

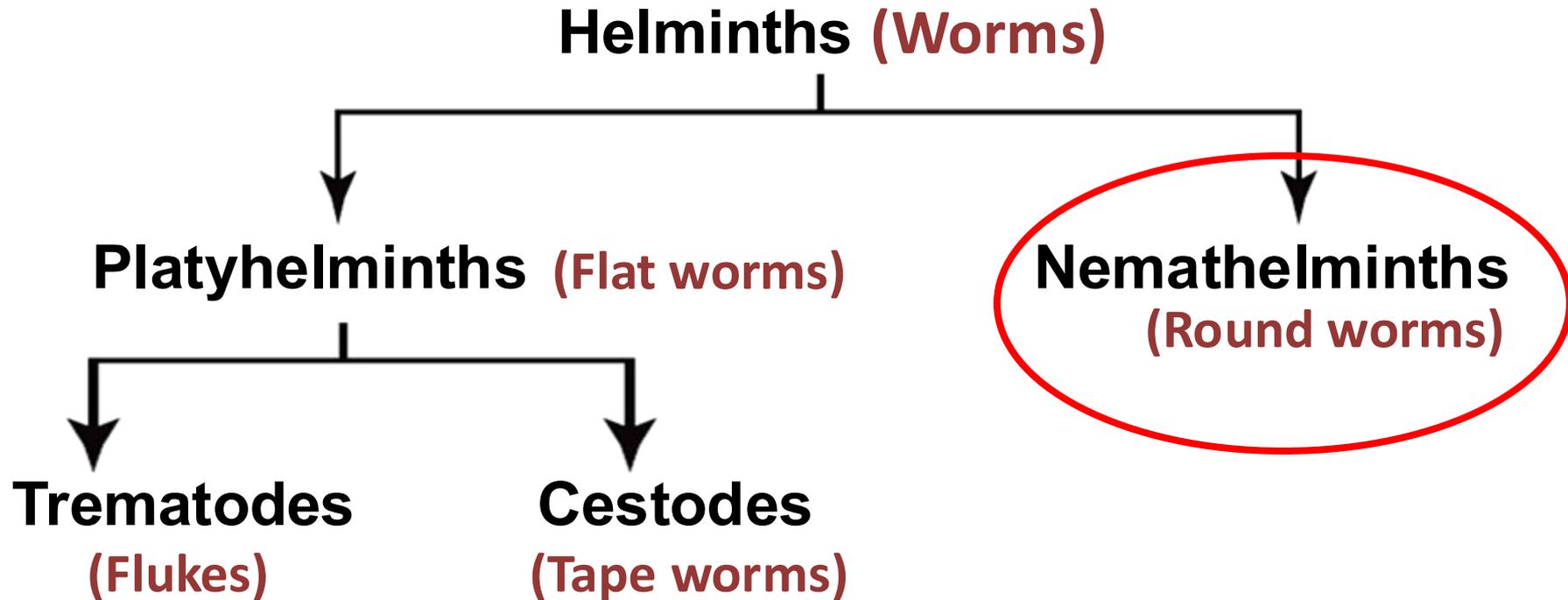
Nemathelminths

Class Nematoda

2025-2026

Dr. Mohammad Odaibat
Department of Microbiology and Pathology
Faculty of Medicine, Mutah University

Classification of Helminths



Nematodes – General Characters

- **Non-segmented** cylindrical worms tapering at both ends.
- **Sexes** are **separate**, male is smaller than female & its posterior end is curved ventrally.
- Females are either
 - **Viviparous** (produce larvae/ embryos)
 - **Oviparous** (lay eggs) or
 - **Ovo-viviparous** (lay eggs which hatch immediately).
- Live in intestinal tract or tissues.



Nematodes of medical importance

Intestinal

Tissue & Blood

Small intestine

With tissue stage:

- *Ascaris lumbricoides*
- *Ancylostoma duodenale*
- *Necator americanus*
- *Strongyloides stercoralis*

Without tissue stage:

- *Enterobius vermicularis*
- *Trichuris trichiura*

Large int.

- *Wuchereria bancrofti*
- *Brugia malayi*
- *Loa loa*
- *Onchocerca volvulus*
- *Dracunculus medinensis*
- *Trichinella spiralis*
- Larva migrans:
 - *Ancylostoma spp.*
 - *Toxocara spp.*

Nematodes of medical importance

Intestinal

- IH: no need for IH.
- ♀ lay eggs (majority of species).
- Nutrition:
 - Sucking blood (hookworms).
 - Embedded worms ingest lysed tissues (*Trichuris* & *Strongyloides*).
 - Feeding on intestinal contents (*Ascaris* & *Enterobius*).

Tissue & Blood

- IH: arthropod vector needed.
- ♀ lay larvae.
- Nutrition:
 - Ingestion of food from body fluid.

Nematodes of medical importance

Intestinal

Tissue & Blood

Small intestine

□ With tissue stage:

- *Ascaris lumbricoides*
- *Ancylostoma duodenale*
- *Necator americanus*
- *Strongyloides stercoralis*
- *Trichinella spiralis*

• Without tissue stage:

- *Enterobius vermicularis*
- *Trichuris trichiura*

Large int.

