ADULT CESTODE INFECTIONS

Dr. Nuwani Manamperi
Dept. of Parasitology
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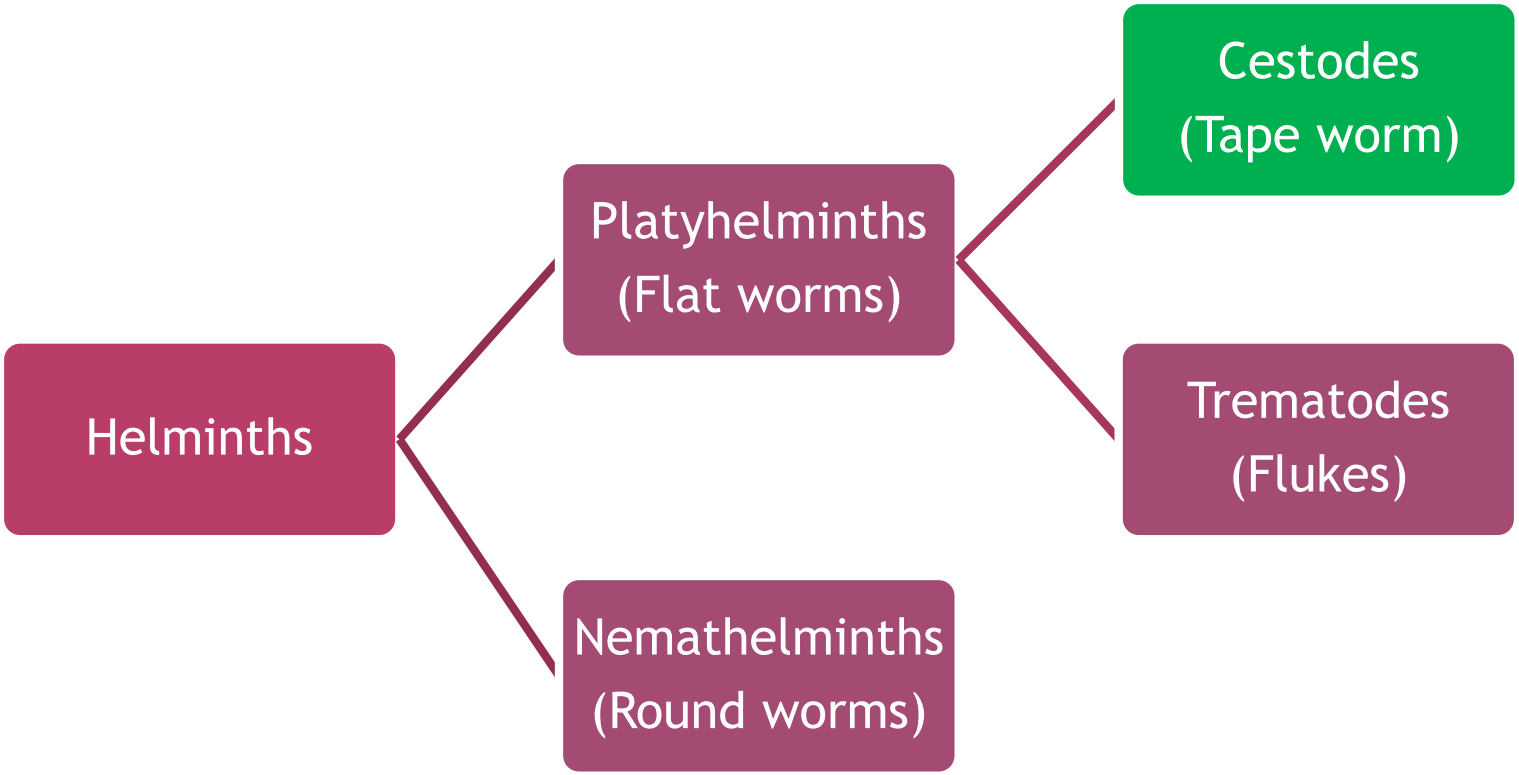
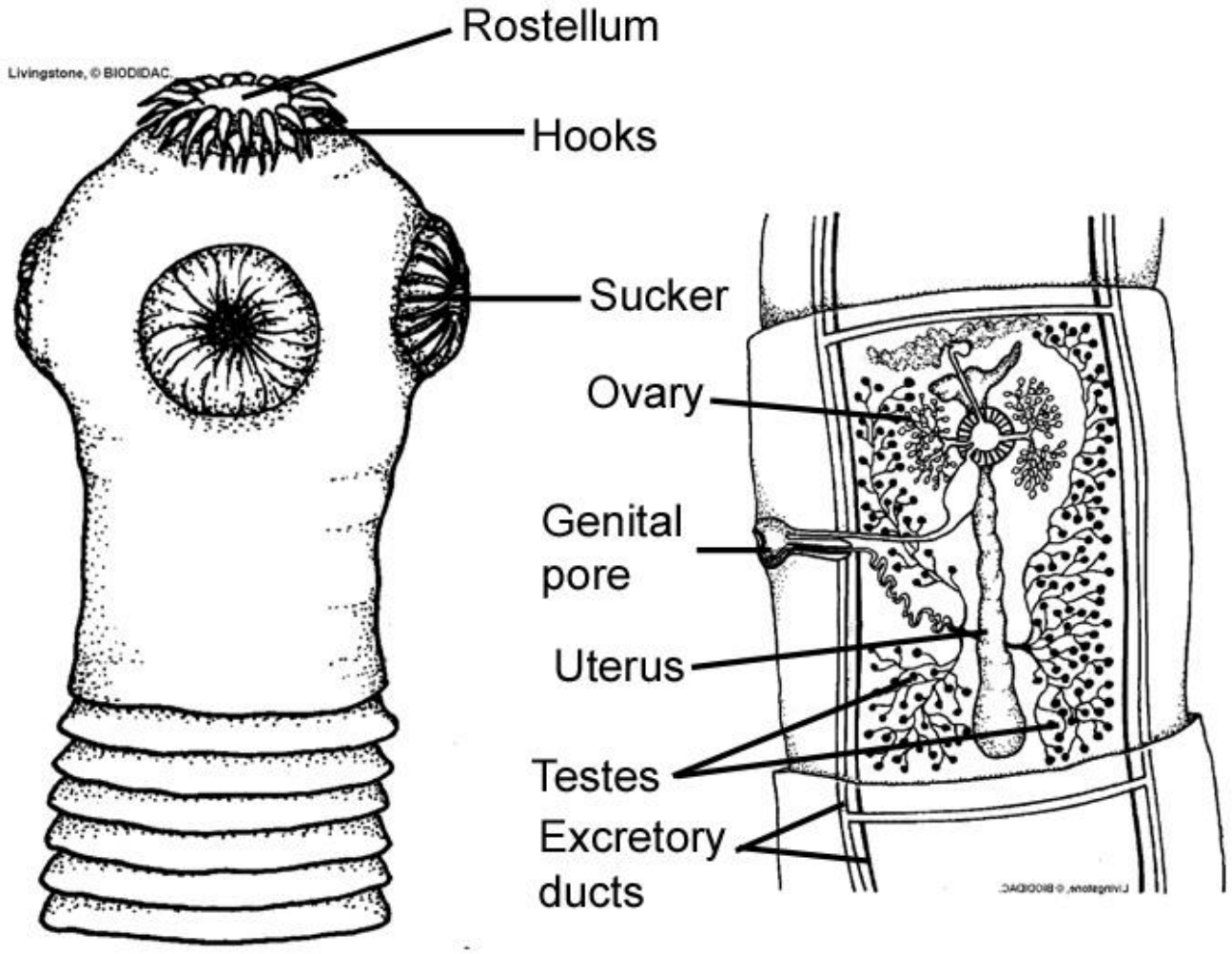
OBJECTIVES

