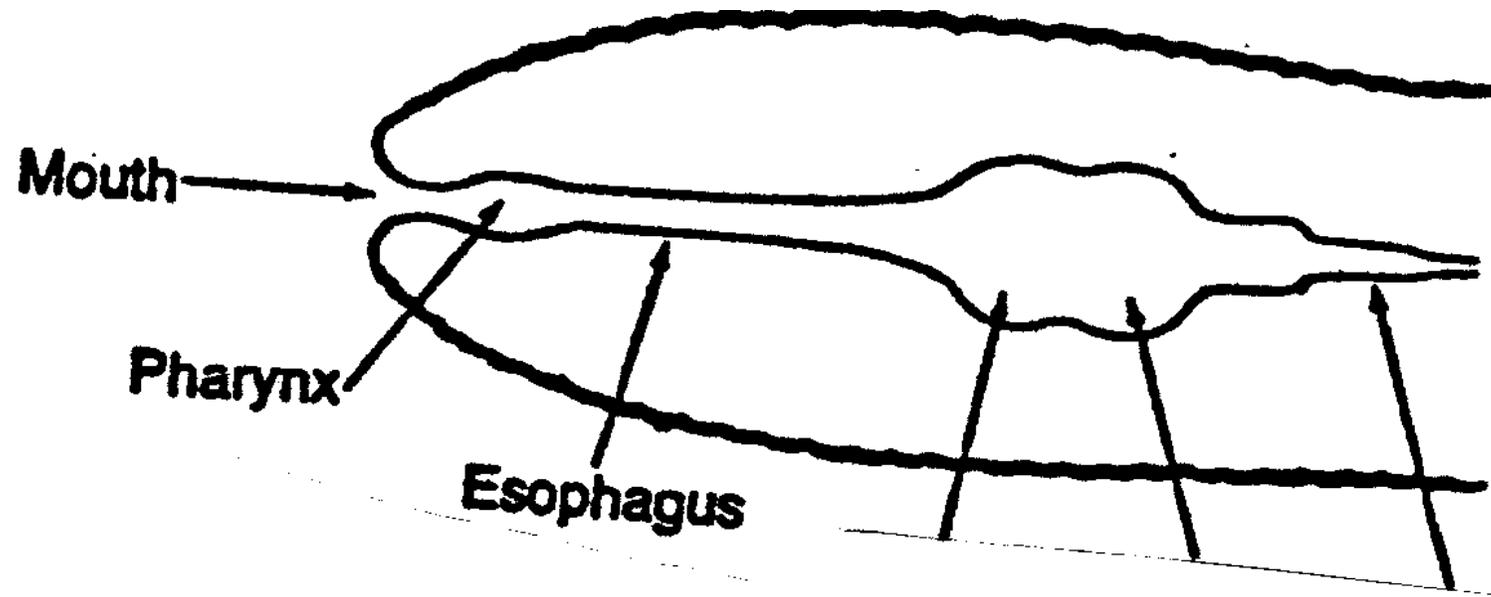
# Digestive System: Pharynx



# Digestive System: Esophagus



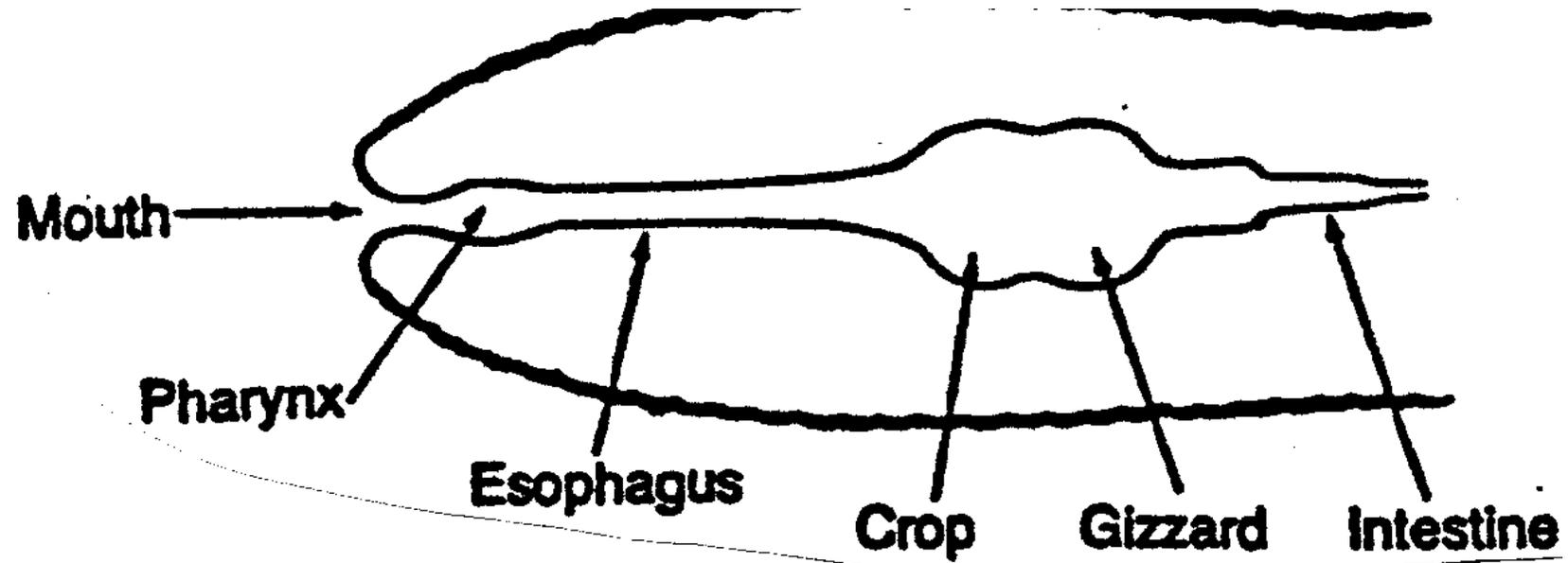
# DIGESTION ANAT.



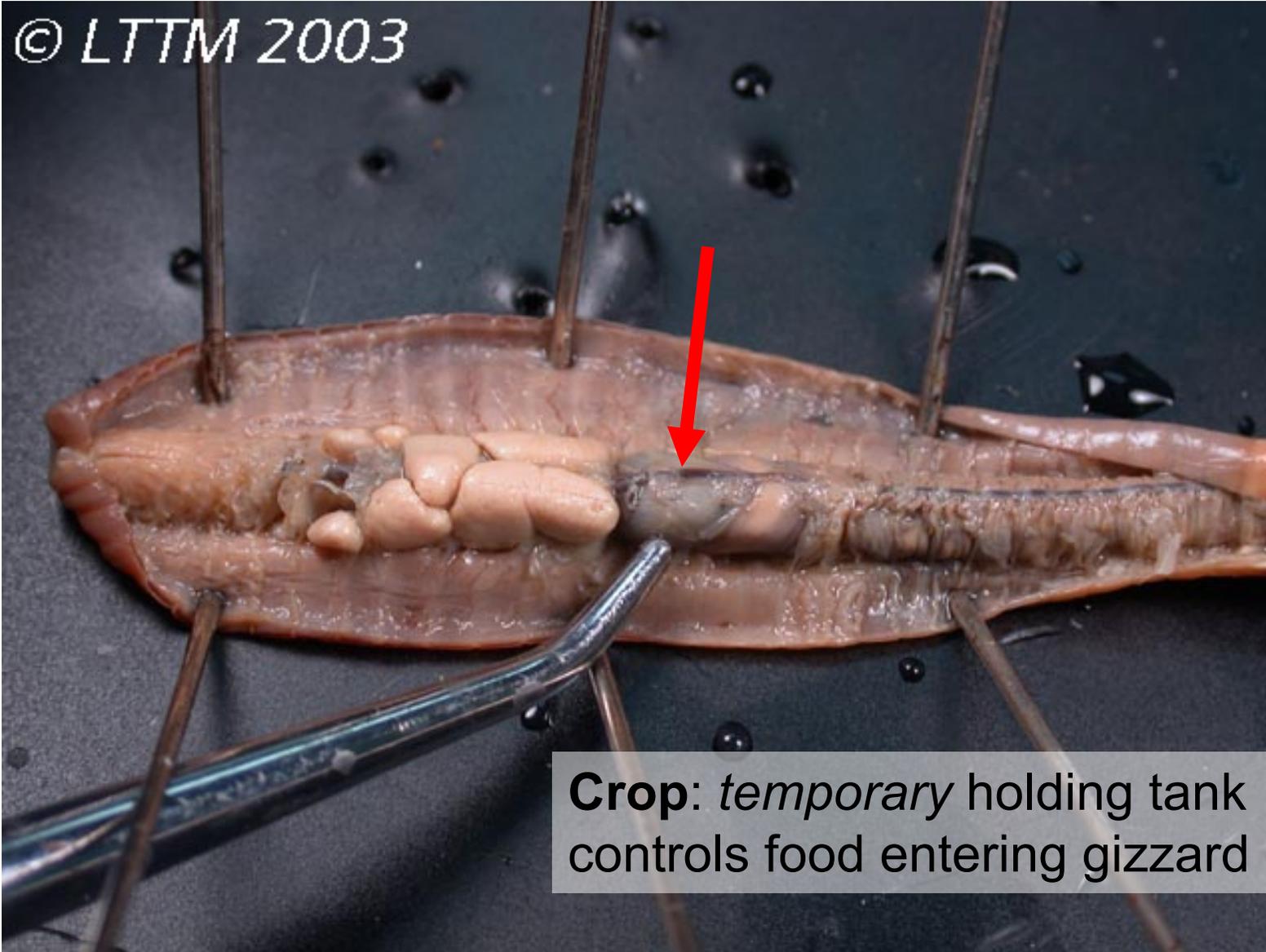
# DIGESTION

- **c) Crop:** a thin walled enlargement of the digestive tube used for storage of the food/storage mixture before its entry into the gizzard
- **d) Gizzard:** a muscular organ in which the ingested food is mechanically digested before entry into the intestine
- **e) Intestine:** a long tube through which the food passes as it is digested chemically by enzymes secreted from the intestine lining.