- *Wuchereria bancrofti*
- *Brugia malayi*
- *Loa loa*
- *Onchocerca volvulus*
- *Dracunculus medinensis*
- *Trichinella spiralis*

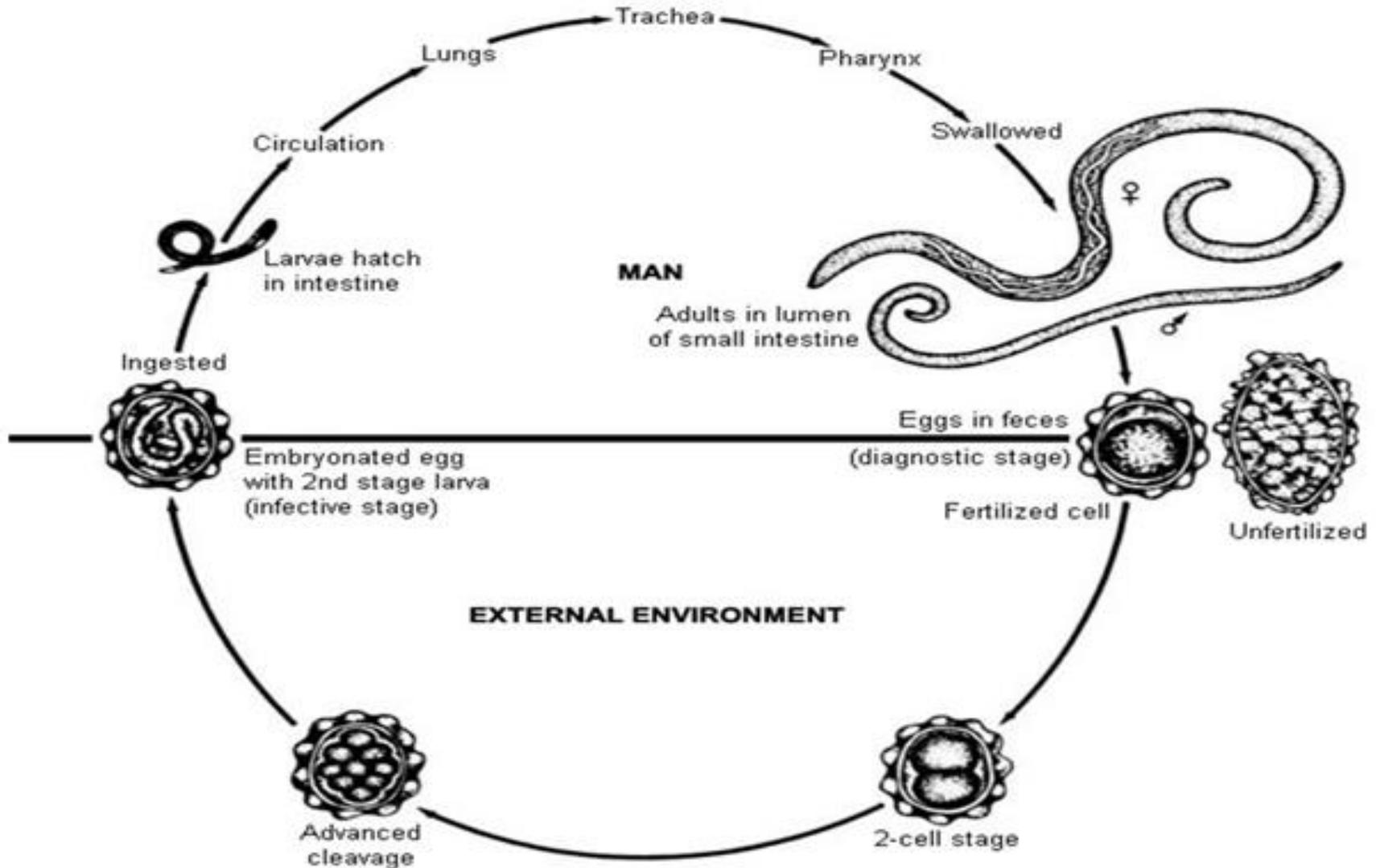
Intestinal Round Worms (Nematodes)

Ascaris lumbricoides

- **Distribution: Cosmopolitans**
- **Ingestion of Infective Eggs**
- **Human ingests embryonated eggs from:**
 - **Contaminated soil and vegetables**
 - **Fecal–oral transmission**
- **Infective stage: Egg with L2 larva**
- **Larvae Hatch in Small Intestine**
- **Bloodstream → Liver → Lungs Migration**
- **This phase can cause:**
- **Löffler syndrome**
→ **transient cough, wheezing, eosinophilia**
- **Larvae Swallowed into Trachea**
- ✓ **Clinical presentations**
Intestinal obstruction, especially in children
Biliary obstruction, pancreatitis (worms migrate)
Cough + eosinophilia (during lung phase)
- ✓ **Treatment**
Albendazole (first-line)
Pyrantel (alternative)

Intestinal Round Worms (Nematodes)

Ascaris lumbricoides (Life cycle)



Nematodes of medical importance

Intestinal

Tissue & Blood

Small intestine

□ With tissue stage:

- *Ascaris lumbricoides*
- *Ancylostoma duodenale*
- *Necator americanus*
- *Strongyloides stercoralis*
- *Trichinella spiralis*

• Without tissue stage:

- *Enterobius vermicularis*
- *Trichuris trichiura*

Large int.