- Name the important adult cestodes infecting man
- Describe their morphology and outline their life cycles
- Name the respective intermediate hosts
- Describe the clinical consequences
- Name the laboratory tests for diagnosis and drugs for treatment
- Outline the prevention and control measures


Helminths
Platyhelminths
(Flat worms)
Nemathelminths
(Round worms)
Cestodes
(Tape worm)
Trematodes
(Flukes)

GENERAL CHARACTERISTICS

- Dorso-ventrally flattened, tape-like bodies
- Size varies from few millimeters to several meters
- 3 regions in the body –
  - head (scolex)
  - neck
  - strobila- a chain of progressively developing segments (proglottids)
- Scolex is used for attachment to the host (using sucking grooves or suckers +/- hooks)


Livingstone, © BIODIDAC
Rostellum
Hooks
Sucker
Ovary
Genital pore
Uterus
Testes
Excretory ducts

- Proglottids mature as they move caudally, developing sexual organs and then turning into gravid proglottids which consist of a uterus filled with eggs
- Segments are hermaphroditic – each contains both testes and ovaries
- Eggs are produced by self-fertilization or cross fertilization between segments
- Nutrients absorbed through the tegument (no intestinal tract)
- Adults usually parasitize mammalian intestine

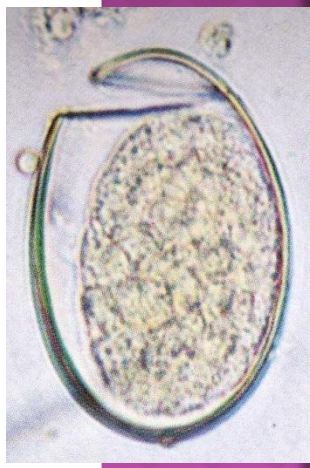
TWO MAIN ORDERS

Cyclophyllidea

- Scolex with rostellum & suckers
- May or may not have hooks
- Eggs are not operculated
- *Taenia* spp., *Hymenolepis* spp., *Echinococcus* spp.

Pseudophyllidea

- Scolex with slit like sucking grooves (bothria) and no rostellum
- Eggs are operculated
- *Diphyllobothrium* spp., *Spirometra* spp.



MEDICALLY IMPORTANT CESTODES

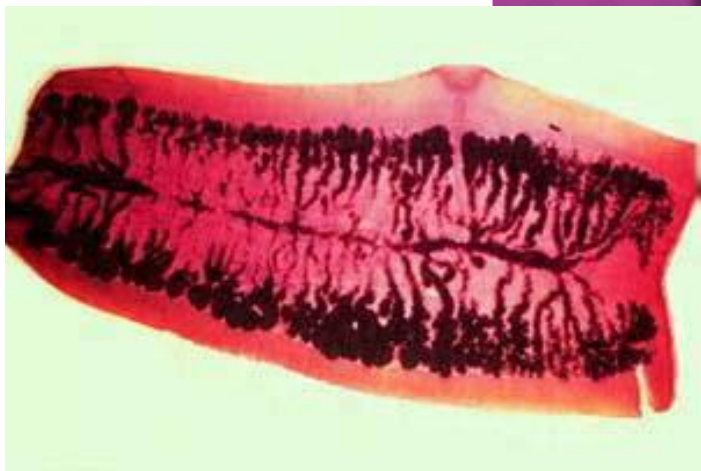
- Cyclophyllids
  - *Taenia saginata* (beef tapeworm)
  - *Taenia solium* (pork tapeworm)
  - *Hymenolepis nana* (dwarf tapeworm)
  - *Hymenolepis diminuta* (rat tapeworm)
  - *Dipylidium caninum* (dog tapeworm)
  - *Echinococcus granulosus* (dog tapeworm)
- Pseudophyllids
  - *Diphyllobothrium latum* (fish tapeworm)

Taenia saginata (Beef tapeworm)

- Found worldwide, especially where beef is eaten raw or undercooked
- Few cases described in Sri Lanka
- Human is the only definitive host
- Cattle is the significant intermediate host

MORPHOLOGY

- Adult worm
  - whitish, semi-transparent
  - Very long – 4-10 m (about 2000 proglottids)
  - Scolex- small (1-2mm diameter), pyriform, 4 suckers and no hooks
  - Gravid segments contain a uterus with 15-32 lateral branches (>15)