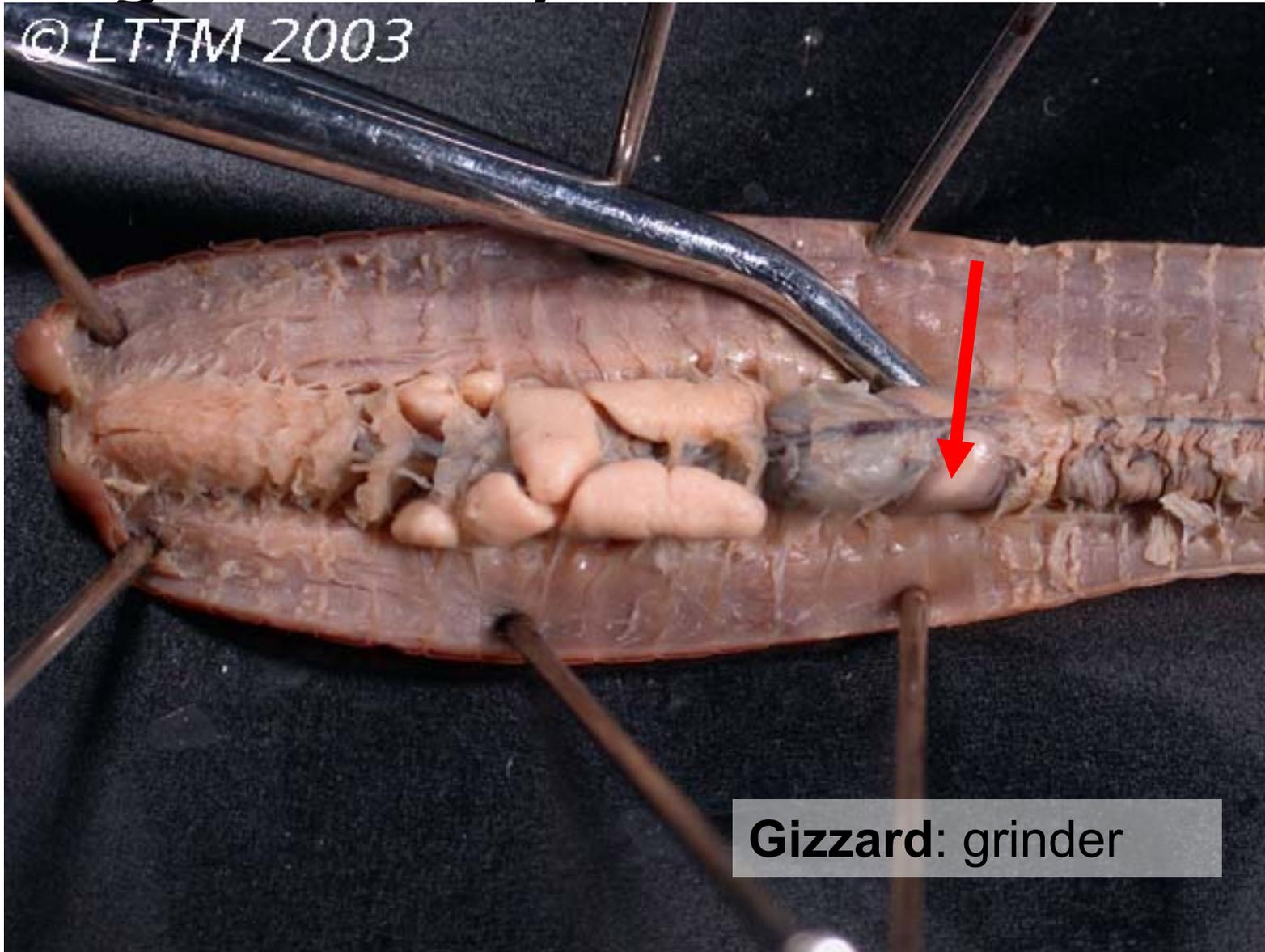
# DIGESTION ANAT



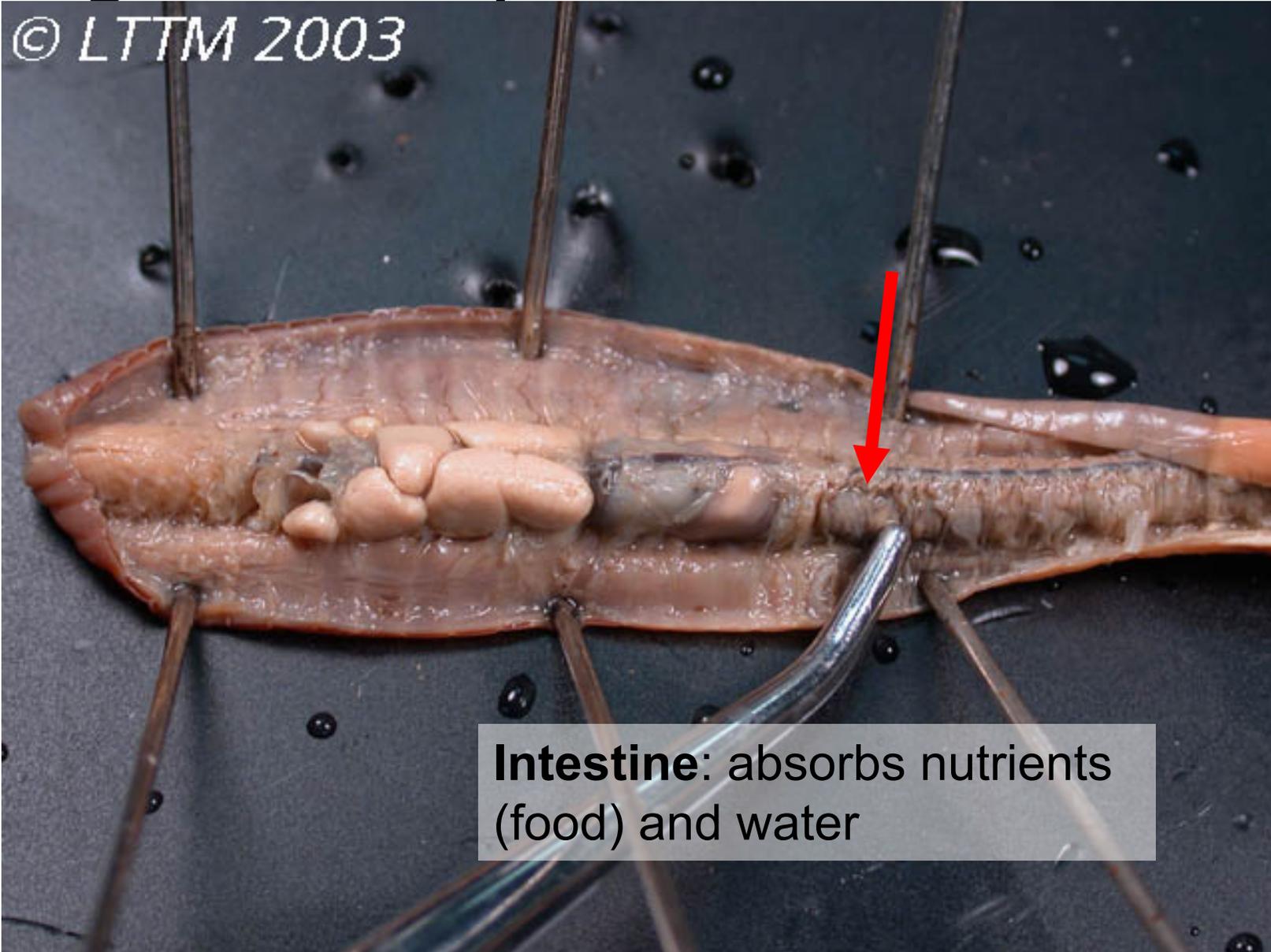
# Digestive System: Crop



# Digestive System: Gizzard



# Digestive System: Intestine



**Intestine:** absorbs nutrients (food) and water

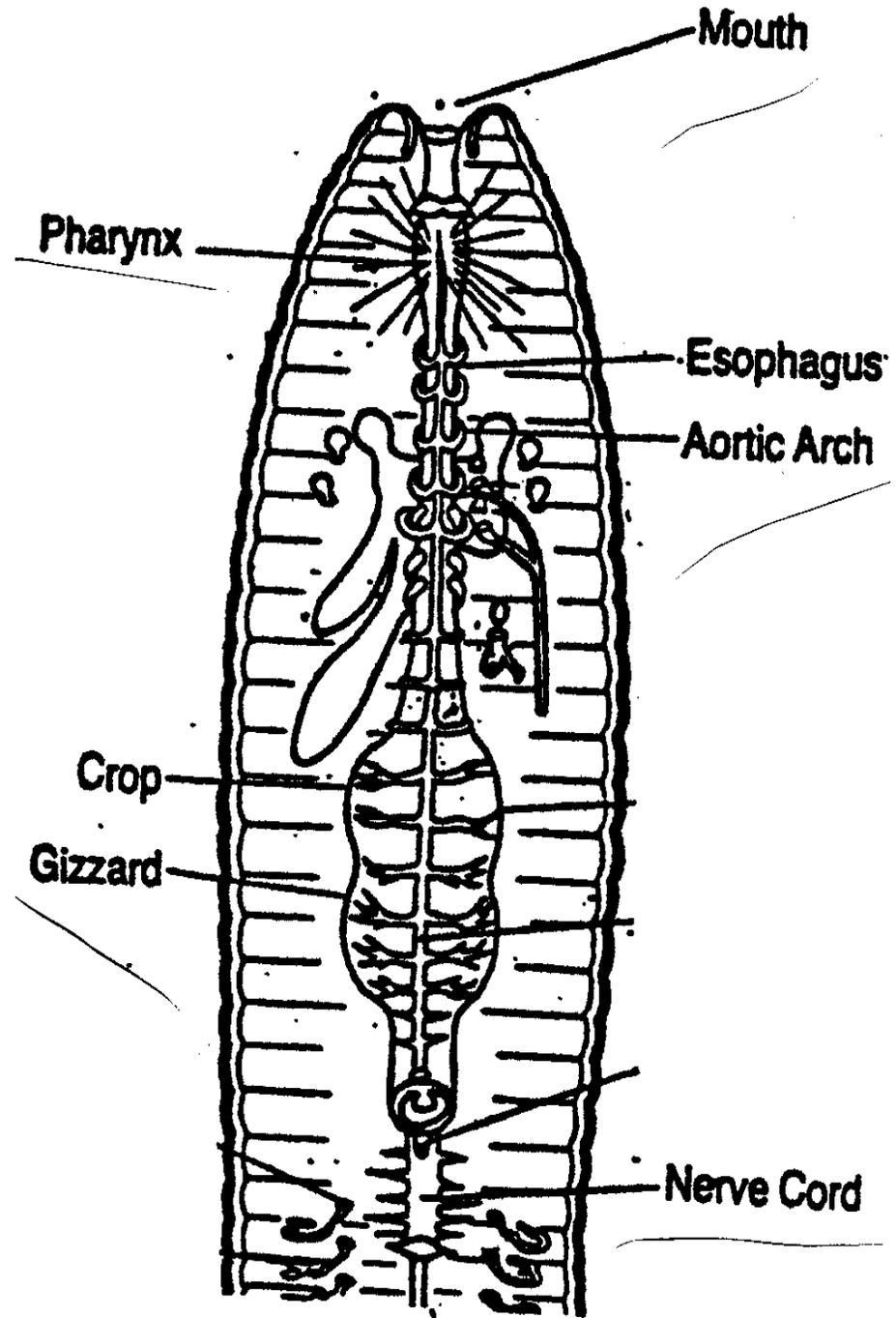
# DIGESTION

- Undigested materials are “egested” (pooped) at the posterior end of the digestive tube through the anus.

# DIGESTION

- These are also known as worm castings and help make awesome soil for those of you who are gardeners!
- Food moves in one direction through this tube and for this reason this design is sometimes referred to as a one-way digestive tube.

# Worm Anatomy



# REPRODUCTION

- A worm is neither a male OR a female,
- but in fact has both male and female sex organs.
- The earthworm's reproductive system is called "hermaphroditic",

# REPRODUCTION

- HOWEVER a worm **can not self fertilize,**
- but must find a **mate to exchange sperm** with.

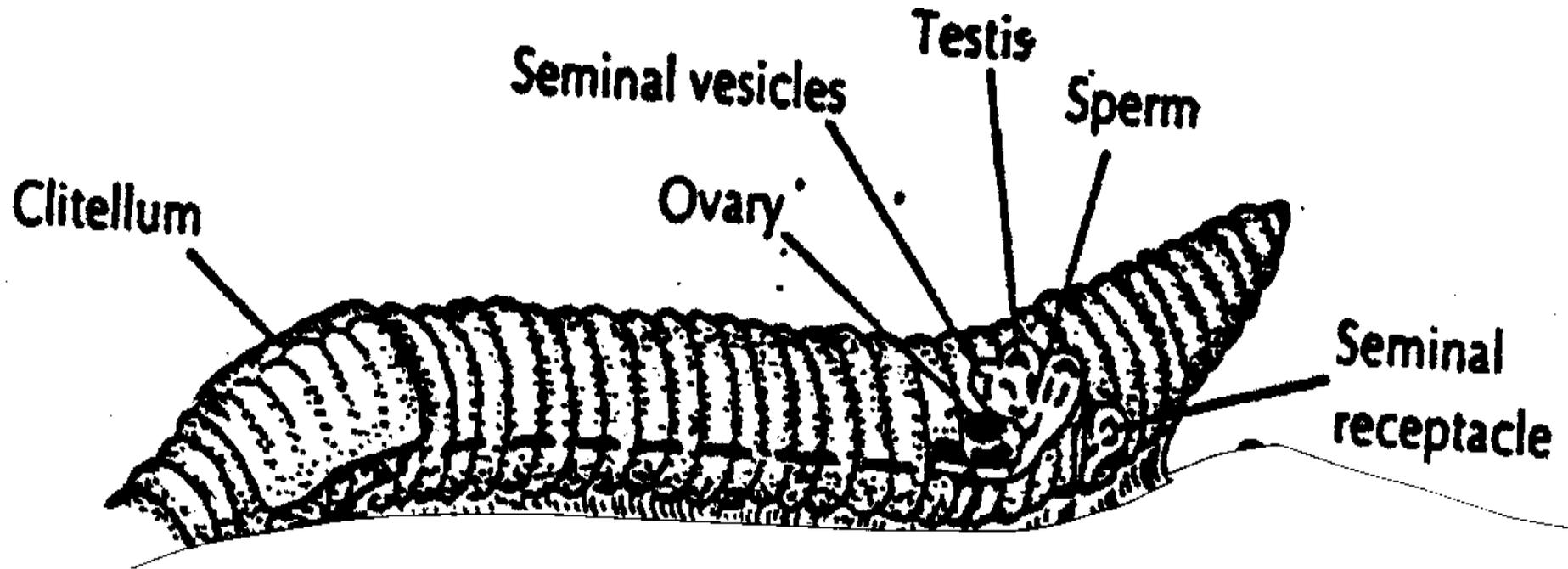
# REPRODUCTION

- The earthworm has **2 pair of testes (the male sex organ that produces sperm)**.
- These are located in sections (somites) 10 & 11. (ie: the 10th & 11th oere starting from the mouth)
- A small tube connects the testes and passes down to section 14.

# REPRODUCTION

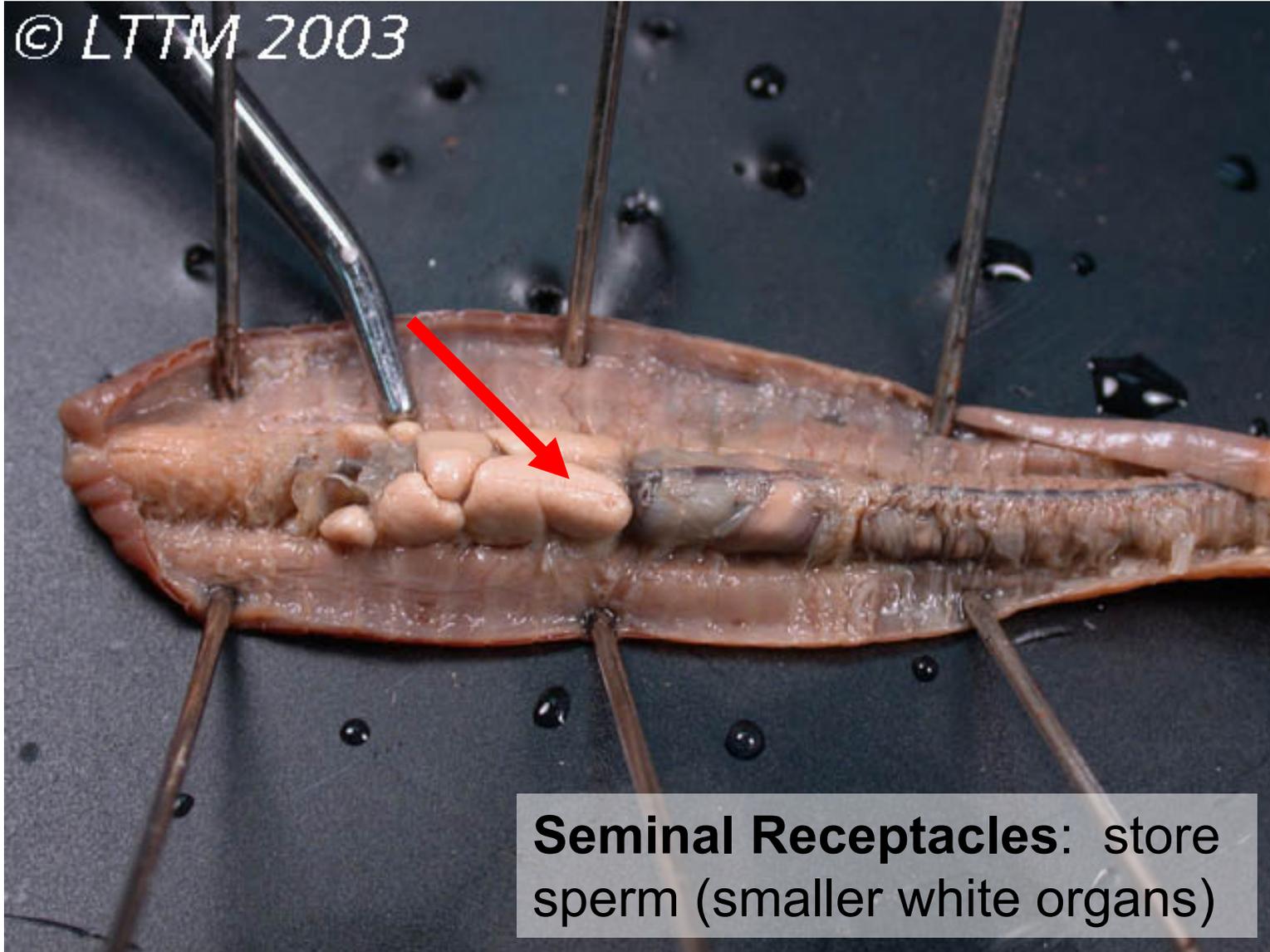
- **A small pair of ovaries (the female organ that produces the egg to be fertilized)**
- are located in somite 13 and is released and carried down to section 14.

