* All Helminths info:-

* Nematodes:- Round worms → intestinal or tissue nematodes or both
- Have seperate sexes, well developed digestive system.

⇒ Intestinal Nematodes:-

* Ascaris lumbricoides:-
- Cause ascariasis, from the most common helminthic infections, benign infections
- related to poor sanitation or night soil = human feces to fertilize soil.
- infective stage = ingestion of eggs which are also observed in stool samples for diagnosis.
- in some, eggs hatch to larvae which penetrates the skin. in others, eggs aren't part of the cycle. life span < 2 years
- infect by eggs = strongly resistant to environmental conditions, thick brown shell
- freshly passed eggs in stool aren't infective as they need 2-3 weeks to develop. to embryonated (contain larvae) ⇒ soil transmitted helminthes = soil-borne, food-borne, water-borne.
- largest nematode in human intestine:- F = 20-35 cm, M = 15-30 cm (has copulatory spicule for mating)
- Ascaris suum = pig round worm, can infect humans so indistinguishable with A. lumbricoides.
- Pathology = mechanical obstruction of bowel/bile/pancreatic ducts ⇒ if not then asymptomatic.
- worms migrate when patient takes anesthetics/steroids ⇒ bowel perforation → peritonitis ⇒ either constipation or diarrhea, anal passage of worms/vomiting abdominal pain/discomfort.
- larvae has transpulmonary route ⇒ migrate thraugh lungs ⇒ inflammation → pneumonitis/cough/hemoptysis ⇒ bronchial spasm ⇒ mucus production ⇒ löffler syndrome (eosinophilia/cough/--) diagnosed via sputum sample (causes)
- egg is bumpy, hard brown shell + albuminous coat.

- life cycle :- ingestion of embryonated egg (not fertilized) then crosses digestive system to small intestines where the eggs hatch ⇒ larvae that cross mucosa & submucosa → blood → lungs (alveoli → bronchioles → bronchi) → out to the throat → patient swallows them again → mature → place eggs → eggs are excreted with fecal matter. diagnosis stage
- the eggs that were placed the 2nd time need to be fertilized to continue life cycle.
- F lay down 200,000 ova daily fertilized or not.
- fertilized eggs in soil need 2-3 weeks to become embryogenated = infectious outside the body
⇒ soil transmitted disease
- infective stage = embryonated egg . diagnostic stage = fertilized or unfertilized egg , adults may slip as well.

* Enterobius vermicularis :- Pin worm
- females :- 10 mm , pointed posterior end . males :- 3 mm , curved posterior end.
- most common worms from helminthes infections.
- eggs are football shaped , clear thin outer shell , transparent , larvae can be infectious observed ≈ 50-60 µm . in night time they move from intestinal tract to sigmoid then exit from anus where they lay eggs.
- diagnostic stage :- eggs and sometimes the worms. infective stage :- embryonated eggs
- eggs of E. vermicularis are immediatly infective (2-6 h) which can cause auto infection ⇒ hand in mouth after perianal scratches or by touching contaminated covers or fomites ⇒ indirectly transmissable
- main symptom = perianal pruritis (itching) especially at night. affects children development.
- recover eggs via scotch tape in the morning before bowel movement then diagnose after microscopy.
- goes immediatly to the intestines → hatches and gives adult stage.
- life span ⇒ less than ascaris lumbricoides

* Trichuris trichiuria :- whipworm, intestinal nematode.
- F:- 30-50 mm, males are smaller. anterior end is slender, posterior is thicker.
- Adults inhabit the colon (mating happens here) females lay eggs that are passed in feces and become infective after 3 weeks of incubation in moist shady soil. eggs ⇒ 50 µm distinct polar plugs., soil transmitted helminthes.
- diagnostic stage = eggs . infective stage = embryonated eggs.

* Ancylostoma duodenale & Necator americanus :- Human hookworms, intestinal nematode
- female hookworms ≈ 10 mm have hook structure. males are smaller with copulatory bursa (broadened posterior end) to mate with females. F lay >10 000 eggs daily into feces where a larva hatches from the egg outside the body within a day or two.
- life cycle:- eggs are oval 60*40 mm → hatch in 48h to give rhabiditiform (outside the body) larva, after 2 days moults to filariform = infective stage that penetrates skin & mucous membranes.
- disease isn't caused by ingestion of eggs. Rather by larvae penetrating the skin & body usually from ankle and feet. They inhabit small intestines and attaches there via hooks ⇒ can cause damage ⇒ bloody stool (anti-coagulants cause) ⇒ iron deficiency anemia. these larvae migrate through different parts in body. (transpulmonary route)
- A few hundred worms in intestine cause hookworm disease, can also cause discomfort & diarrhea. skin penetration causes ground itch (pruritis)

* Strongyloides stercoralis: Human thread worm, intestinal & tissue nematode
- Adult F = 2mm inhabit intestine, parthenogenic (no mating needed)
- life cycle: has 3 parts as follows: autoinfection / parasitic / free living. Eggs are laid within intestine, larvae (inside) hatches from eggs and are passed with feces (free living) or migrate transpulmonary ⇒ parasitic form. Free living form ⇒ males and females mate to produce several generations in soil.
- diagnostic stage = larvae. infective stage = larvae penetrating skin or ingestion
- only one with internal autoinfection ⇒ completes life cycle in the body ⇒ eggs hatch inside the body.

* Intestinal & Tissue Nematodes:
- Trichinella spiralis: only intracellular helminthic infection, don't lay eggs but produce larvae directly then they encyst.
- acquired by eating raw or improperly cooked pork infected with larval stage. in small intestine they become adults and after mating with male the female releases live larvae that penetrate and circulates with blood and eventually encysts in muscle tissue (cardiac / smooth / skeletal) + brain.
- Treated with medications or surgical interference.
- F worms live several weeks → diarrhea / pain / nausea. symptoms are mild to none & often goes unnoticed as they encyst in muscle tissue.