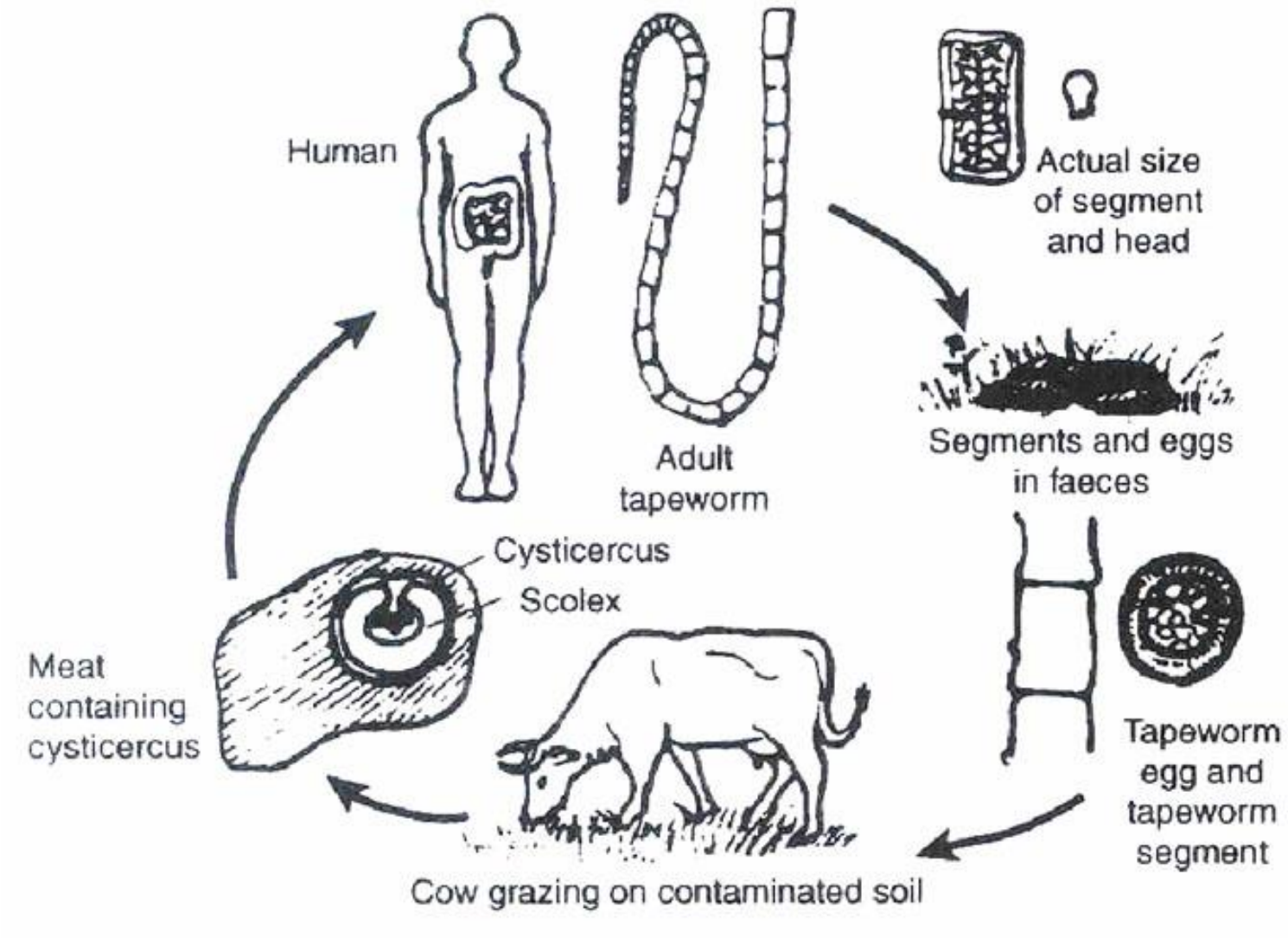


MORPHOLOGY……

Egg

- Spherical, about 35 µm in diameter
- Thick, radially striated egg shell
- Internal oncosphere with 6 small hooks (hexacanth embryo)

LIFE CYCLE


Human
Adult tapeworm
Actual size of segment and head
Segments and eggs in faeces
Cysticercus
Scolex
Meat containing cysticercus
Tapeworm egg and tapeworm segment
Cow grazing on contaminated soil

Cysticercus bovis

Larval stage of *Taenia saginata* found in cattle

- 8 x 5 mm in size, white in colour
- Small invaginated scolex without hooklets
- Remain viable for about 8 weeks
- Can resist temperature up to 48°C and refrigeration
- Cannot resist deep freezing for more than 3 weeks
- When cysticercus is ingested by man, bladder is digested ->scolex attaches itself to small intestinal mucosa (upper jejunum) -> develops in to an adult

TRANSMISSION

- Cattle acquire infection via grass contaminated with human faeces

- Humans acquire the infection through undercooked beef containing cysticerci

CLINICAL FEATURES

- Most infections are asymptomatic
- IBP – 5-12 weeks
- First sign of infection - passage of an active whitish segment in faeces or a segment crawling out of the anus
- Other non-specific symptoms- abdominal pain, nausea, headache etc.
- Can remain in the intestine without harm for upto 25 years

DIAGNOSIS

- By finding segments (commonly) or eggs in stool/perianal region (by Scotch tape swab)
- Segments injected with a dye (India ink) to highlight the uterus
- Identified by counting the number of lateral branches (>15)
- Detection of antigens in faeces (ELISA)

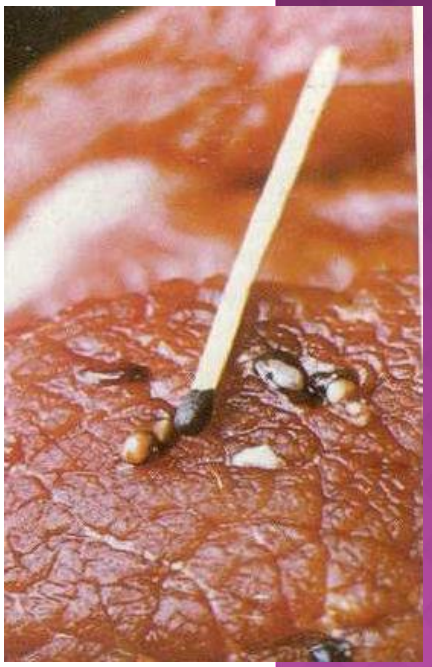
TREATMENT

- Praziquantel
  - Single dose 10-20 mg/kg after a light breakfast

- Niclosamide
  - Single dose after a light breakfast
    - Adults – 2 g
    - Child up to 2 yrs - 500 mg
    - Child 3 to 6 yrs -1g