- *Wuchereria bancrofti*
- *Brugia malayi*
- *Loa loa*
- *Onchocerca volvulus*
- *Dracunculus medinensis*
- *Trichinella spiralis*

□ Larva migrans:

- *Ancylostoma spp.*
- *Toxocara spp.*

Intestinal Round Worms (Nematodes)

Strongyloides stercoralis (The dwarf thread worm)

Free living worms

Moist soil

Infective form

Filariform larvae

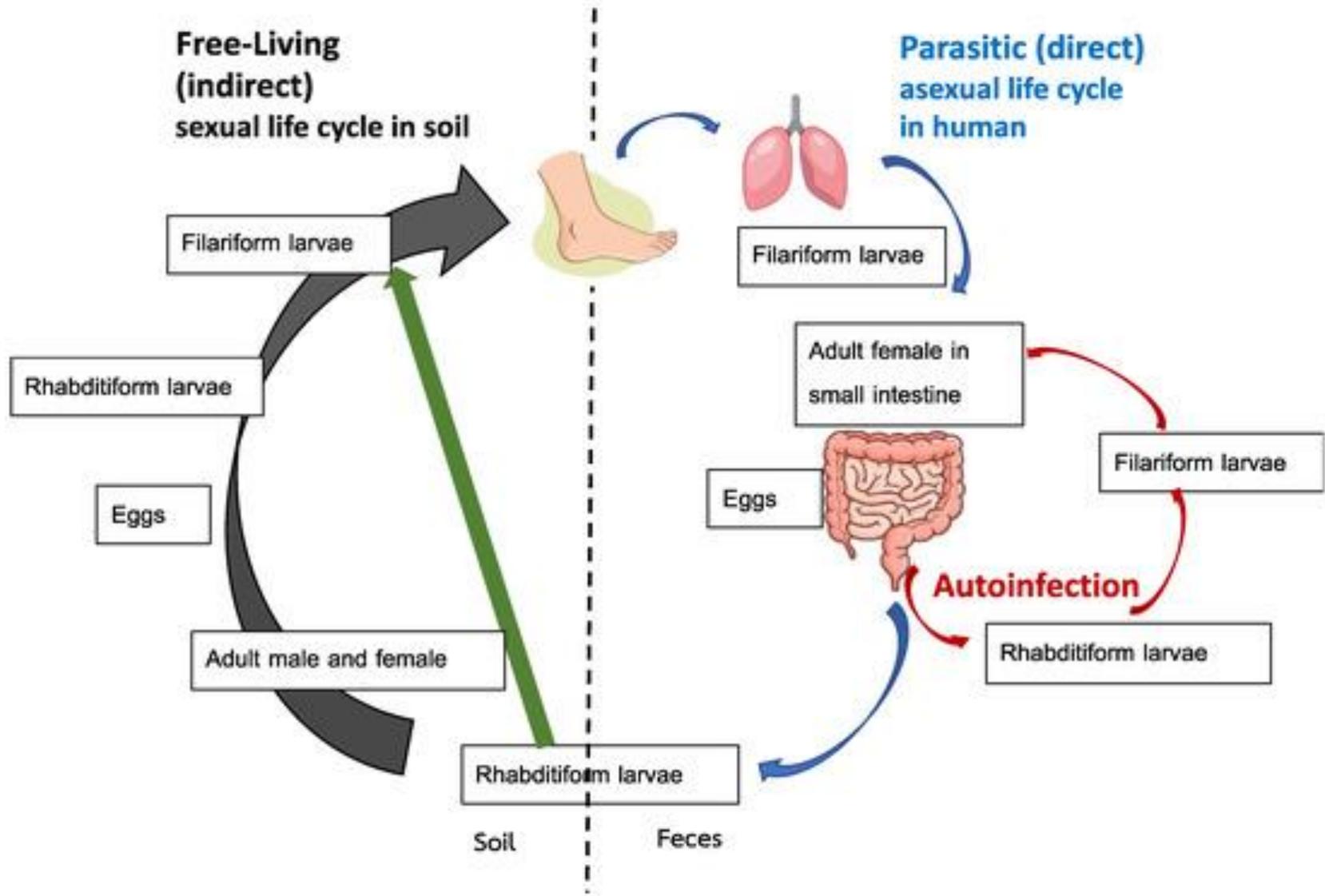
Mode of transmission

Penetration / autoinfection

Site of localization

Wall of Small intestine, mainly
duodenum & jejunum

Life cycle – Strongyloides stercoralis



Nematodes of medical importance

Intestinal

Tissue & Blood

Small intestine

□ With tissue stage:

- *Ascaris lumbricoides*
- *Ancylostoma duodenale*
- *Necator americanus*
- *Strongyloides stercoralis*

Without tissue stage:

- *Enterobius vermicularis*
- *Trichuris trichiura*

Large int.