* Tissue Nematodes:- adults are parasites of lymphatic system or CT.
- they are filariform, lay larvae not eggs, these larvae require an intermediate host (vector that bites) to complete development ⇒ infective stage = microfilaria larvae
- prefers body cavaties, lymphatic system + CT.
→ Family Filariidae:-

* Wuchereria bancrafti + Brugia malayi:- both need mosquito as vector.
- cause elephantitis ⇒ blockage of lymph. circulation in one of the forelegs, gives morphology + texture of elephants legs.

* Loa Loa (eye worm, fly genus chrysops, day-biting flies) + Onchocerca volvus (River blindness, black flies) — causes elephantitis as well
- causes eye unilateral worm disease.

* Lymphatic filaria:- found in lymphatics/body cavities/subcut tissue.
- progenies are embryos not fully developed ⇒ microfilariae ⇒ between eggs & larvae.
- requires vector to transmit them, the worm obstructs lymphatic passage ⇒ fluid accumulation ⇒ lymphedema

* Platyhelminthes:- flat worms, hermaphroditic except schistosomes. They absorb so they compete with us * in ~~absorpt~~ absorbing and are of two classes:- Cestoda & trematoda.

* Cestoda:- tape worms, ribbon-like. 2 muscular suckers (scolex) + neck, rest of their body is segmented = proglottids (helps in diagnosing through stool)

* Trematoda:- leaf-shaped, 2 muscular suckers (flukes) blood/lung/liver flukes.
⇒ famalies:- fascilodae, heterophyidae, schistosoma.
- fertilization occur either cross between 2 worms or self fertilization. All trematodes undergo complex asexual reproductive phase ⇒ larval stage in a snail. their first intermediate host. eggs are oval, operculated, pass to fresh water ⇒ hatch & release ciliated (snail-seeking) 1st larval form (non-infective) - meracedium - swims to find its snail and devebps to final larval stag - cercariae (infective stage) - these swarm out to penetrate a 2nd host (intermediate) and may encyst = metacercariae also infective stage. (I.H) = snails, can be fertilized by themselves or cross fertilization.

* Fasciloddes:-
- large trematodes, ventral sucker near anterior end, require more than 1 (I.H), affect specific organs (flukes)
- Liver flukes:- Clonorchis sinensis ⇒ chinese/oriental liver fluk // fasciola hepatica ⇒ sheep liver fluke.
- Lung fluke:- Paragonimus westermani ⇒ paragonimus westermani.

⇒

* Schistosoma mansoni/japonicum/haematobium ⇒ blood flukes.
- adult = worms are long & slender, 10-20 years within venous system
- penetration causes infection.
- S. haema. causes schistosomiasis or bilharzia ⇒ granulomatous reaction ⇒ fibrosis ⇒ metaplasia ⇒ urinary cancer.
- Sianatotim intermediate is bulinus snail
- diagnostic stage = eggs
- S. mansoni ⇒ inferior mesentric veins of large intestine, fresh water snails of biomphalaria alexandrina, round eggs with lateral spine
- S. Japonicum ⇒ inferior + superior mesentric — of small intestines, fresh //// of oncomelania, small carved rudimentary spine on egg
- S. haematobium ⇒ veins of urinary bladder, fresh //// of bulinus trancatus, terminal spine on egg, can cause 2nd ry infections.
- Schistosomiasis ⇒ eggs not adult worms. F lays 100's 1000's of eggs in veins and circulate to fluke region or excreted with feces.
- S. mansoni/japonicum ⇒ granulomatous reaction ⇒ metaplasia ⇒ impedes liver blood flow ⇒ portal hypertension ⇒ ascites ⇒ hepatosplenomegaly ⇒ esophageal varices

* Cestoda = Tapeworms, segmented, aquire infection from eating infected flesh, 3 infectious groups:- Taenia/Echinococcus granulosus/Diphylopothrium latum.

* Taenia saginata = Beef tapeworm.
- contaminated undercooked meats (contains larvae) (cysticercus) ⇒ I.H = cattle
- 6-7 mm, adult = 4-8 meters, 1000 segments

* Taenia solium :- Pork tapeworm
- kinda similar to T. saginata but shorter, ~~mod~~ modified scolex, adult:- 6 mm width, 2-7 m length, 800 segments.
- cysticerosis ⇒ larval stage ⇒ cysticercus cellulosae ⇒ encyst in muscle, brain ⇒ epilepsy. , from contaminated beef has encystated larvae but if egg is directly consumed ⇒ neuro cysticerosis.
- Humans is:- D.H ⇒ ingest larvae = benign disease
I.H ⇒ ingest eggs = serious disease

* Echinococcus granulosus :- Hydatid cyst
- Small / 3 segmented tape worm . dog intestine (D.H) ⇒ I.H are humans ⇒ causes hydatid cyst, adult ≈ 5mm
- in humans cysts with larvae develop after egg ingestion in lungs and liver infective stage = protoscolices , treated by surgery ⇒ rupture of cyst can cause anaphylactic shock ⇒ death.

* Diphyllobothrium latum :- Broad fish tapeworm - intestinal cestode
- longest one ⇒ 10 m , aquired from undercook fish infected with larvae known as plerocercoids ⇒ white grains of rice in fish flesh.
- Human is :- D.H ⇒ larvae ingestion , I.H ⇒ egg ingestion
- requires 2 I.H , in intestine ⇒ rapid growth, chain of segments ⇒ more than 1 million eggs per day.

* T. saginata / solium + D. latum ⇒ only a threat when human is I.H.