PREVENTION

- Beef should be well cooked (>56°C)
- Deep freezing beef at -10°C for 10 days will kill cysticerci
- Inspection of meat by PHI for white pin head size cysticerci ('measly beef')



- Prevent unhygienic disposal of human faeces

Taenia solium (Pork tapeworm)

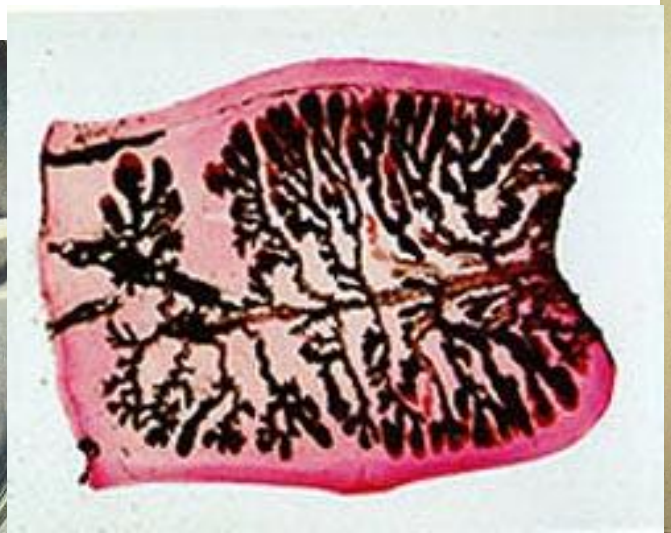
- Found worldwide, in countries where pork or pork products are eaten raw or undercooked
- Common in Eastern Europe, Mexico, Chile, South Africa, China, Indonesia
- Few cases in Sri Lanka

MORPHOLOGY

Adult

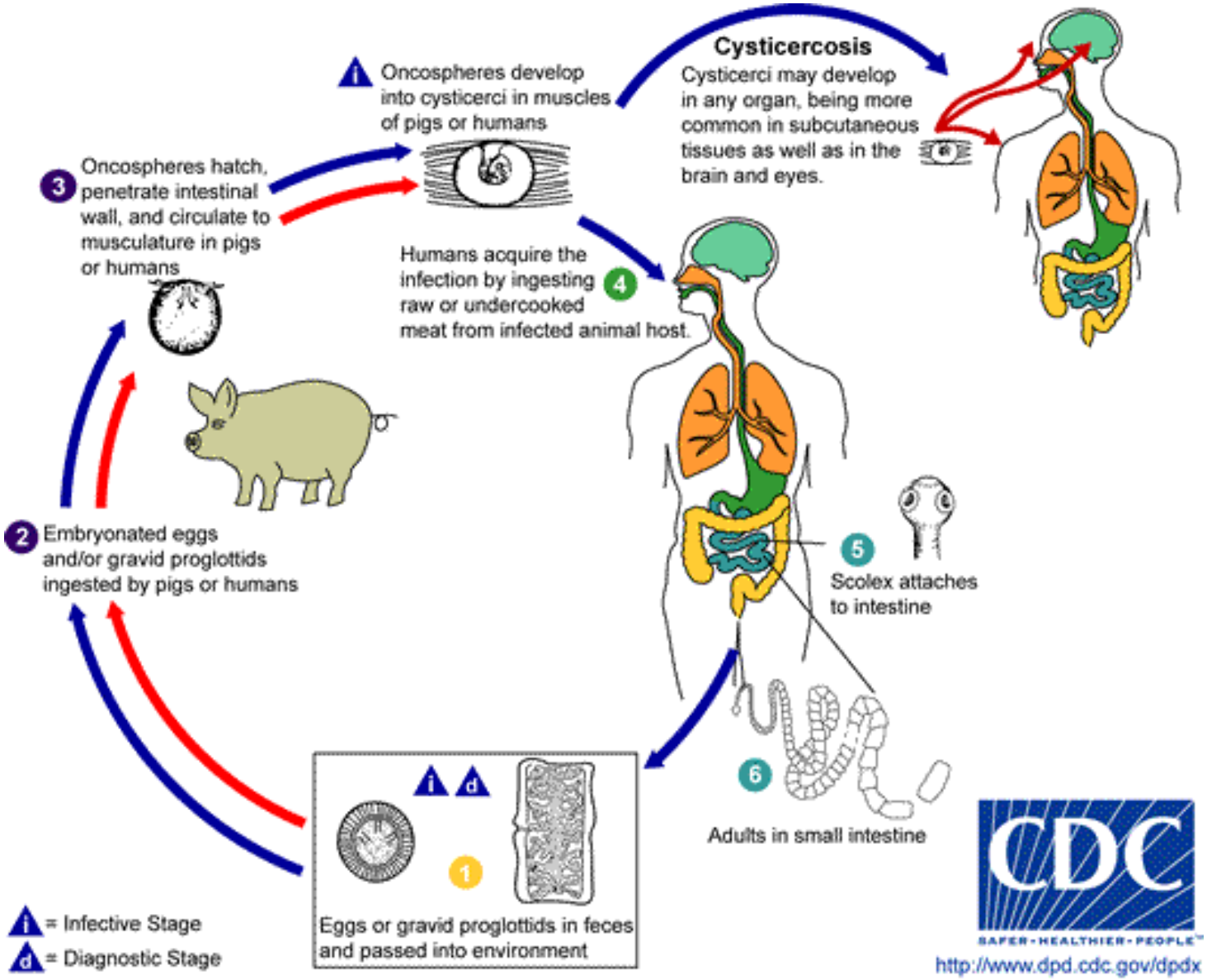
- Little smaller than *T. saginata*, 2-10 m (upto 1000 proglottids)
- Scolex – globular, 1 mm in diameter
- Armed with a double raw of hooklets
- Uterus has 7-13 lateral branches (<15)

Egg – similar to *T. saginata*



LIFE CYCLE

- Very similar to that of *T. saginata*, except
  - Pig is the intermediate host
  - Man can also be infected with the larval stage (Cysticercosis)