- *Wuchereria bancrofti*
- *Brugia malayi*
- *Loa loa*
- *Onchocerca volvulus*
- *Dracunculus medinensis*
- *Trichinella spiralis*
- Larva migrans:
 - *Ancylostoma spp.*
 - *Toxocara spp.*

Intestinal Round Worms (Nematodes)

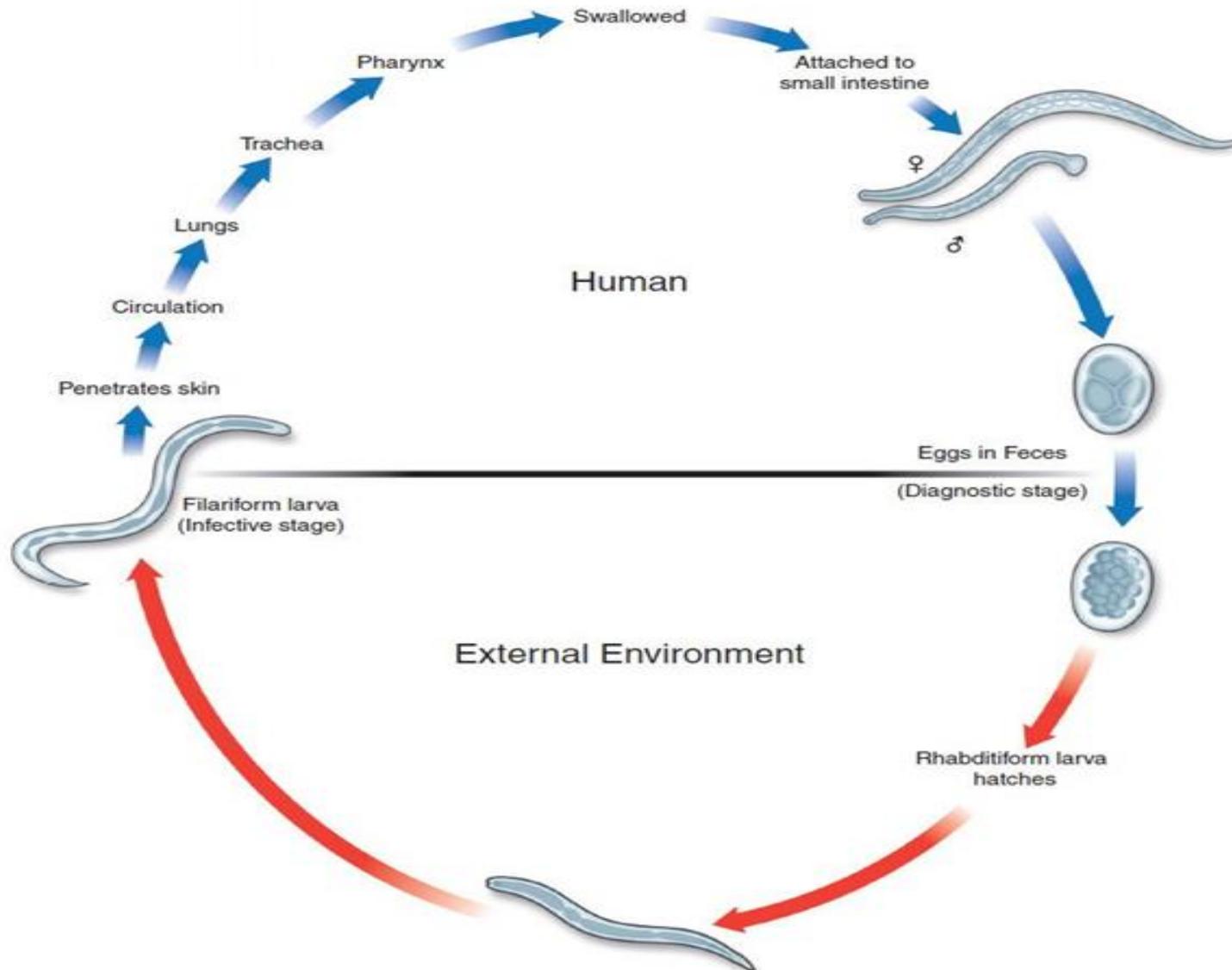
Necator americanus and *Ancylostoma duodenale* (hookworms)

| | |
|----------------------|--|
| Infective form | 3 rd stage filariform larva |
| Mode of infection | Penetration into skin |
| Site of localization | Small intestine |

Intestinal Round Worms (Nematodes)

hookworms

Life Cycle



Nematodes of medical importance

Intestinal

Tissue & Blood

Small intestine

□ With tissue stage:

- *Ascaris lumbricoides*
- *Ancylostoma duodenale*
- *Necator americanus*
- *Strongyloides stercoralis*
- *Trichinella spiralis*

• Without tissue stage:

- *Enterobius vermicularis*
- *Trichuris trichiura*

Large int.