# REPRODUCTION ANAT



# Reproductive System: Seminal Receptacles

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**Seminal Receptacles:** store sperm (smaller white organs)

# REPRODUCTION

- The process of sexual fertilization (the exchange of sperm from one worm to another) takes place as follows:

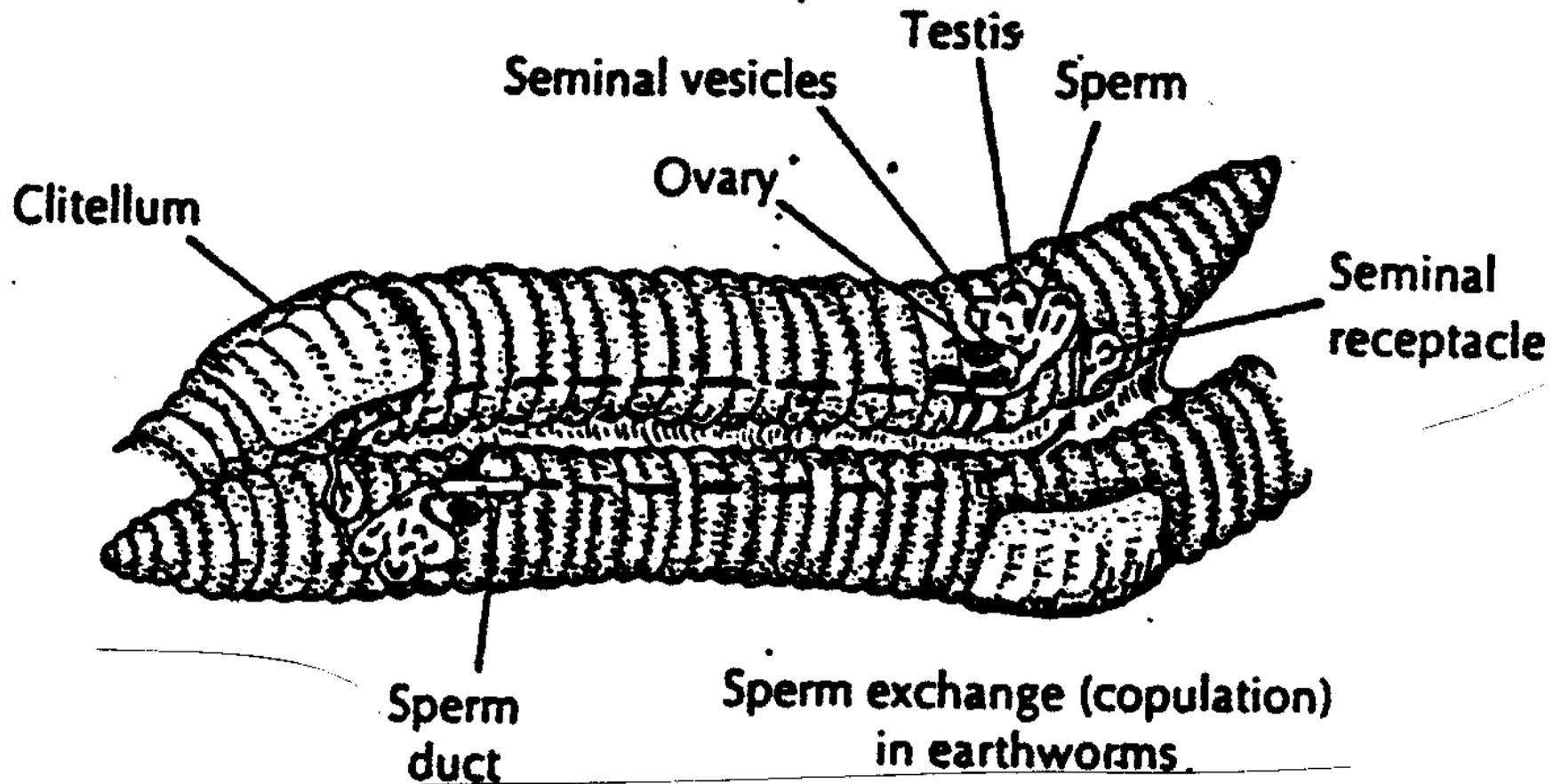
# REPRODUCTION

- The worm must be a **mature worm, usually a year old.**
- This can be recognized by the mature **clitellium (or band)** that appears at around segment 30-35.

# REPRODUCTION

- **Typically it is in the spring time, the ground is soft, warm and moist.**
- **The worms attach mouth to anus, anus to mouth and "copulate" or exchange sperm.**
- **The worms EACH release sperm that travel to the other's seminal receptacles. This process of sliming usually takes about 2 hours.**

# REPRODUCTION



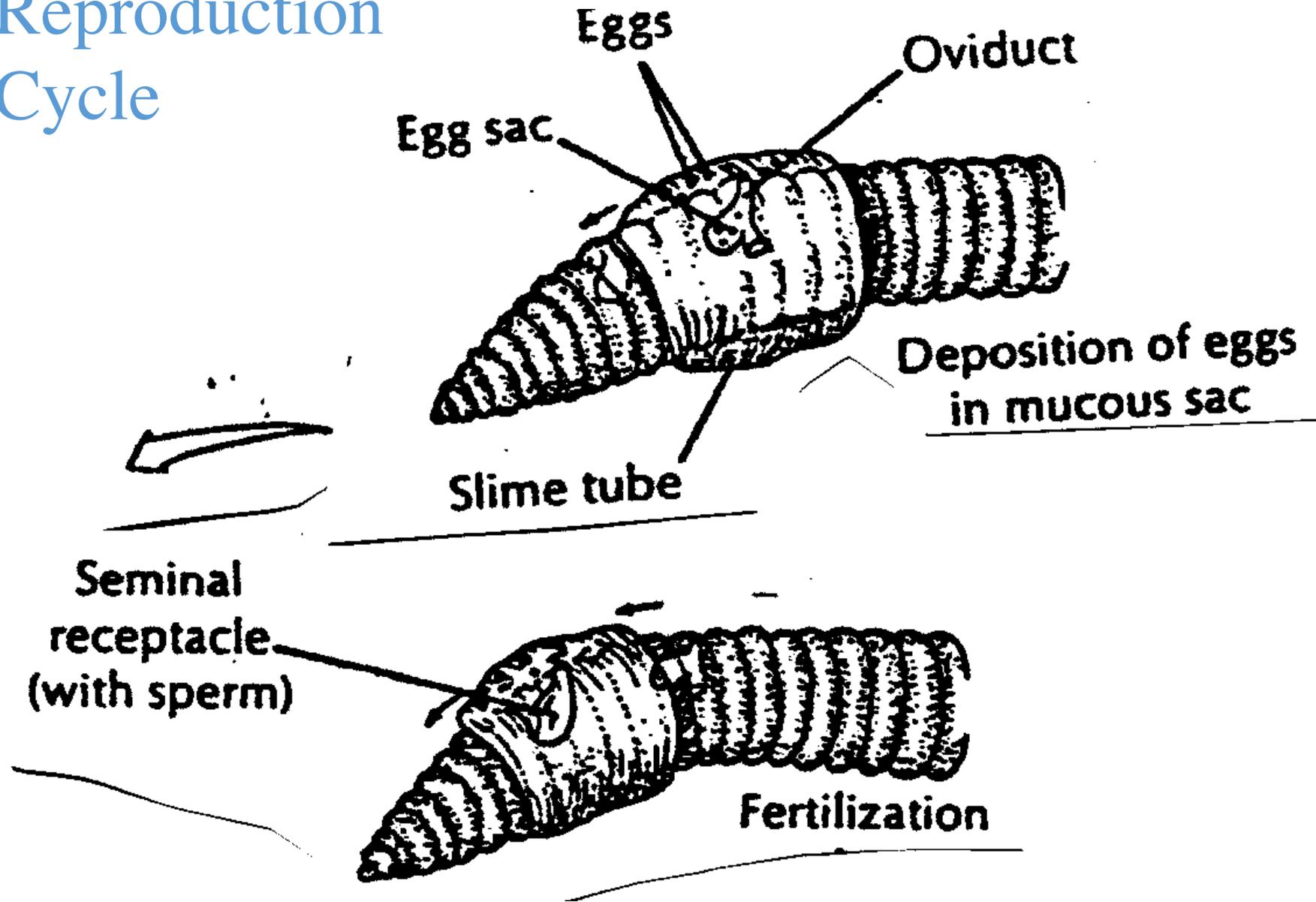
# REPRODUCTION

- **After copulation, the worms separate, each having the other's sperm stored in the seminal receptacles until used for fertilization.**
- **When the eggs have reached maturity and have been released the clitellium secretes a tube of mucus which slips over the front of the worm.**
- **The tube receives the eggs as it passes segment 14, and receives the other worm's sperm cells as it passes segments 9&10.**

# REPRODUCTION

- **Fertilization occurs inside the tube as it slides forward until it finally slips off the anterior end.**
- **The tube, which is then sealed, is usually left in the burrow to form a cocoon containing several zygotes.**

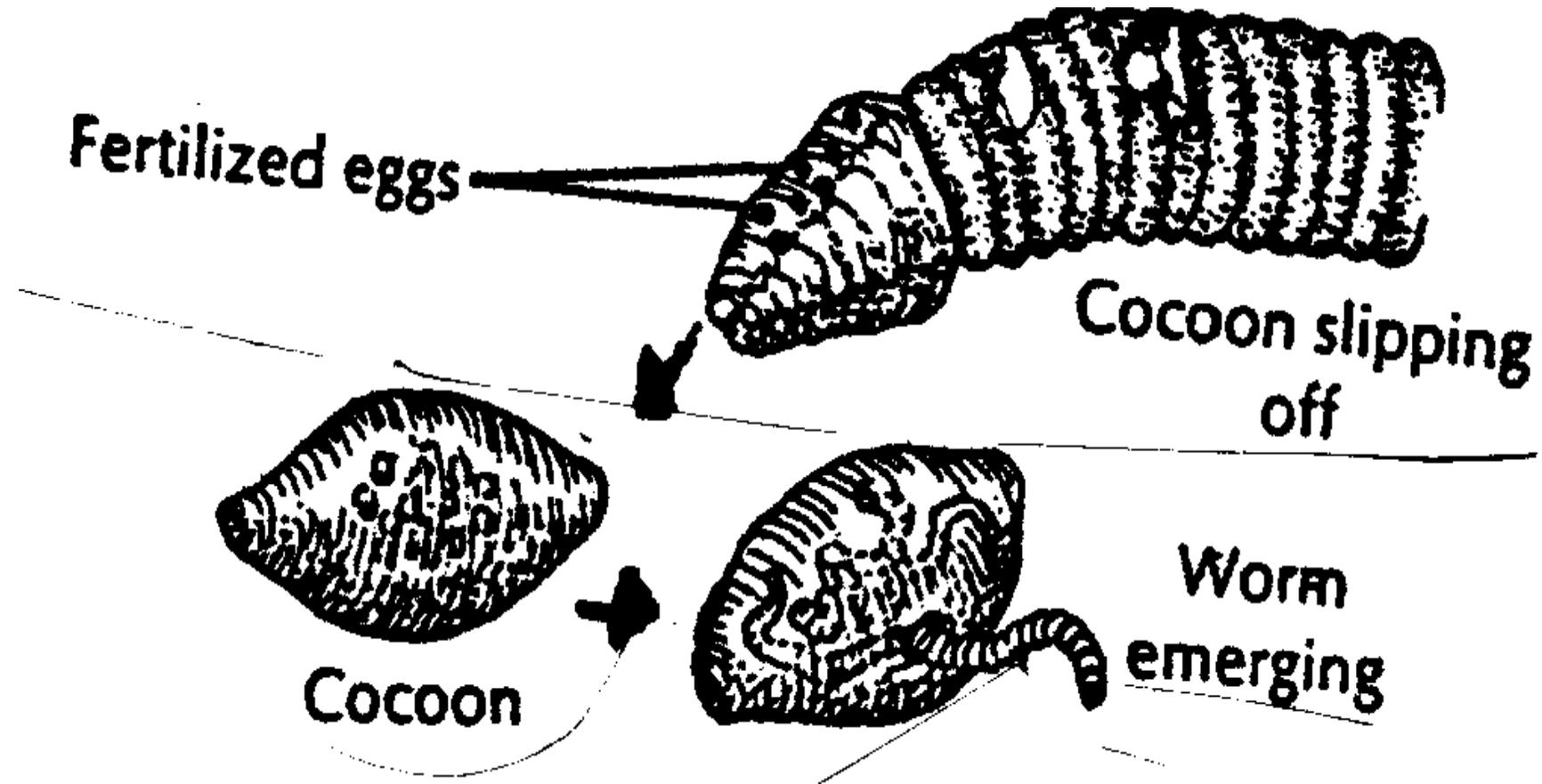
# Reproduction Cycle



# REPRODUCTION

- **After 3-4 weeks, pale, whitish wormlets crawl out as miniature adults.**
- **If the moisture and temperature are not quite right, the eggs can stay in the case for a year or more.**
- **The adult worms do not stay with the cocoon, but crawl off.**

# REPRODUCTION



Internal View: How many parts can you name?