Cysticercosis
Cysticerci may develop in any organ, being more common in subcutaneous tissues as well as in the brain and eyes.
i Oncospheres develop into cysticerci in muscles of pigs or humans
3 Oncospheres hatch, penetrate intestinal wall, and circulate to musculature in pigs or humans
Humans acquire the infection by ingesting raw or undercooked meat from infected animal host. 4
2 Embryonated eggs and/or gravid proglottids ingested by pigs or humans
5 Scolex attaches to intestine
6 Adults in small intestine
i d 1
Eggs or gravid proglottids in feces and passed into environment
i = Infective Stage
d = Diagnostic Stage
CDC
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- Infection with adult worm is acquired through eating raw/undercooked infected pork or pork products(ham)

- Clinical features

  - Similar to those seen in *T. saginata* infections except there is also a risk of cysticercosis

Diagnosis

- Needs to be differentiated from *T. saginata*
- Gravid/mature segments : no. of uterine branches
- Scolex: hooks on rostellum (possible only after treatment)
- Demonstration of eggs
- Detection of faecal antigens

Treatment

- Same drugs as for *T. saginata* are effective
- Treatment is more important due to risk of cysticercosis

Prevention

- Same as for beef tapeworm infection

Hymenolepis diminuta (Rat tapeworm)

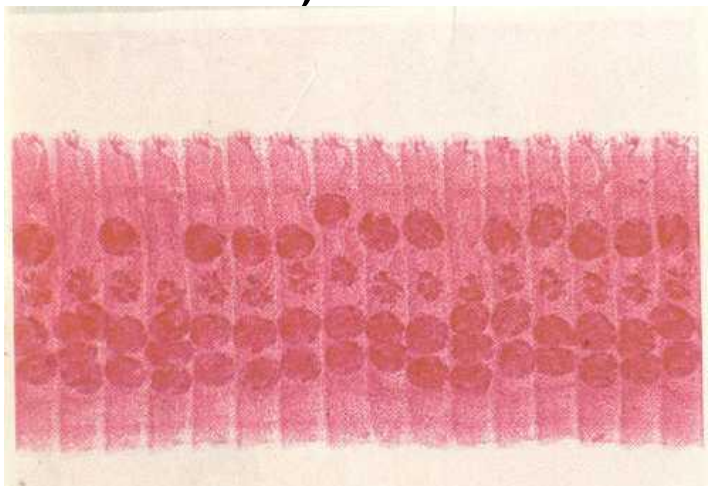
- Parasite of rats and mice
- Occasional parasite of humans
- Most cases reported from children (usually < 3 yrs)

MORPHOLOGY

Adult

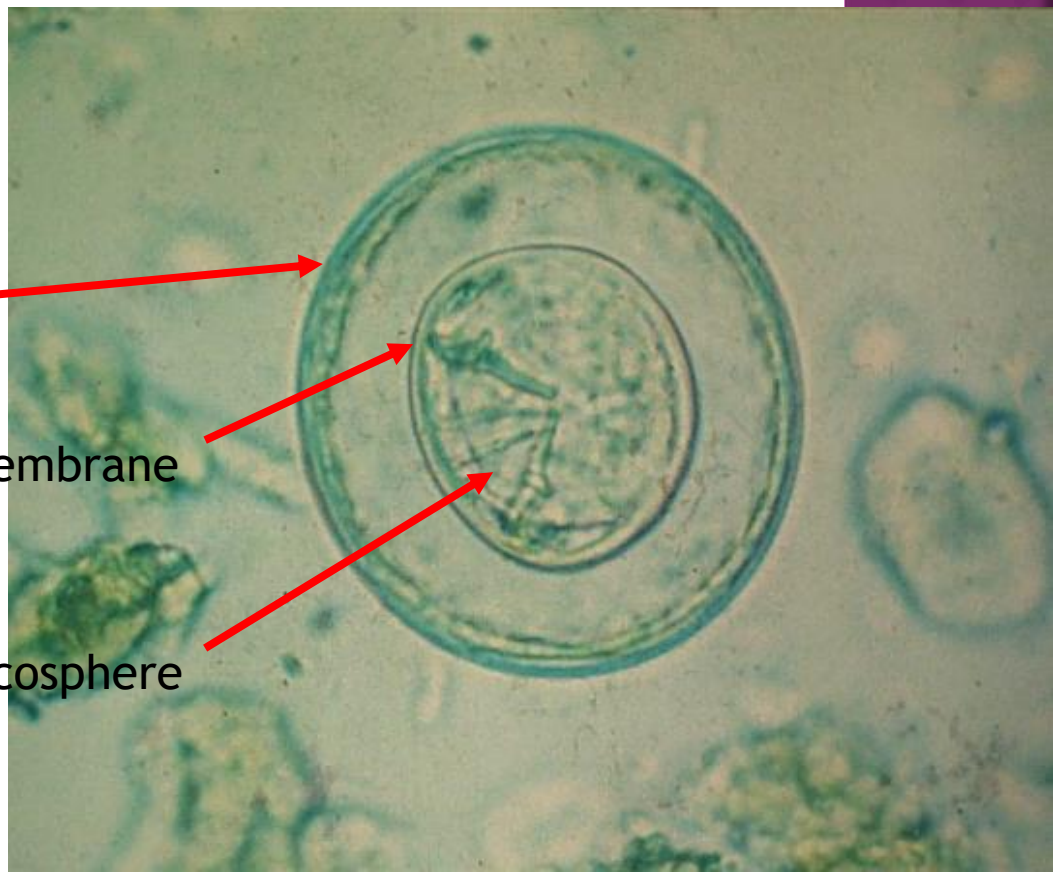
- Length – 10-60 cm (around 1000 proglottids)
- Scolex – small (about 0.4 mm in diameter)

  - 4 suckers and rostellum with no hooks
- Gravid segments are short and wide (length :breadth – 1:4)