- *Wuchereria bancrofti*
- *Brugia malayi*
- *Loa loa*
- *Onchocerca volvulus*
- *Dracunculus medinensis*
- *Trichinella spiralis*

□ Larva migrans:

- *Ancylostoma spp.*
- *Toxocara spp.*

Intestinal Round Worms (Nematodes)

Enterobius vermicularis (Pin Worm)

Geographical Distribution:-

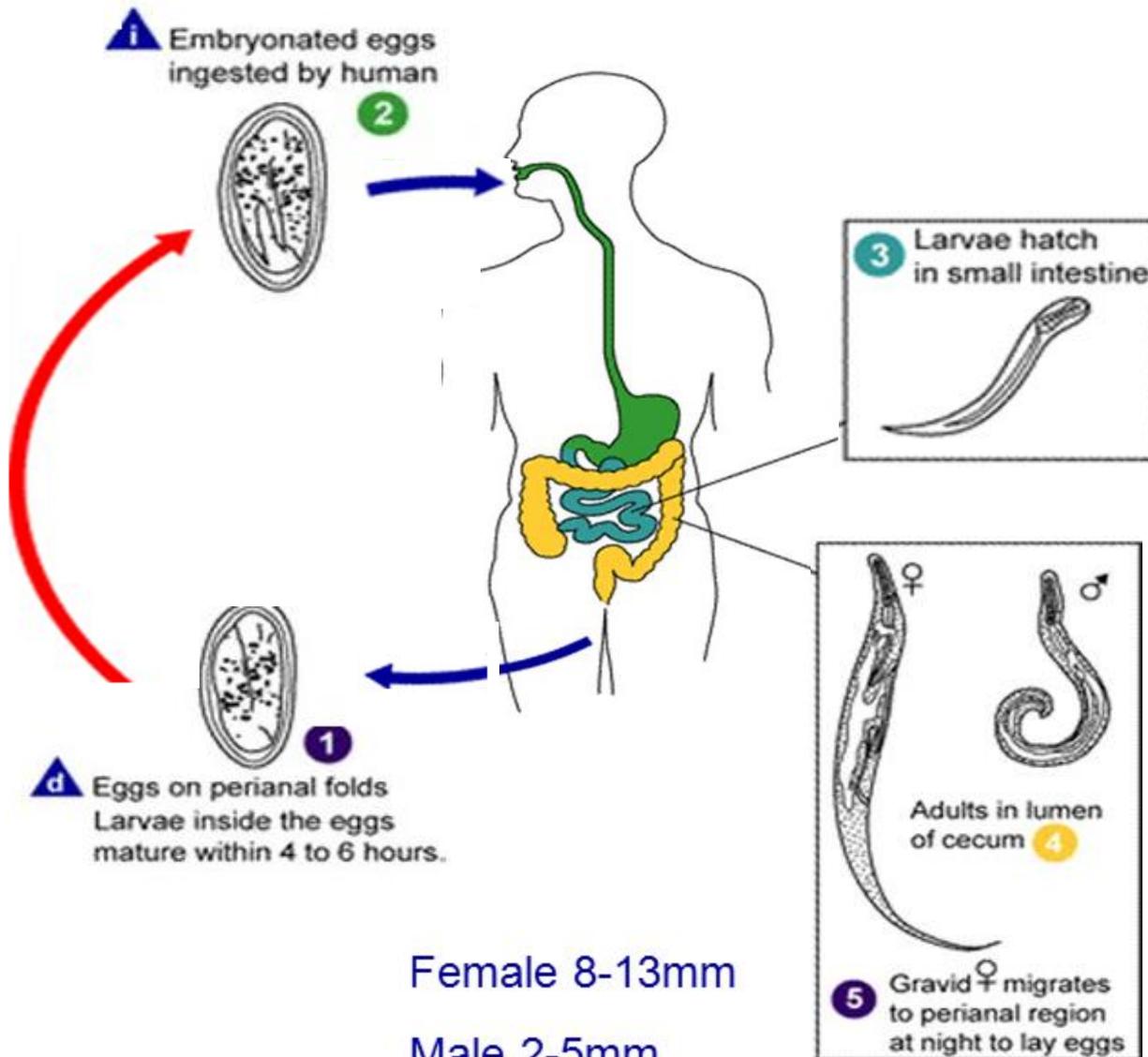
- Cosmopolitan more common in temperate and cold climates than in warm climates.

Habitat:

- Adult: small intestine (terminal ileum)
- Gravid female: Caecum and rectum
- Eggs : In faeces or deposited on perianal skin



Enterobius vermicularis (Life cycle)



The time interval from ingestion of infective eggs to oviposition by the adult females is about one month.