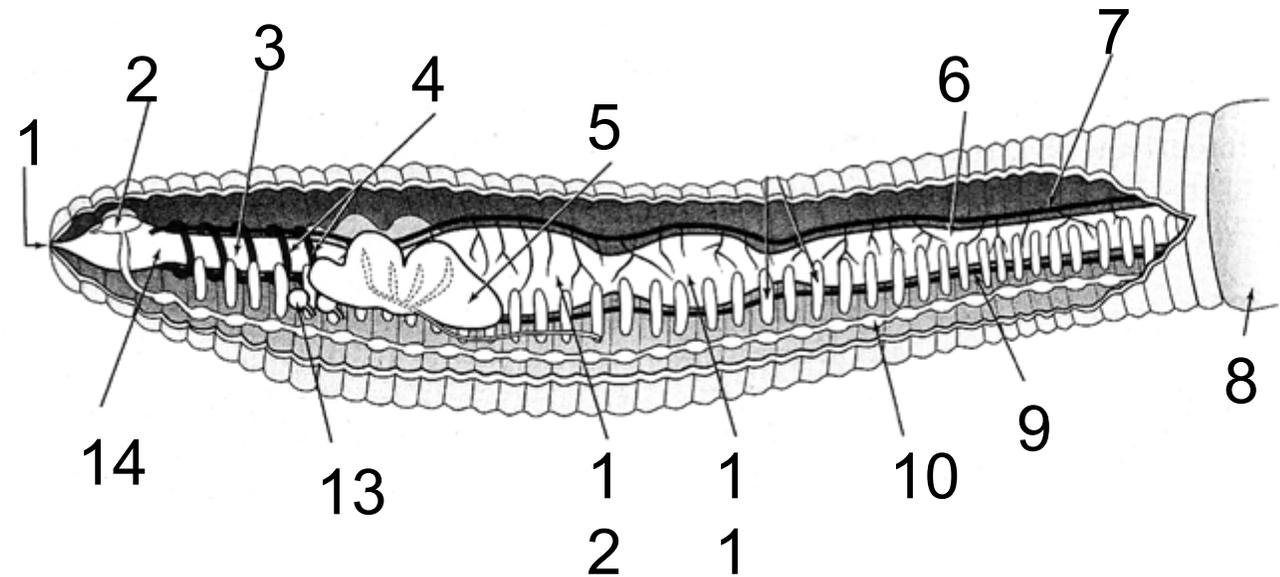


# Labeling Diagrams

Match the letter appearing in front of each word in the word bank with the number of the structure.

- a. Mouth
- b. Pharynx
- c. Esophagus
- d. Crop
- e. Gizzard
- f. Intestine
- g. Aortic Arches
- h. Dorsal Blood Vessel
- i. Ventral Blood Vessel

- j. Clitellum
- k. Seminal Vesicle
- l. Seminal Receptacles
- m. Ventral Nerve Cord
- n. Brain

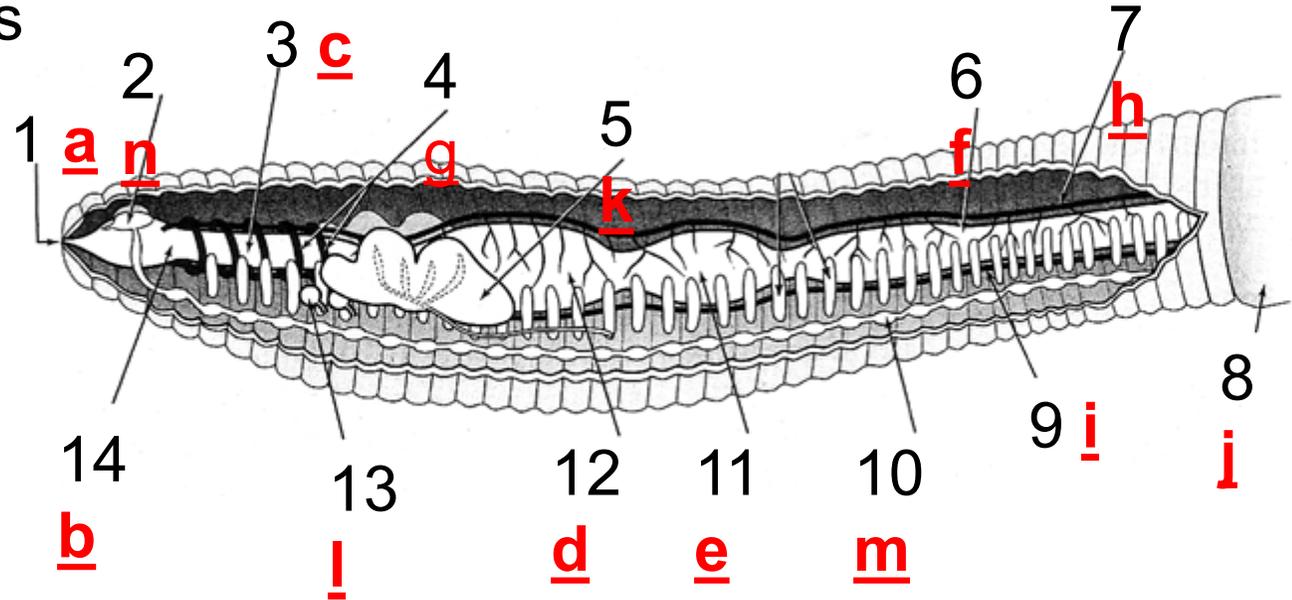


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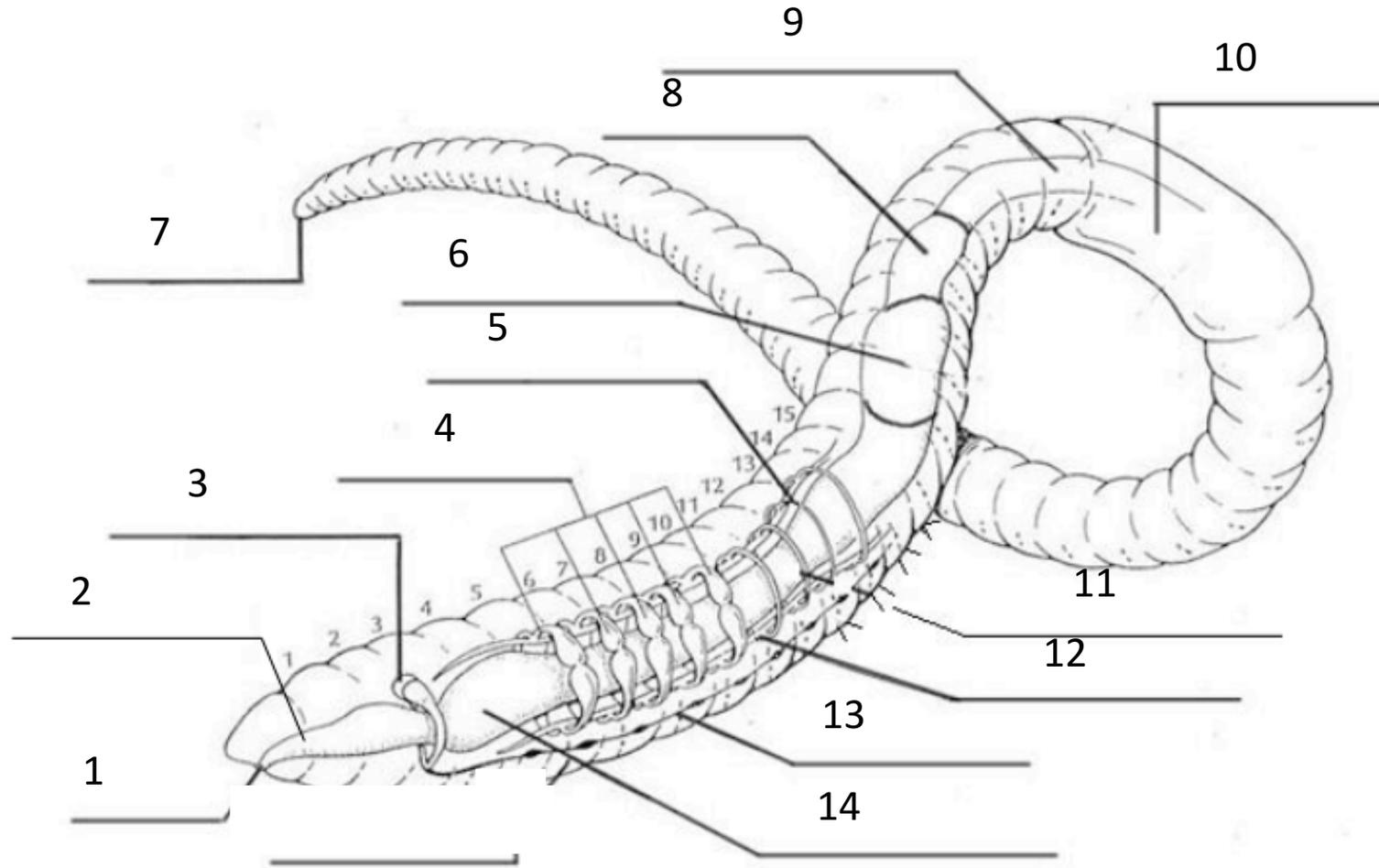
- a. Mouth
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- i. Ventral Blood Vessel

- j. Clitellum
- k. Seminal Vesicles
- l. Seminal Receptacles
- m. Ventral Nerve Cord
- n. Brain



# Annelid Anatomy

Eg. Class Clitellata, Subclass Oligochaeta (The Earthworm)



- Crop
- Gizzard
- Intestine
- Anus
- Clitellum
- Aortic Arches ("heart")
- Ganglia ("brain")
- Dorsal Blood Vessel
- Ventral Blood Vessel
- Ventral Nerve Cord
- Mouth
- Septa
- Esophagus
- Pharynx