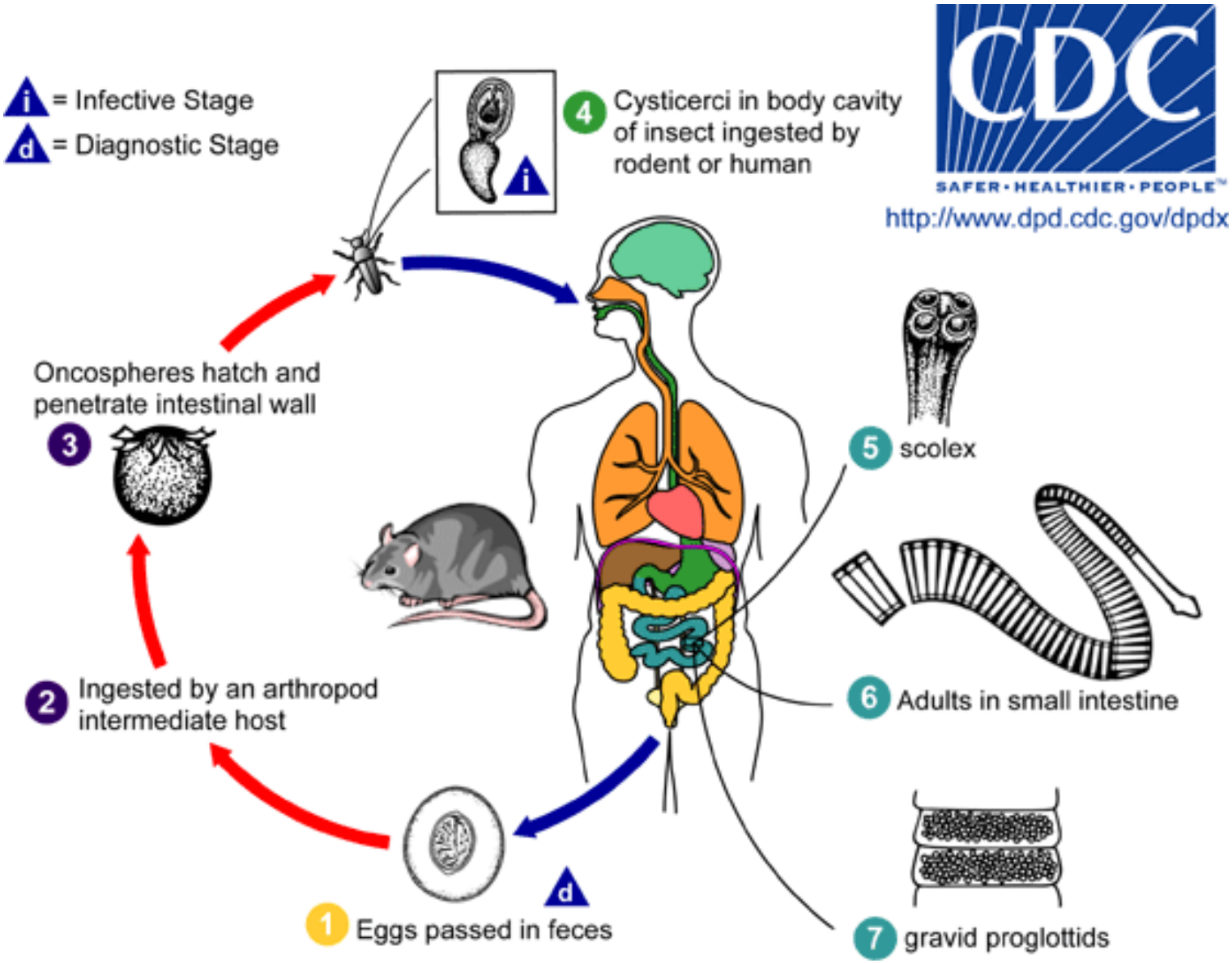


Egg

- Slightly ovoid
- Thick yellow outer shell
- Thin colourless inner membrane
- No polar filaments
- Hexacanth embryo



LIFE CYCLE


i = Infective Stage
d = Diagnostic Stage
4 Cysticerci in body cavity of insect ingested by rodent or human
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Oncospheres hatch and penetrate intestinal wall
3
5 scolex
2 Ingested by an arthropod intermediate host
6 Adults in small intestine
d
1 Eggs passed in feces
7 gravid proglottids

Transmission

- Through swallowing infected fleas or flour beetles in dried grains or fruits
- Multiple infections common

Clinical features

- Most infections are in children
- Usually asymptomatic, but may cause GI disturbances

Diagnosis

- By finding the characteristic eggs in faeces

Treatment

- Praziquantel or niclosamide

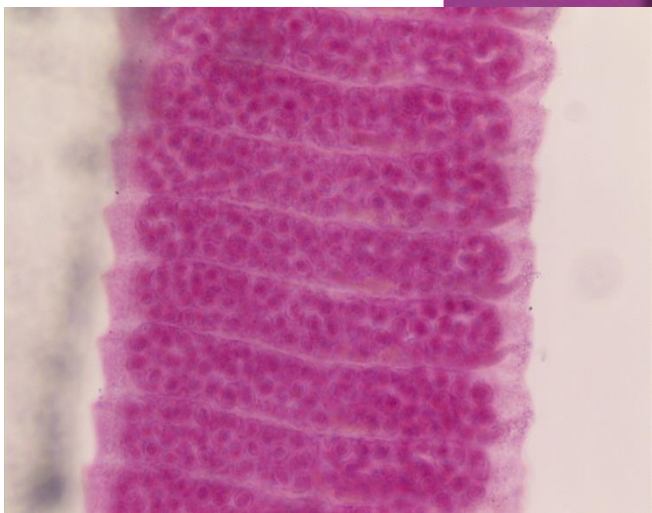
Hymenolepis nana (Dwarf tapeworm)

- Found worldwide
- More common in tropical countries
  - Africa, Asia, South America
- No human cases reported in Sri Lanka (potential zoonosis)
- Very common in children in some areas