Adult worm in caecum, colon or rectum

•The life span of the adults is about two months.

i = Infective Stage
d = Diagnostic Stage

Pathogenesis and Symptomatology

Disease: Enterobiasis

Itching of the perianal region (**pruritus ani**) especially at night ⇒ abrasion which may be infected ⇒ restlessness, insomnia, irritability and anxiety.

Sometimes the adult female may enter the female urethra or vagina especially in children leading to:

- Urethritis, cystitis & nocturnal enuresis.
- Vaginal discharge & vulvo-vaginitis.

Sometimes the adult enter the appendix ⇒ **Appendicitis.**

Nematodes of medical importance

Intestinal

Tissue & Blood

Small intestine

□ With tissue stage:

- *Ascaris lumbricoides*
- *Ancylostoma duodenale*
- *Necator americanus*
- *Strongyloides stercoralis*
- *Trichinella spiralis*

• Without tissue stage:

- *Enterobius vermicularis*
- *Trichuris trichiura*

Large int.

- *Wuchereria bancrofti*
- *Brugia malayi*
- *Loa loa*
- *Onchocerca volvulus*
- *Dracunculus medinensis*
- *Trichinella spiralis*

□ Larva migrans:

- *Ancylostoma spp.*
- *Toxocara spp.*

Intestinal Round Worms (Nematodes)

Trichuris trichiura (The Whipworm)

Adult worm

30 – 50 mm. whip-like shape, anterior 3/5th of the worm resembles a whip

Eggs

- 60 μ , bile stained (yellow brown).
- Barrel-shaped with Mucus plug at each pole
- Unsegmented ovum

Infective form

Mature embryonated eggs



Mode of transmission

Ingestion

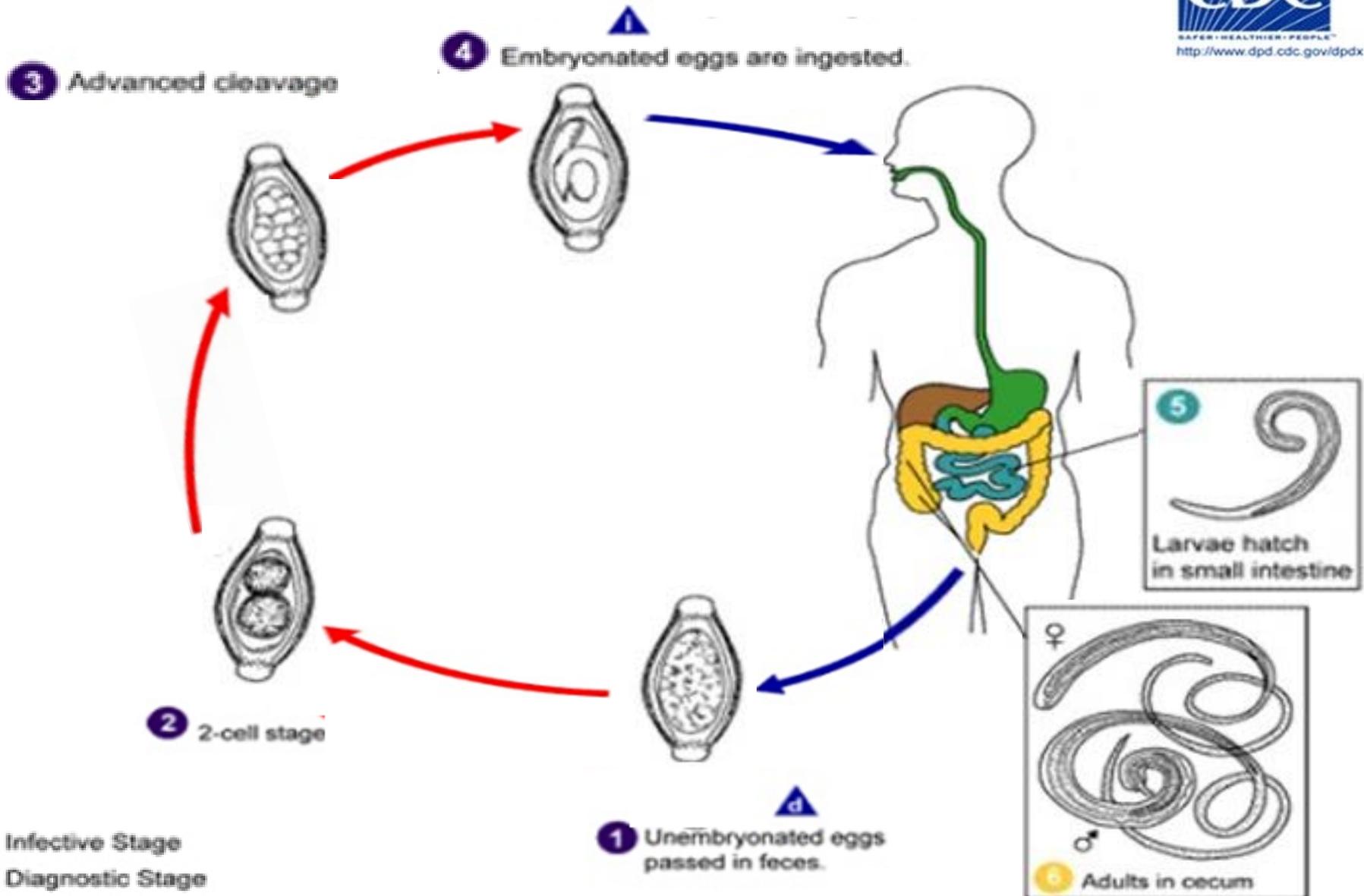
Site of localization

Large intestine - caecum



Intestinal Round Worms (Nematodes)

