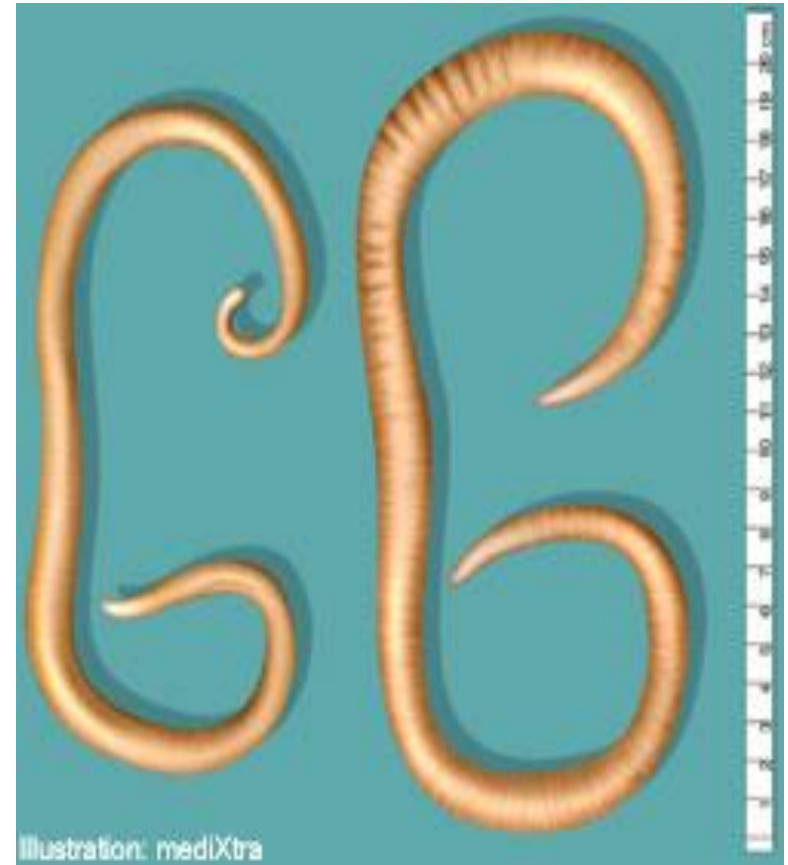
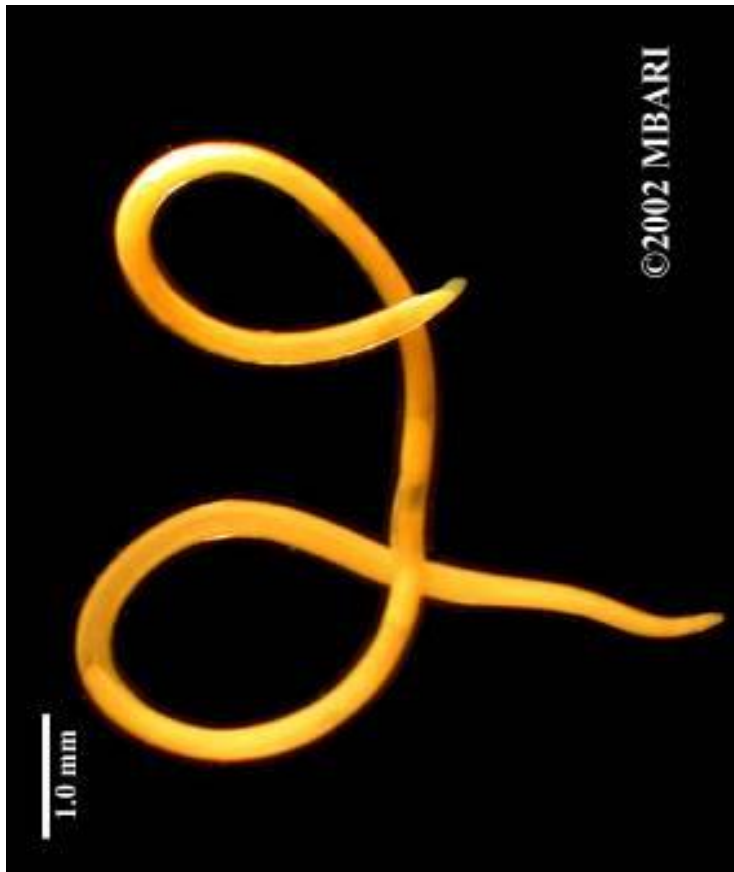