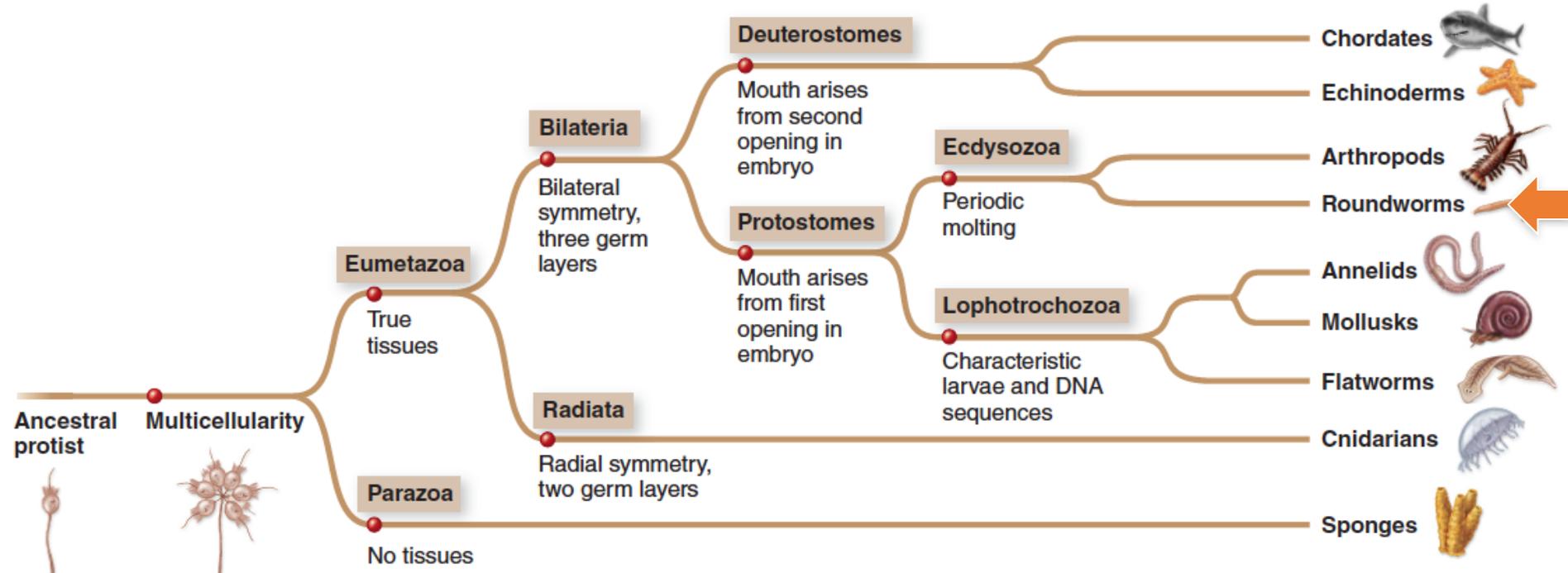
# ROUNDWORMS



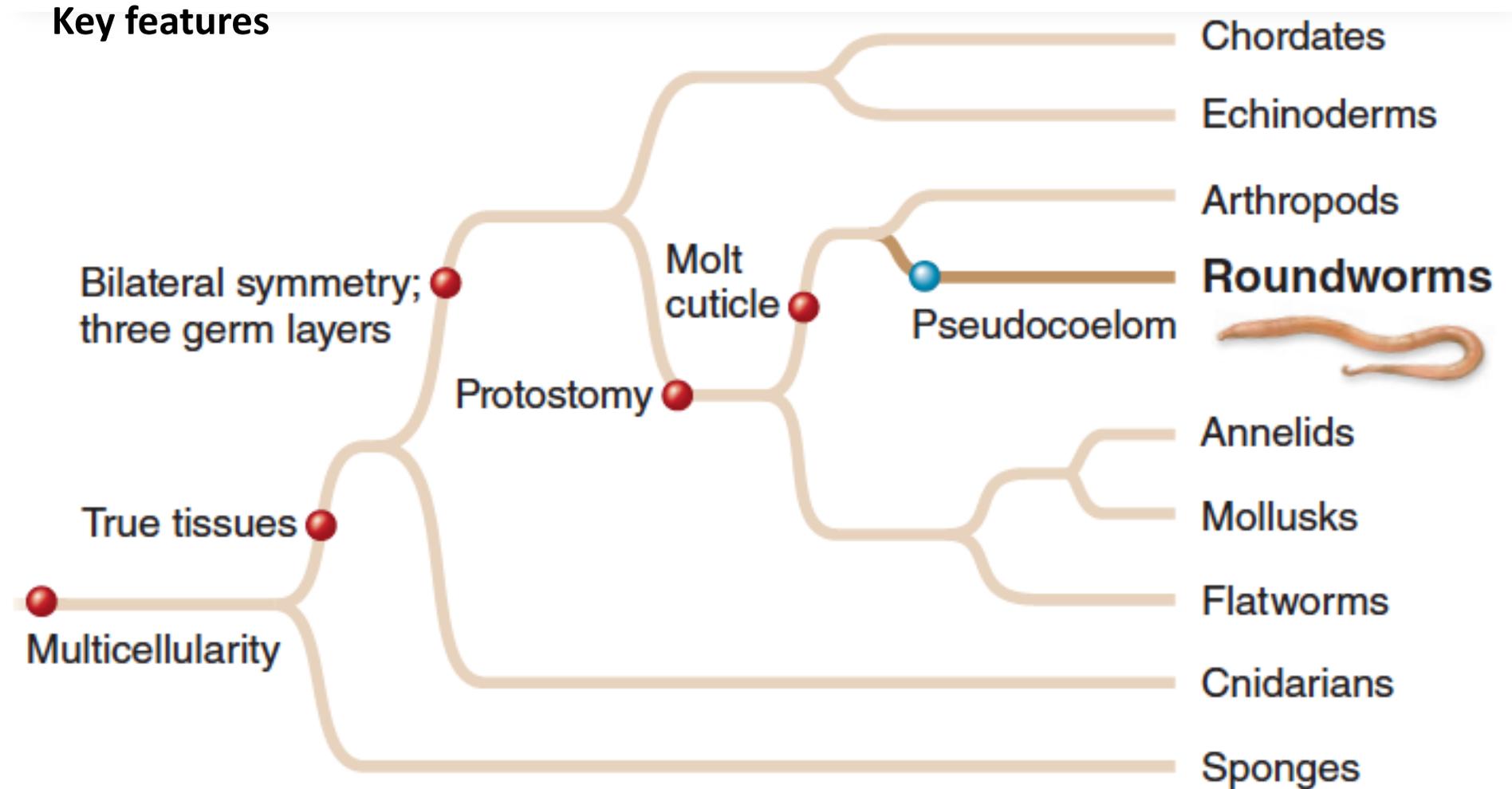
**PHYLUM : NEMATODA – (Aschelminthes)**

# Nematodes Are Unsegmented Worms

## Phylum Nematoda (roundworms)



# Nematodes Are Unsegmented Worms



# CHARACTERISTICS

- They are **vermiform** (worm-like), usually cylindrical in shape
- Body plan is a **tube within a tube**
- Triploblastic and non-segmented with bilateral symmetry.
- Size varies from microscopic to pencil-sized.
- Covered with cuticle, having no external cilia.
- Body cavity a **pseudocoelom**, which functions as a hydrostatic skeleton

# Characteristics

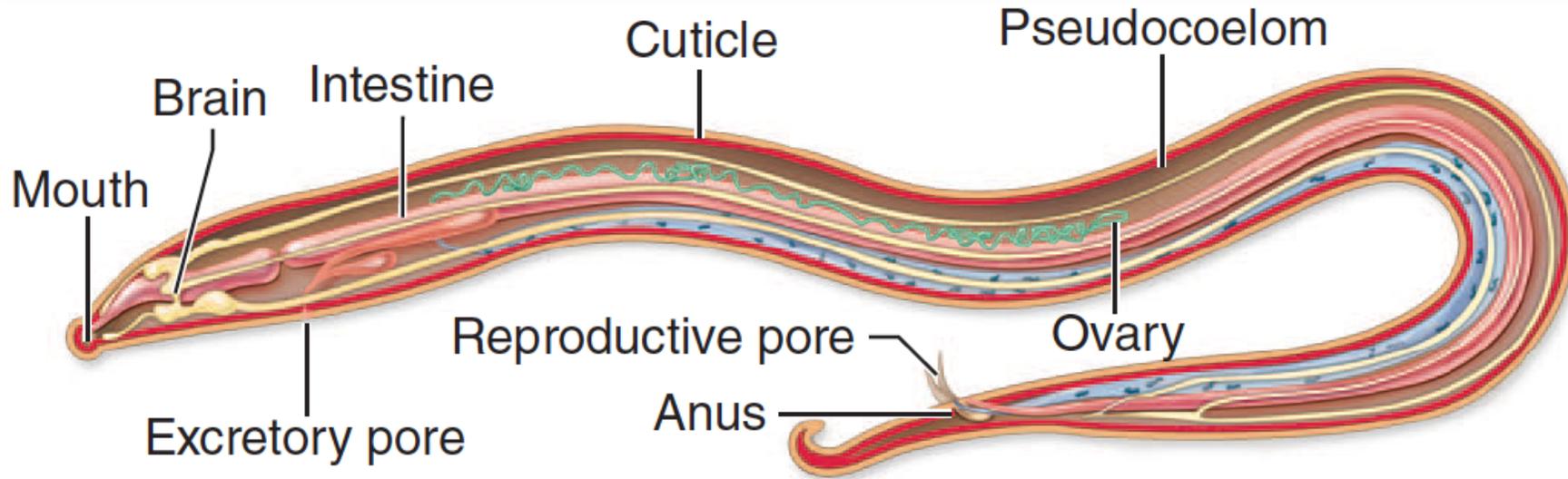
- Muscle layers include **longitudinal fibers** and move in a **S motion**
- **Most are Parasitic**
- Complete digestive system
- Circulatory and respiratory organs lacking
- Excretory system consists of one or more large gland cells opening to an excretory pore or canal system
- Virtually **all plants & animals are parasitized** by one or more nematodes with **over 60 species** parasitizing man

# Characteristics

- Circular nerve ring with dorsal and ventral nerve cords; sense organs include **ciliated pits**
- Sexes usually separate (**dioecious**)
- Male is smaller than the female
- **Fertilization internal**
- More complicated life histories (especially parasitic forms)

# Nematodes Are Unsegmented Worms

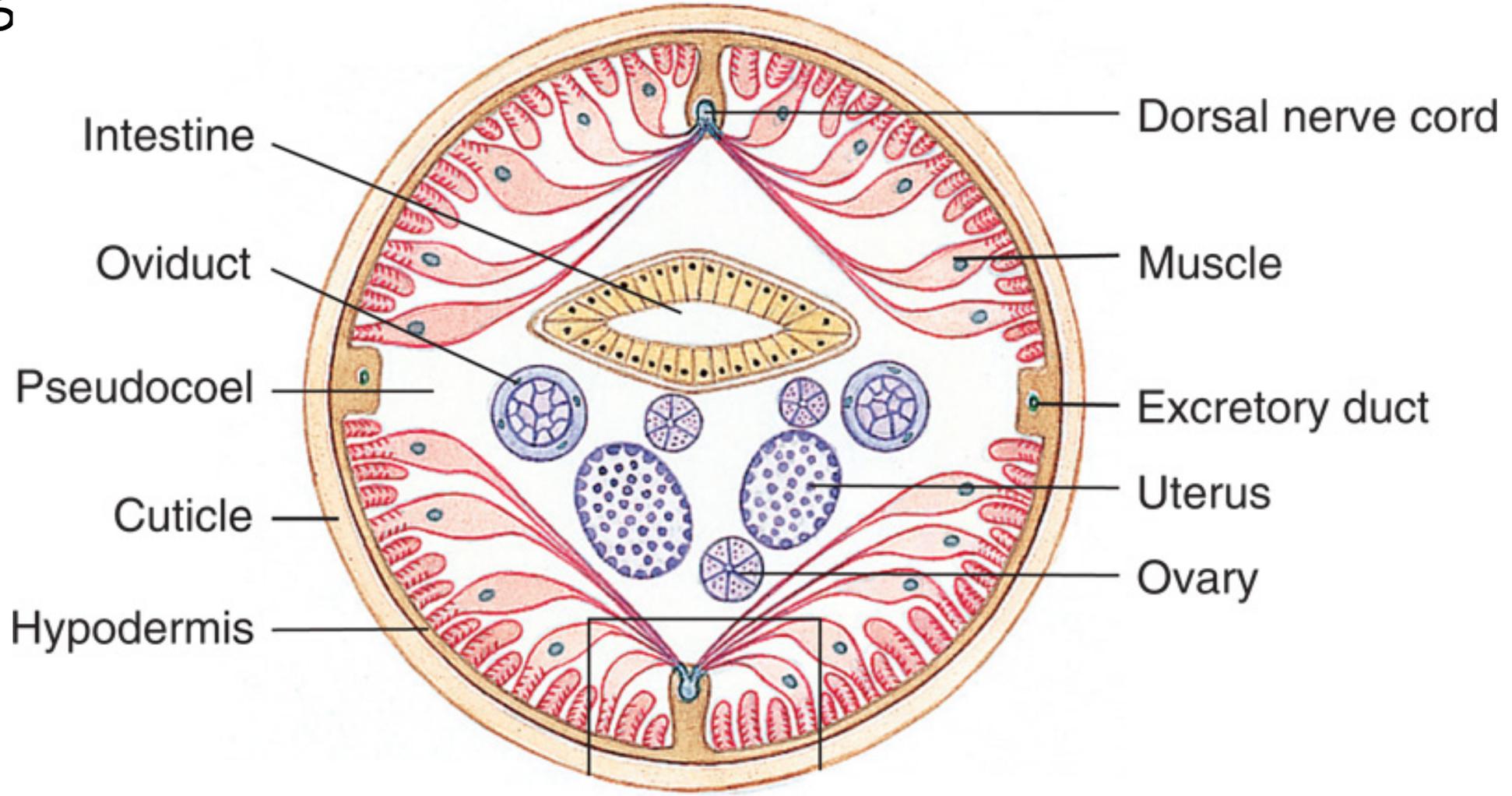
## Anatomy



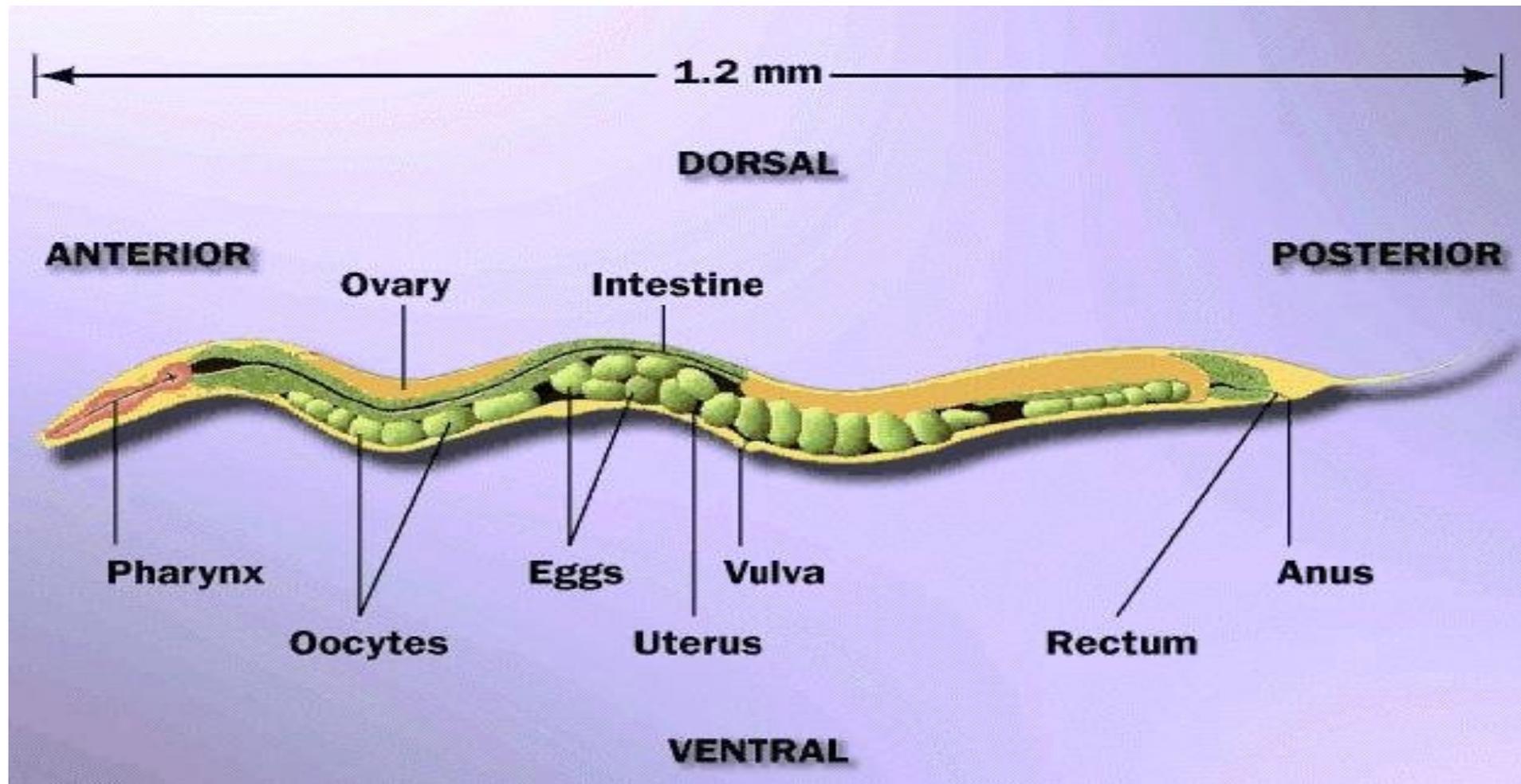
# Female Cross-section

Fig

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**Range in size, many are very small (as below) but some may be up to a meter in length. Largest Nematode measured 30 feet and 1 inch in diameter, found as parasite in a Sperm Whale's placenta.**