Trichuris trichiura (Life cycle)



Nematodes of medical importance

Intestinal

Tissue & Blood

Small intestine

□ With tissue stage:

- *Ascaris lumbricoides*
- *Ancylostoma duodenale*
- *Necator americanus*
- *Strongyloides stercoralis*
- *Trichinella spiralis*

• Without tissue stage:

- *Enterobius vermicularis*
- *Trichuris trichiura*

Large int.

- *Wuchereria bancrofti*
- *Brugia malayi*
- *Loa loa*
- *Onchocerca volvulus*
- *Dracunculus medinensis*

• *Trichinella spiralis*

□ Larva migrans:

- *Ancylostoma spp.*
- *Toxocara spp.*

Tissue Nematodes

Wuchereria bancrofti & *Brugia malayi*

Geographical Distribution:-

- In subtropics and tropics, Asia, Africa, America, Middle East, Far East,

Habitat

- Adults:
 - Coiled in lymphatic glands, or lying in lymphatic vessels, superficial abscesses, or wondering in retroperitoneal tissues.
 - Found usually in lymphatic of the lower limb.
- Microfilariae:
 - In lymphatic vessels, and in the peripheral blood normally at night but during day in lung and other internal organs.
 - Infective larvae: In the gut and muscles including mouth parts of certain species of mosquitoes.

Tissue Nematodes

Wuchereria bancrofti & Brugia malayi

Life Cycle:

- Infective filariform larvae → Adult worm → microfilariae
- It requires two hosts to complete its life cycle :
 - Definitive host: man.
 - Intermediate hosts: species of female culex, Anopheles and Aedes mosquitoes.



Tissue Nematodes

Wuchereria bancrofti

Pathology:

- Causes lymphatic filariasis or elephantiasis of usually the limbs, genital organs and breasts.

Prevention and Control:

- Controlling mosquitoes vector.
- Avoid mosquitoes bite.
- Treating infected person.
- Giving health education.



Tissue Nematodes

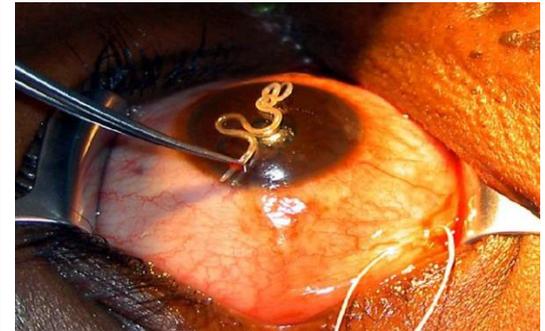
Loa Loa (Eye worm)

Geographical Distribution:

- The Distribution is restricted to the rain forest area of west and central Africa.

Habitat:

- Adults: In connective tissues under the skin, in the mesentery and the parietal peritoneum.
- Microfilariae: In peripheral blood of man during day time.
- Infective larvae: In the gut, mouth parts and muscles of tabanide flies of the genus *Chrysops*.