MORPHOLOGY

Adult

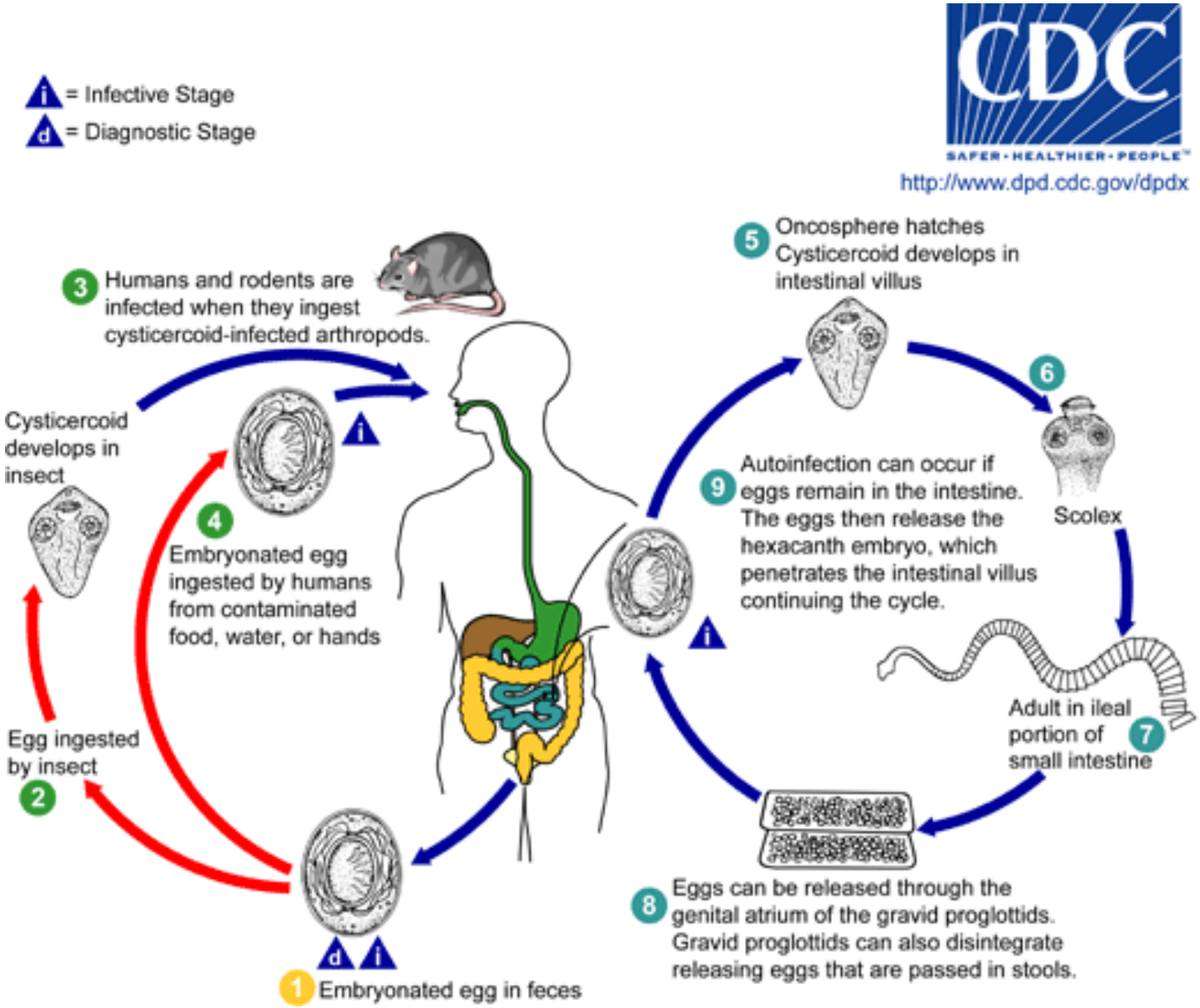
- Very small – 15 – 40 mm in length
- 100 – 200 segments
- Scolex – globular, rostellum with a single raw of hooklets & 4 suckers
- Proglottids – wide and short (like *H. diminuta*)



Egg

- Oval or globular
- Thin transparent outer membrane
- Inner membrane with 2 polar thickenings
- Polar filaments arising from the polar thickenings
- Hexacanth embryo

LIFE CYCLE


i = Infective Stage
d = Diagnostic Stage
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1 Embryonated egg in feces
2 Egg ingested by insect
3 Humans and rodents are infected when they ingest cysticercoid-infected arthropods.
4 Embryonated egg ingested by humans from contaminated food, water, or hands
5 Oncosphere hatches Cysticercoid develops in intestinal villus
6 Scolex
7 Adult in ileal portion of small intestine
8 Eggs can be released through the genital atrium of the gravid proglottids. Gravid proglottids can also disintegrate releasing eggs that are passed in stools.
9 Autoinfection can occur if eggs remain in the intestine. The eggs then release the hexacanth embryo, which penetrates the intestinal villus continuing the cycle.
Cysticercoid develops in insect

TRANSMISSION

- Direct person to person transmission by faeco-oral route
- No intermediate host is required

CLINICAL FEATURES

- Light infections – asymptomatic
- Heavy infections (>1000 worms)
  - Diarrhoea, vomiting, abdominal pain
  - Weight loss, weakness, growth retardation
- Auto-infection leads to build up of worms

Diagnosis

- By finding characteristic eggs in stools

Treatment

- Praziquantel or niclosamide

Prevention

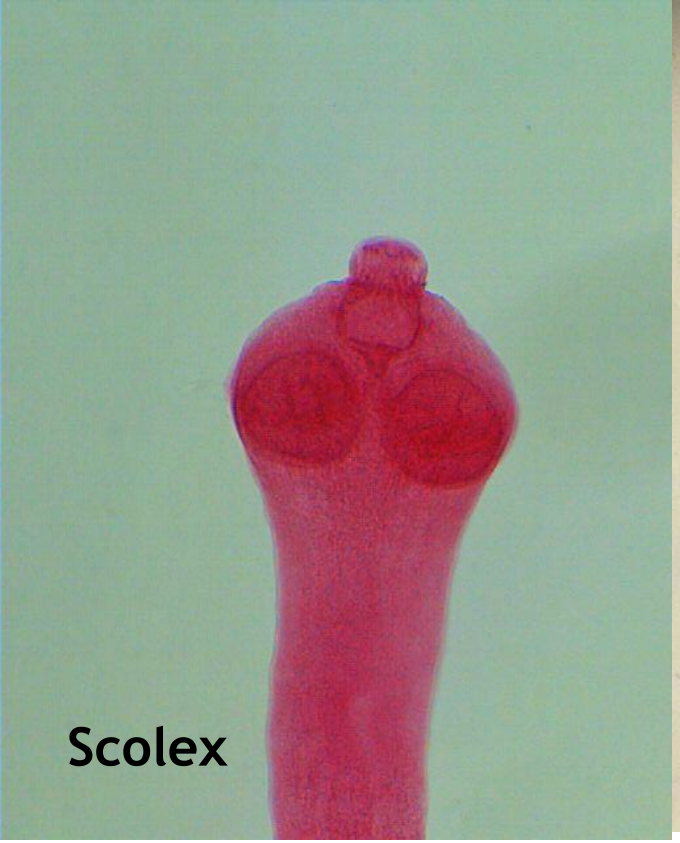
- Sanitory disposal of faeces
- Good personal hygiene