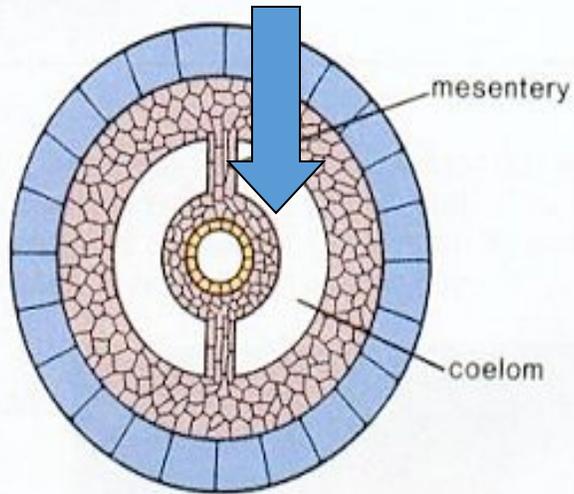


**- ADVANCEMENTS over Platyhelminthes: Most exhibit Separate Sexes (Dioecious) and all have a Complete Gut.**

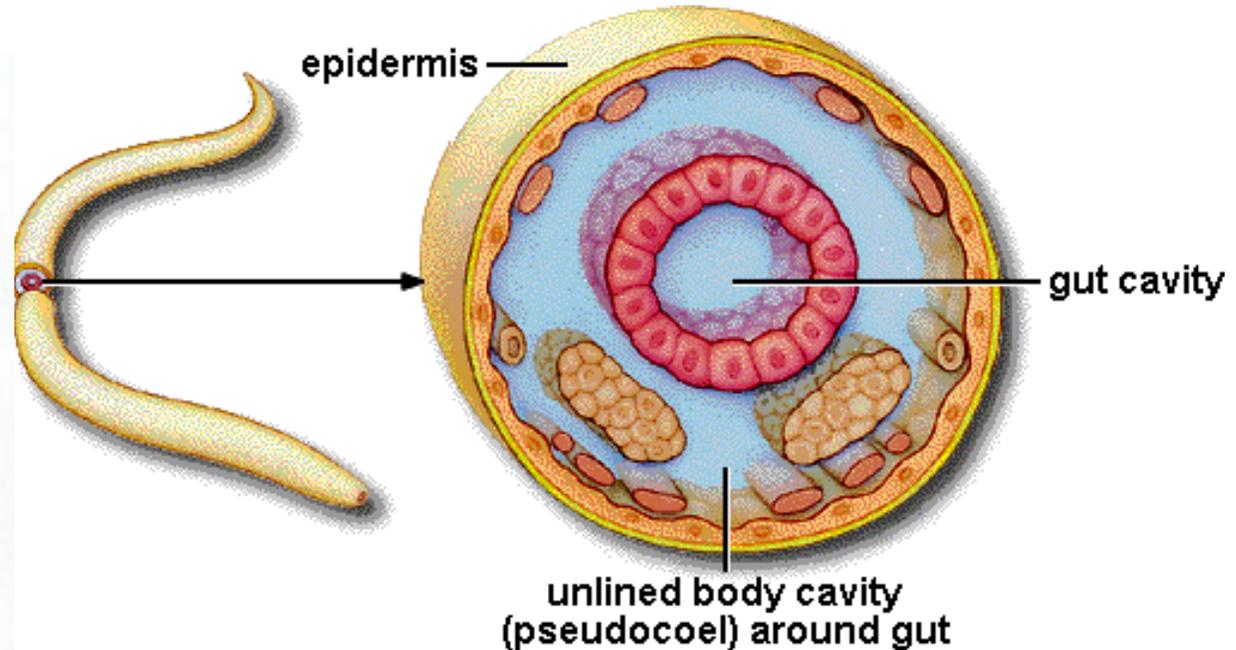
Nematodes also possess fluid-filled body cavity called a “**Pseudo-coelom**”. This false cavity is completely enclosed but it is **NOT** completely enclosed by mesodermal tissue.



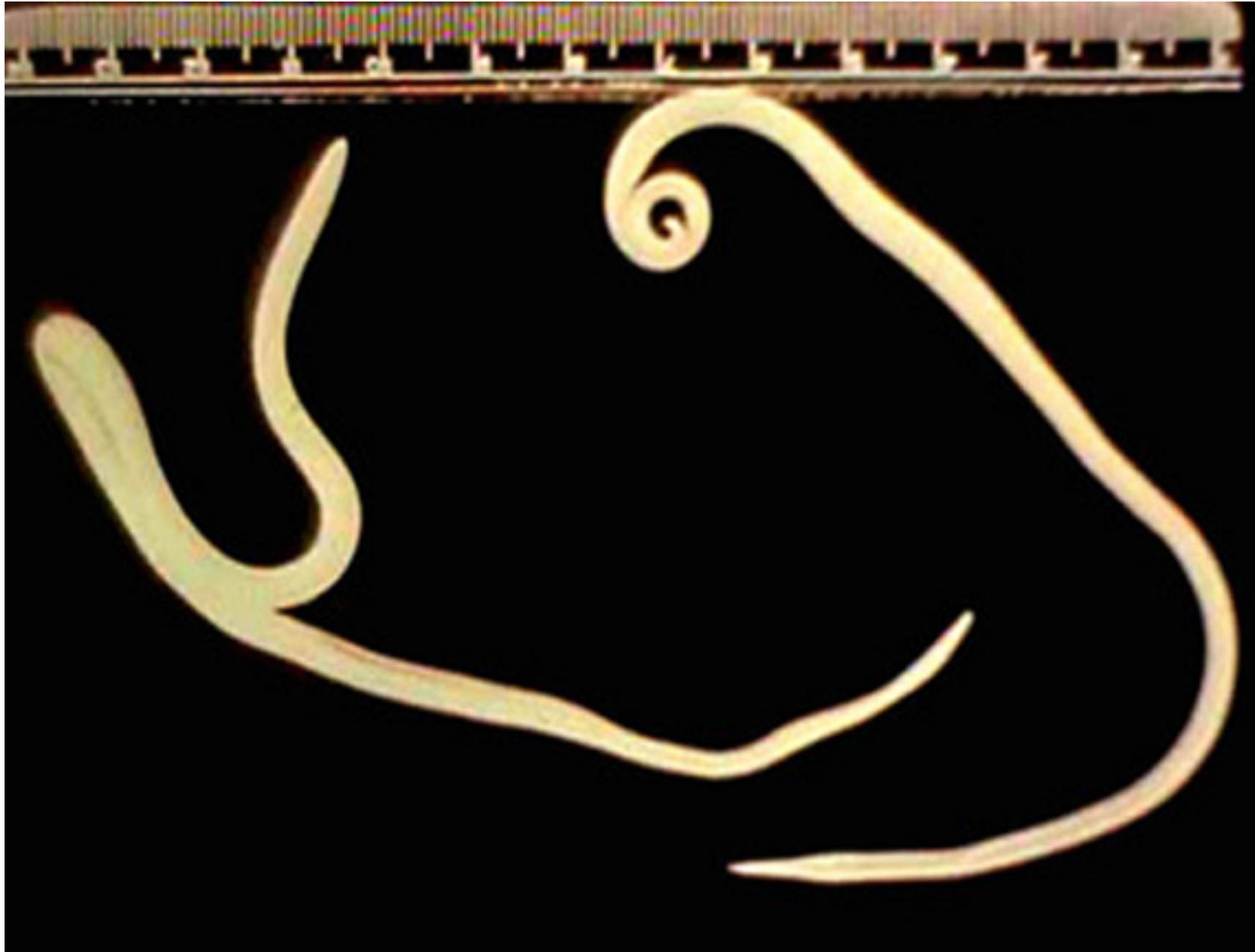
## TRUE COELOM



Coelomate  
(coelom completely lined by mesoderm)



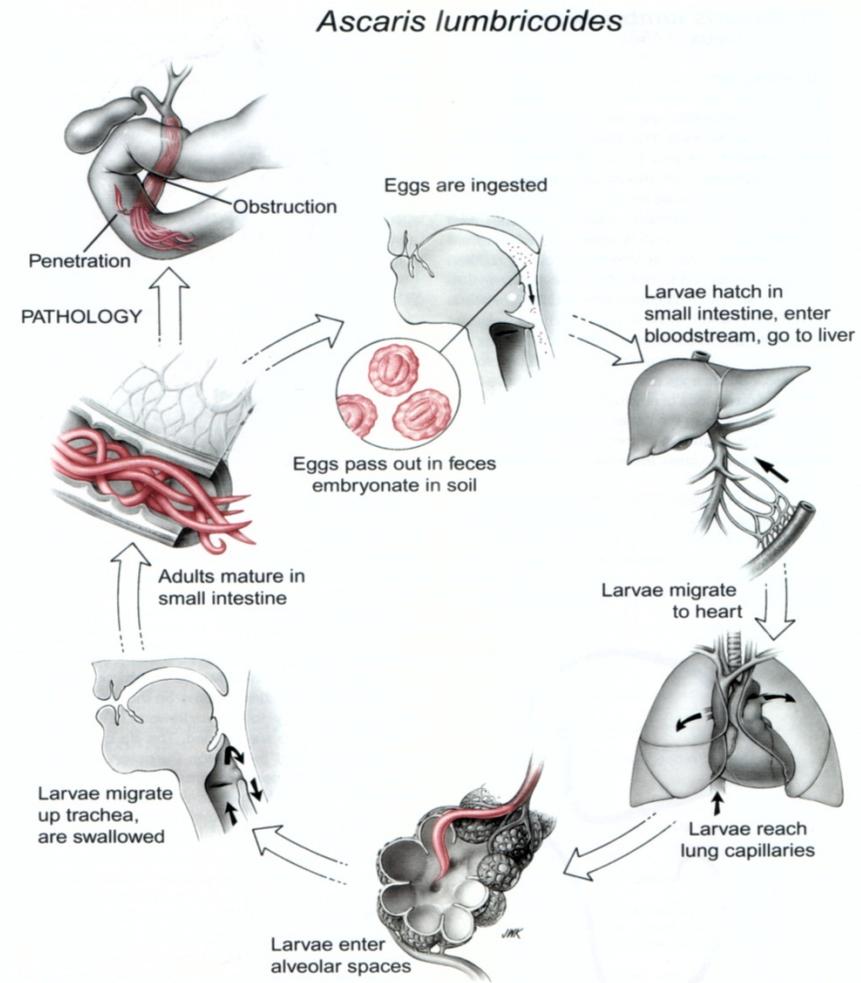
**Although Most Nematodes are “Free—Living, our focus will be on the parasitic round worms that cause health problems on a global scale.**



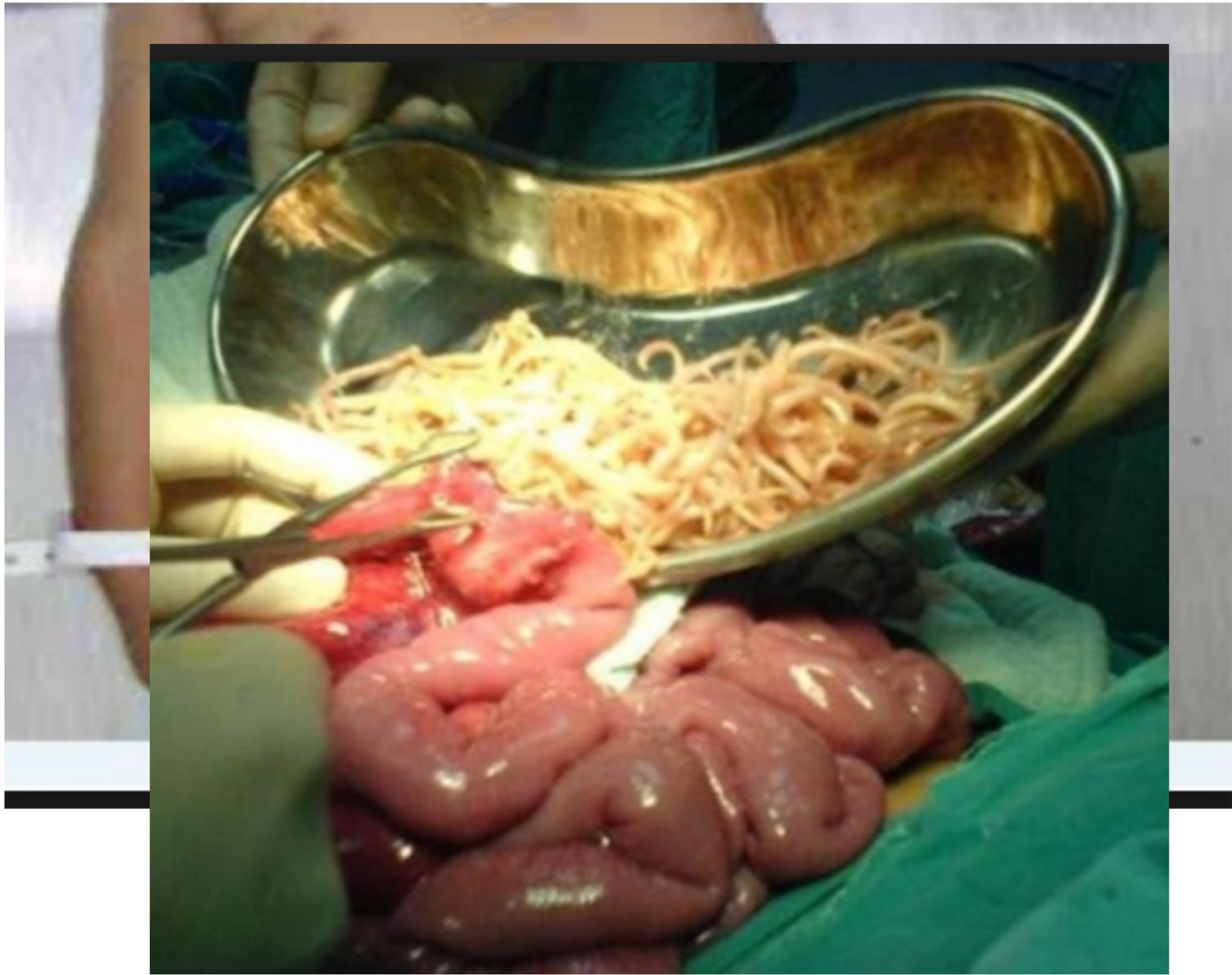
**Nematodes in the order Ascaridida are relatively large nematodes found in a wide variety of aquatic and terrestrial vertebrates, mostly in Tropical and Subtropical Regions**

**Ascaris lumbricoides** – A human intestinal parasite. The males reach a 1 foot, while the females reach a length of 16 inches.