Tissue Nematodes

Trichinella Spiralis

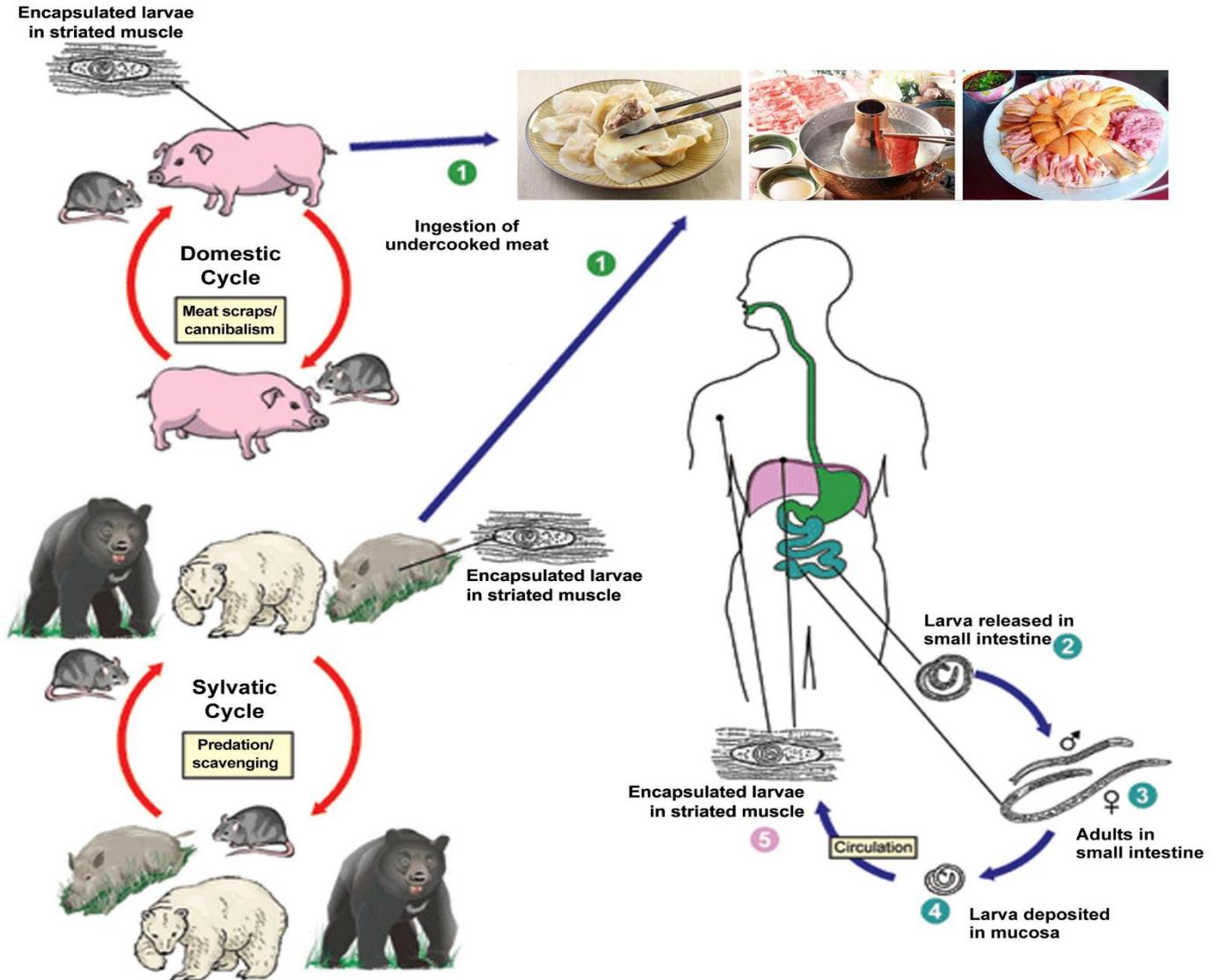
Habitat

- **Adults:** Embedded by its anterior part in mucosa of muscular epithelium of duodenum and Jejunum of Man, Dog, Rate, Cat, Pigs and wild Carnivores.
- **Larvae:**
 - Encysted in the straited muscle of the body of meat eating animals including man.
- **Egg:** No eggs passed in the faeces , female gives birth to larvae.

Tissue Nematodes

Trichinella Spiralis

Life cycle



INTESTINAL NEMATODES (Roundworms)

INGESTED — “**EAT** + **TT**”

| Organism | Key Buzzwords | Diagnosis | Treatment |
|---|--|------------------|------------------------|
| E nterobius vermicularis (Pinworm) | Perianal itching, kids, school | Scotch tape test | Albendazole / Pyrantel |
| A scaris lumbricoides | Lung migration → cough, intestinal obstruction | Eggs in stool | Albendazole |
| T richuris trichiura (Whipworm) | Rectal prolapse (severe), barrel eggs | Eggs in stool | Albendazole |
| T richinella spiralis | Undercooked pork, myositis, periorbital edema | Muscle biopsy | Albendazole + steroids |
| T oxocara canis/cati | Visceral/ocular larva migrans | Serology | Albendazole + steroids |

SKIN PENETRATION

“**SANd**”

| Organism | Buzzwords | Diagnosis | Treatment |
|-----------------------------------|---|-----------------|-------------|
| S trongyloides stercoralis | Autoinfection, hyperinfection (ICU, steroids) | Larvae in stool | Ivermectin |
| A ncylostoma duodenale | Hookworm | Eggs in stool | Albendazole |
| N ecator americanus | Hookworm | Eggs in stool | Albendazole |

Complication: Iron-deficiency anemia (hookworms suck blood)

FILARIAL NEMATODES (Blood/Lymph/Skin) — “W-BLO”

| Organism | Vector | Buzzwords | Diagnosis | Treatment |
|------------------------------|----------|------------------------------------|-----------------------|--------------------|
| W uchereria bancrofti | Mosquito | Elephantiasis (blocked lymphatics) | Night blood smear | Diethylcarbamazine |
| B rugia malayi | Mosquito | Lymphatic filariasis | Night blood smear | Diethylcarbamazine |
| L oa loa | Deer fly | Calabar swelling, worm in eye | Blood smear (daytime) | Diethylcarbamazine |
| O nchocerca volvulus | Blackfly | “River blindness”, skin nodules | Skin snip | Ivermectin |