Dipylidium caninum (Dog tapeworm)

- Common tapeworm of dogs, cats and jackals
- Found also in Sri Lanka
- Proved zoonosis

Morphology

- Adults – 15-40 cm long (about 200 segments), scolex with 4 suckers and 3-4 cicles of hooks
- Each segment has 2 genital pores
- Gravid segments containing “egg packets” are discharged in faeces

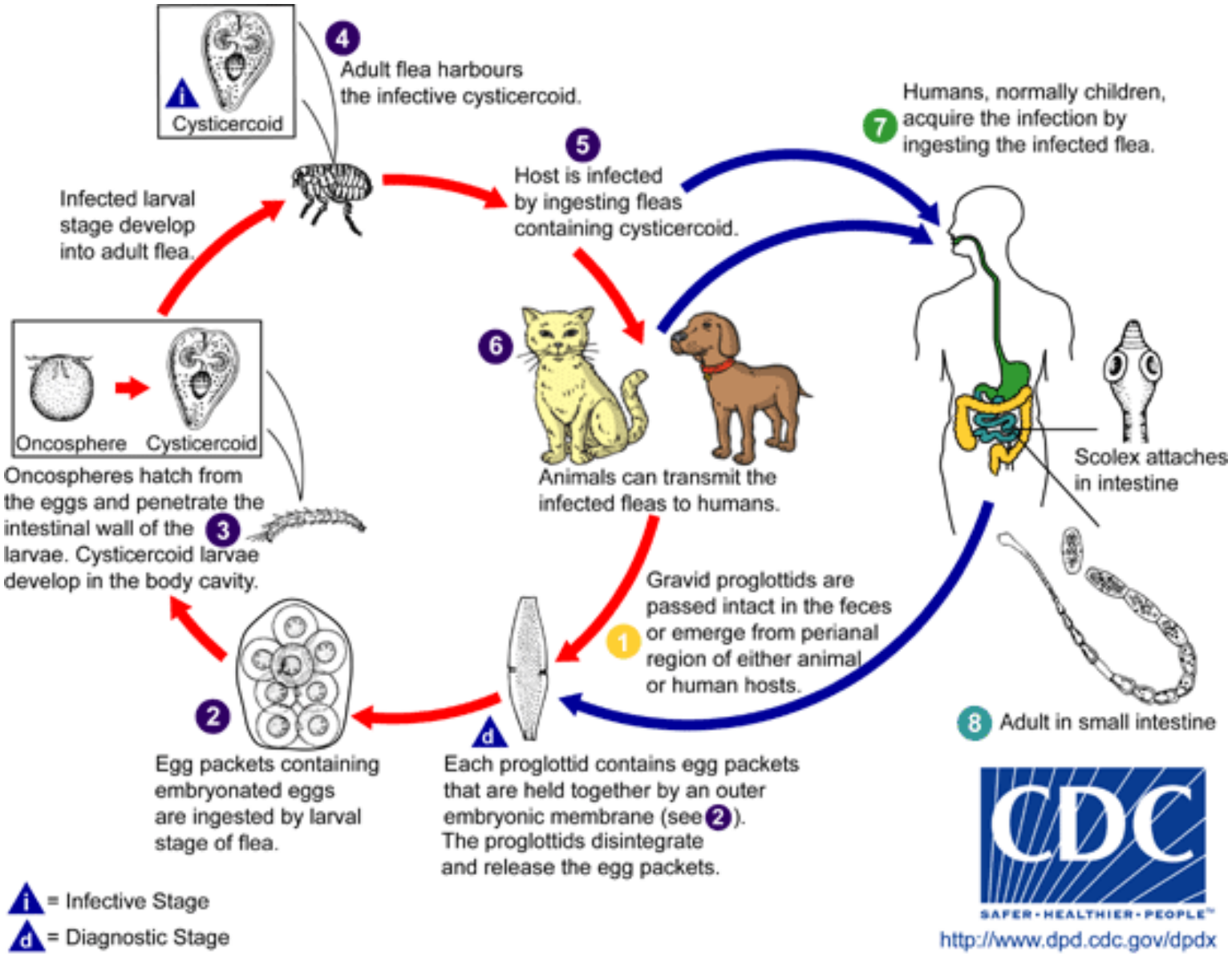


Scolex

Egg packet

Proglottid

LIFE CYCLE


Cysticercoid
4 Adult flea harbours the infective cysticercoid.
5 Host is infected by ingesting fleas containing cysticercoid.
7 Humans, normally children, acquire the infection by ingesting the infected flea.
Infected larval stage develop into adult flea.
Oncosphere
Cysticercoid
Oncospheres hatch from the eggs and penetrate the intestinal wall of the larvae. Cysticercoid larvae develop in the body cavity.
3
6
Animals can transmit the infected fleas to humans.
Scolex attaches in intestine
Gravid proglottids are passed intact in the feces or emerge from perianal region of either animal or human hosts.
1
2
Egg packets containing embryonated eggs are ingested by larval stage of flea.
d
Each proglottid contains egg packets that are held together by an outer embryonic membrane (see 2). The proglottids disintegrate and release the egg packets.
8 Adult in small intestine
i = Infective Stage
d = Diagnostic Stage
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- Transmission
  - through accidental swallowing of infected adult dog flees
- Clinical features
  - Mostly asymptomatic
  - Restlessness at night due to migration of gravid segments to peri-anal region
  - Abdominal symptoms
- Diagnosis
  - By segments with “egg packets” in stools
- Treatment
  - Praziquantel

Thank You!