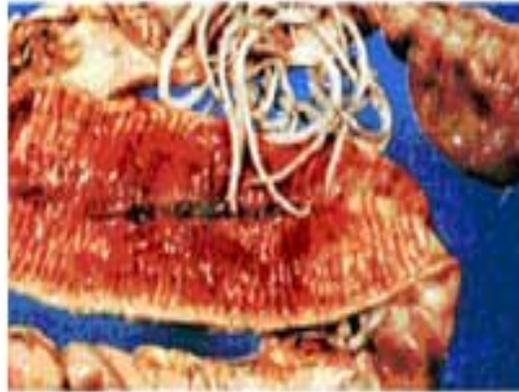
- They produce about 200,000 eggs per DAY !!!!!
- May live for **many years** in the human intestine.
- Most damage is done when they migrate around bodily tissues then return to the gut to reach maturity.



**BOLUS REMOVAL - VC**



# Various species of Ascarids infect the guts or circulatory vessels of cats, dogs, pigs, horses, cattle, chickens, sheep, and HUMANS



Roundworm in intestines



**Anti-Helminthic Drugs can be used to wipe out the worm infection**

**Example : Drontal Plus Allwormer For dogs And Cats**

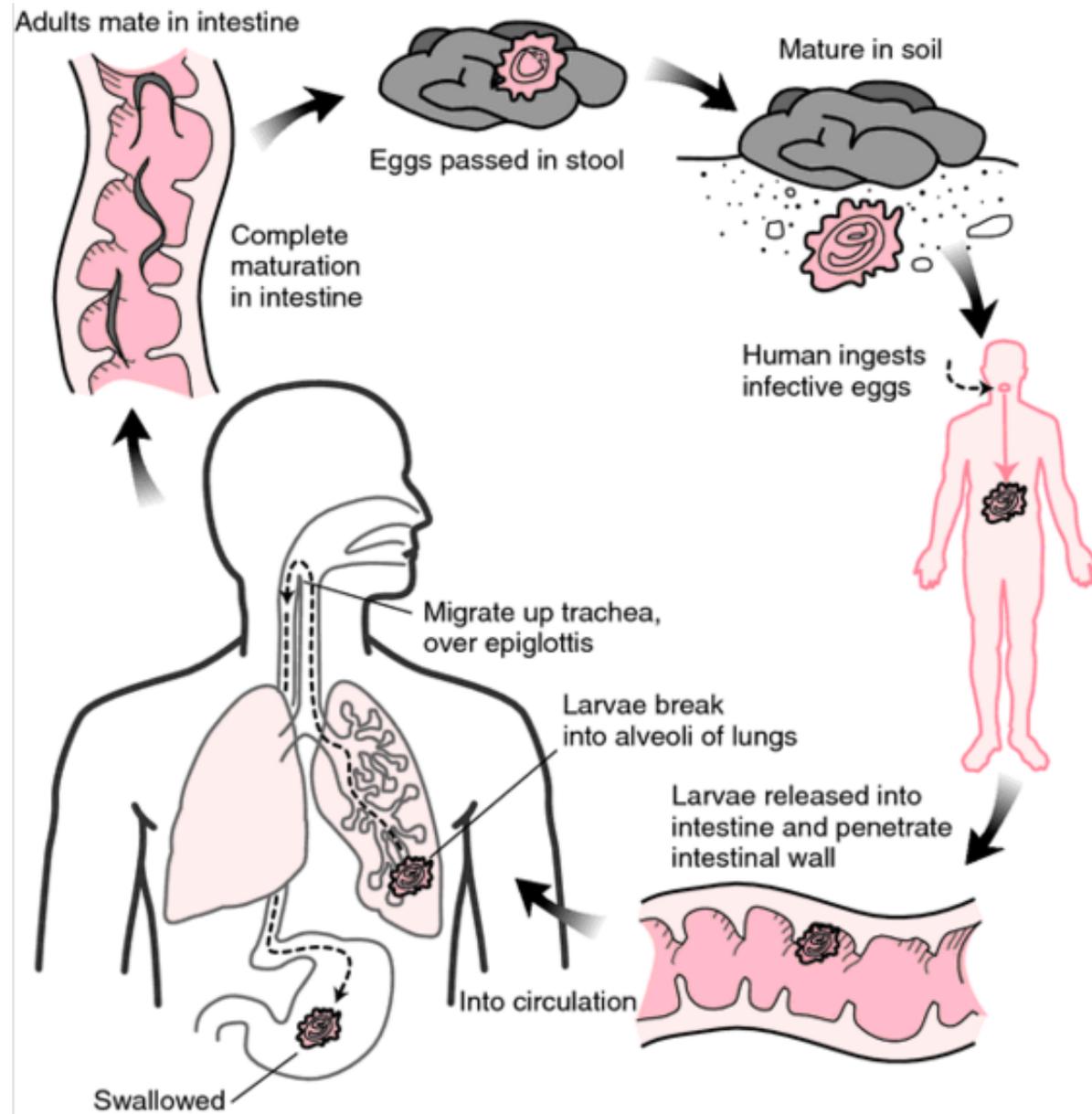
**Drontal Plus for dogs eliminates tapeworms, hookworms, ascarids and whipworms. Drontal for cats and kittens eliminates tapeworms, hookworms and large roundworms.**



# Nematoda: Roundworms

*Ascaris*

## Life Cycle



# Another “NASTY NEMATODE” – THE HOOKWORM



Pups may ingest milk containing larvae

Infective larvae are injected or penetrate the skin

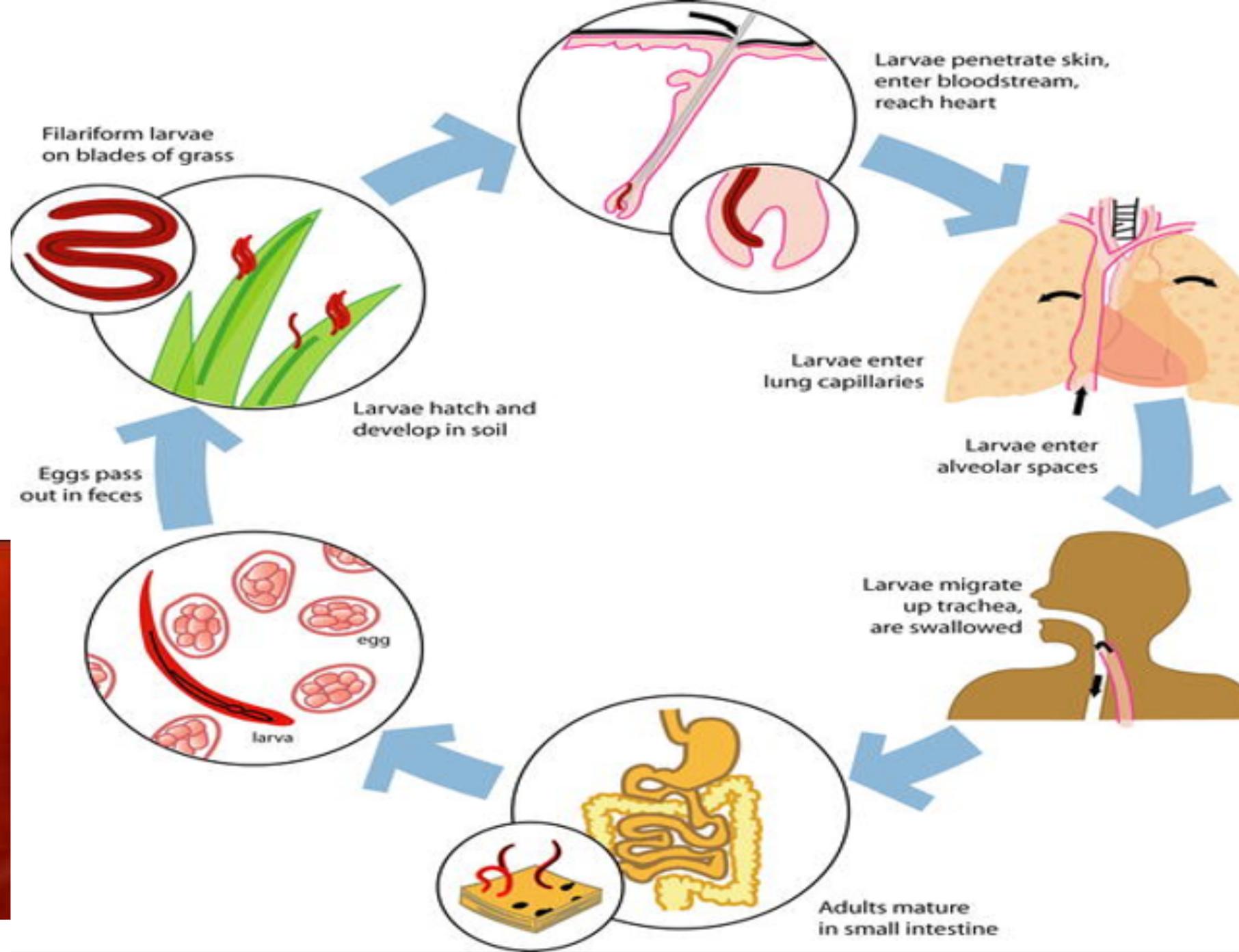
Infective third-stage larvae in the environment

Adult hookworms are bloodsucking parasites of the small intestine.

Eggs are passed in the feces



# Hookworm Lifecycle



# Another “NASTY NEMATODE” is the Filarial Worm

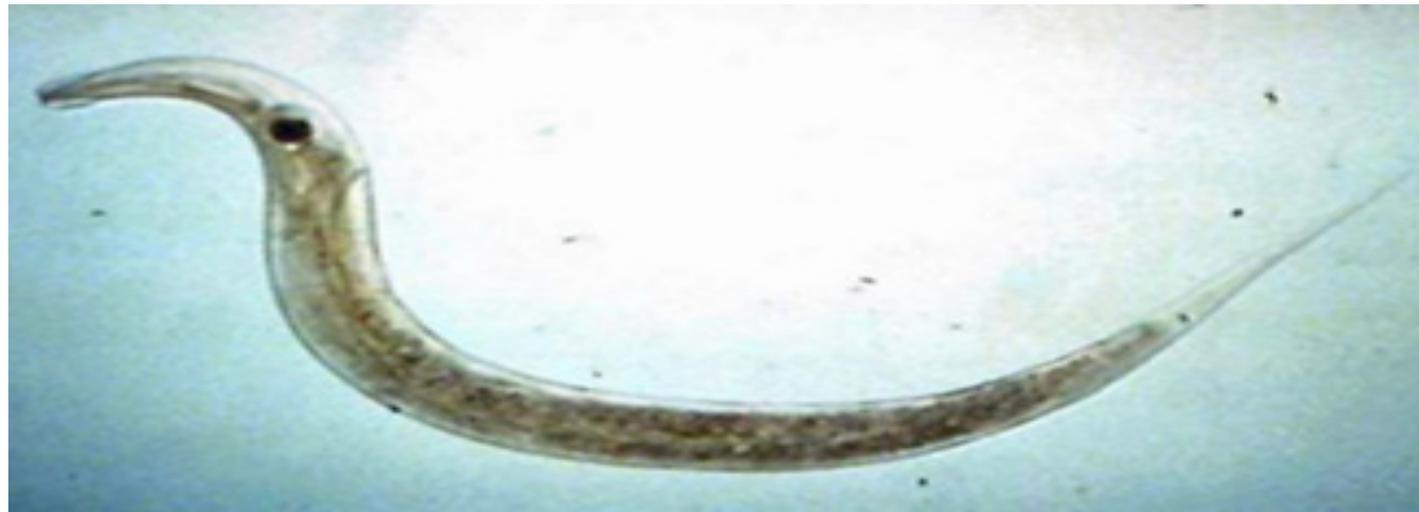


## Another “**Somewhat Nasty Nematode**” are Pinworms?

Pinworms (*Enterobius vermicularis*) are the most common intestinal parasite in the U.S./Canada.

Pinworms occur most often in school-age children, but are highly contagious, and can easily spread to the entire family.

According to the Center for Disease Control, pinworm infestation is twice as common as head lice, and some sources estimate as much as *25% of the North American population is affected annually with pinworms.*





- It is estimated that pinworms infect more than 1 billion people throughout the world (15% of humans), and in many areas of the world (e.g., North America and Europe) it is the most common nematode parasite of humans.

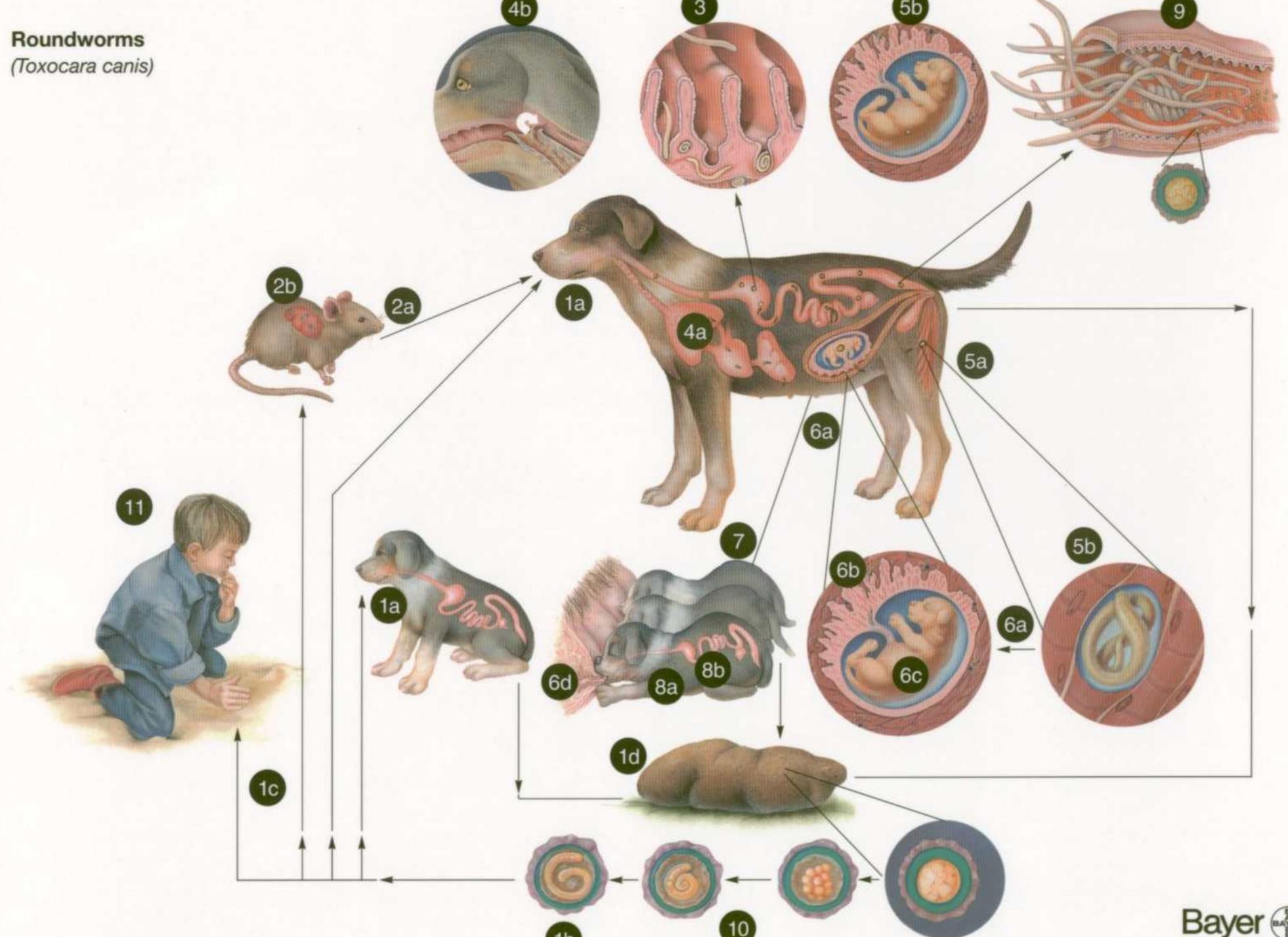
- **Adult pinworms live in the large intestines of their host; males and females are about 5 mm and 10 mm long, respectively. After copulation the males die. When the female is ready to lay eggs she crawls out of the anus and deposits the eggs on the perianal skin.**

**A single female can produce more than 10,000 eggs. After laying her eggs, the female also dies.**

**When ingested by another person the eggs hatch in the small intestine, and the juvenile worms grow into adult, sexually mature worms in about a month.**



**Roundworms**  
*(Toxocara canis)*



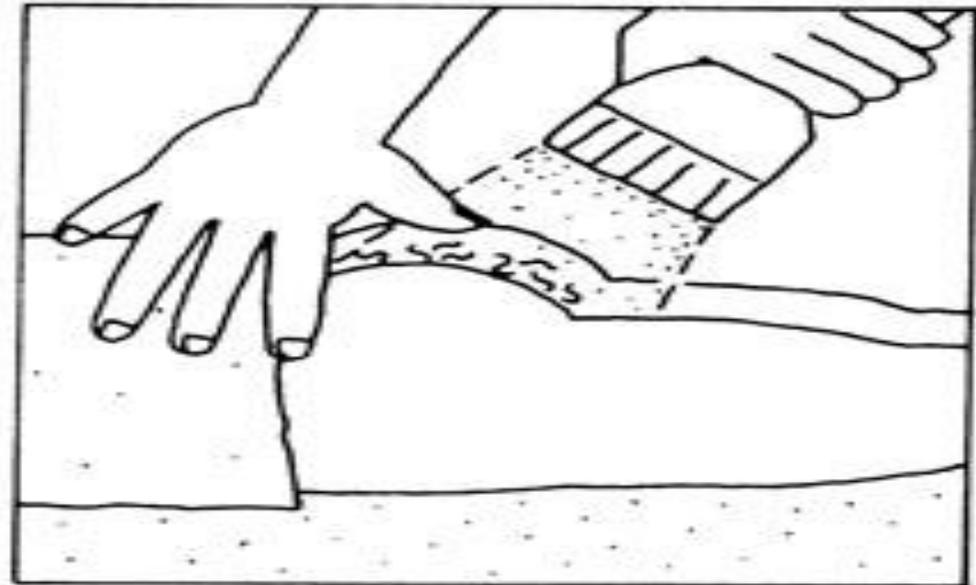
- **Pinworms infections can be asymptomatic or result in mild gastrointestinal upsets. A common symptom associated with pinworm infections is perianal itching. Scratching of the perianal skin to relieve the itching can lead to bacterial infections that result in more itching, etc. This cycle can result in a situation where the infected person becomes very uncomfortable.**

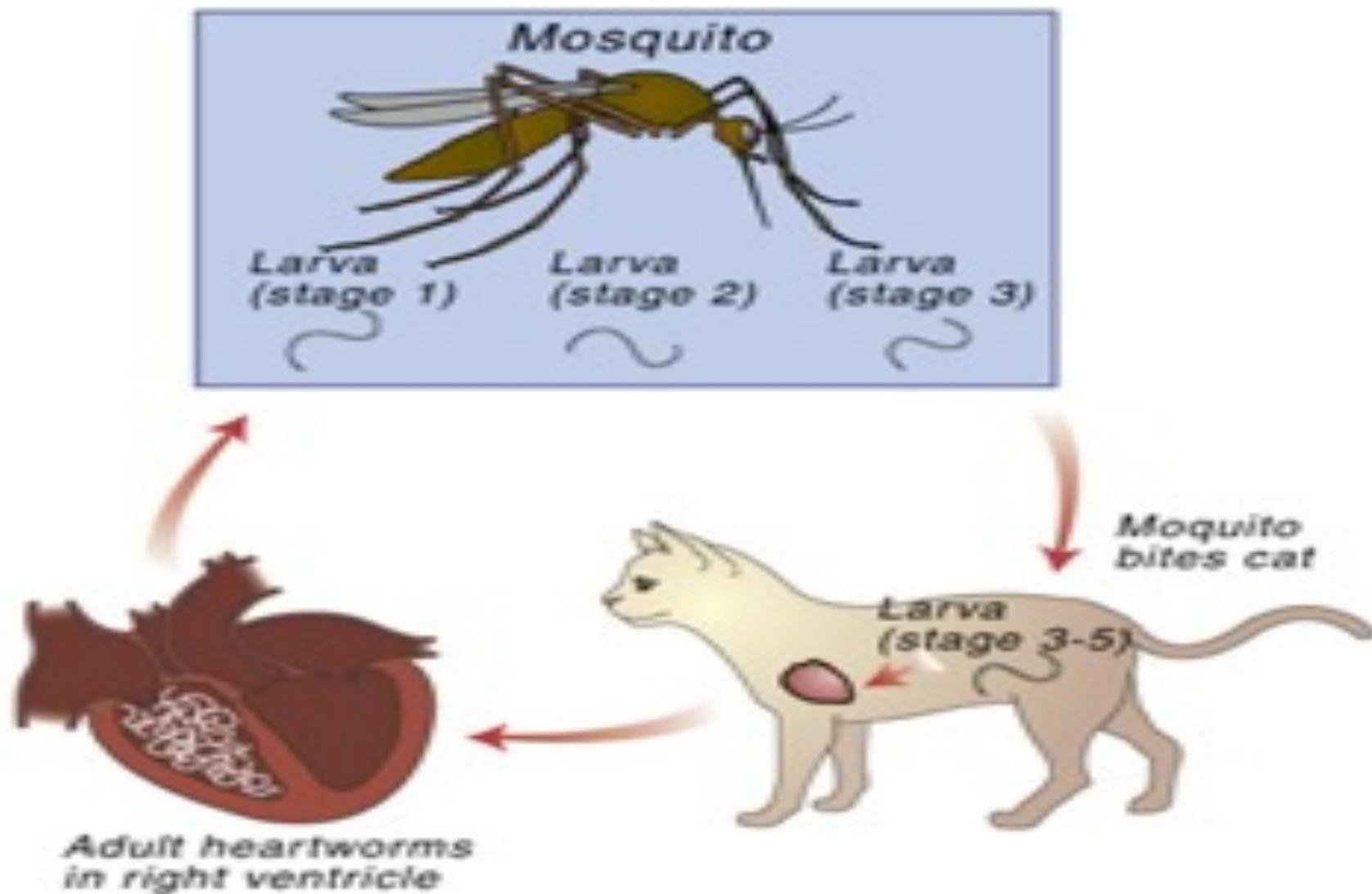
**Children infected with pinworms often undergo behavioral changes, including restlessness, irritability, and insomnia. In women, the adult pinworms can enter the vagina and cause additional irritation.**



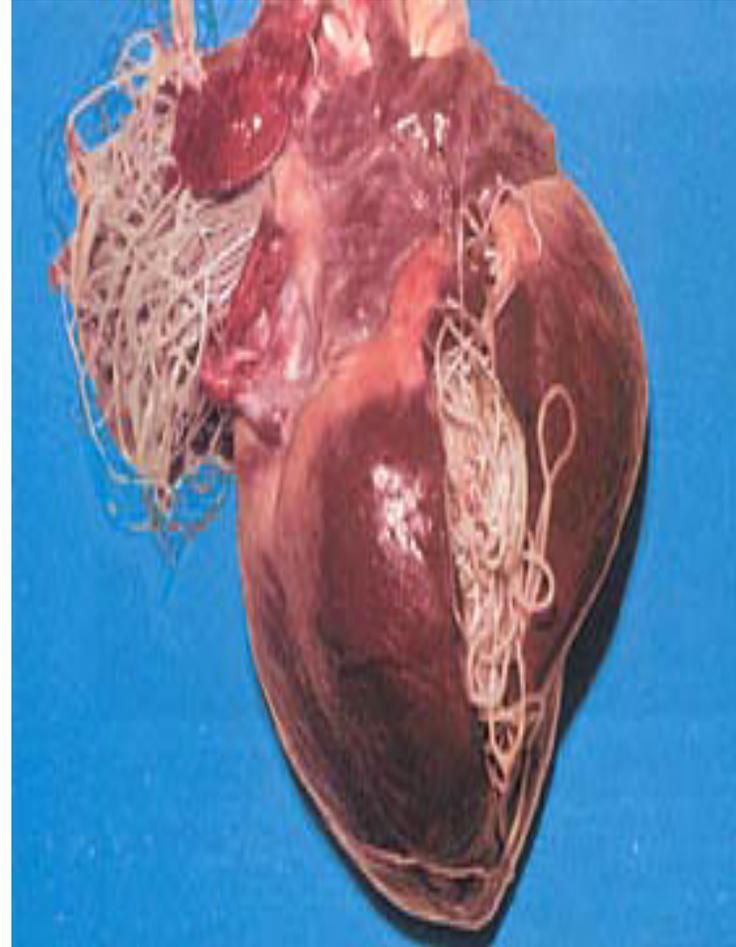
**Pinworm infections are detected by finding the eggs or worms on the perianal skin. If the perianal skin is examined using a flashlight the worms can be seen; they literally "glow" under the bright light. Because the female pinworms lay their eggs during the early morning hours.**

**Eggs on the perianal skin can be detected by using a piece of cellophane ("Scotch") tape attached to a wooden applicator stick, sticky side out. The tape is then pressed against the perianal skin and later examined for eggs. This is best done as soon as a child awakens.**





LIFECYCLE OF THE HEARTWORM



# Heartworm Life Cycle

The life cycle of the heartworm begins when a mosquito bites and feeds on the blood of an infected dog that is carrying tiny immature heartworms in its blood. During the next two to three weeks, the larvae develop into the infective stage within the mosquito. When the infected mosquito feeds again, it can transmit heartworm larvae to a healthy cat or dog.



A mosquito bites an infected dog, taking in heartworm microfilariae as it feeds.



The microfilariae develop into infective stage larvae within the mosquito.

Heartworms can grow up to 12 inches in length. Left untreated, heartworm disease may be fatal.



The mosquito transmits the infective stage larvae to a healthy dog. The larvae migrate through the tissues, eventually reaching the heart.



# Complications of Nematodes In Humans

Roundworms- *Ascaris*

**Prevalance- 1 billion estimated infections**

## **Symptoms**

- Most affected have **NONE**
- **Nausea & Abdominal pains** are more common symptoms if they have any
- **Bloody stool**
- **Shortness of breath (if severe)**

## **Treatments**

- **Antiparastic drugs such as Medendazole**

## **Preventive Care**

- **Not eating uncooked meat or unwashed fruits and vegetables**
- **Not handling pet feces**
- **Practice good hygiene**

# Complications of Nematodes In Humans

Pinworms- *Enterobiasis*

**Prevalance- 1 out of 4 people it the world**

## **Symptoms**

- Itching in and around the anus especially at night

## **Treatments**

- Antiparastic drugs such as c. Whole family recommended at a time

## **Preventive Care**

- Wash bedding frequently 1 every couple weeks at minimum in hot water
- Cook meat to recommended temps
- Do not co-bathe (usually small kids) if infected
- Shower after public pools- chlorine pools does not kill pinworms