Introduction to Nematode

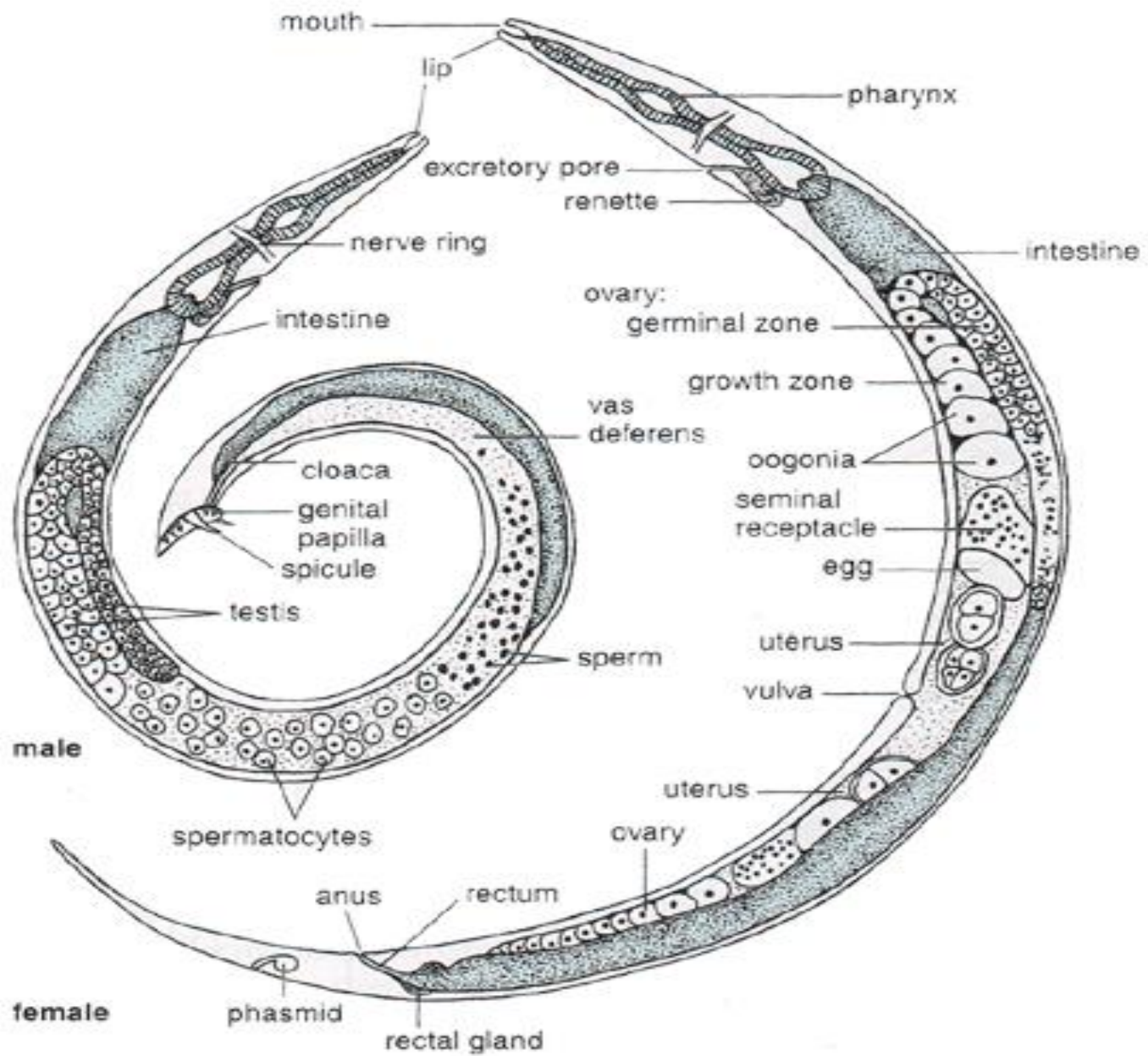
Nematode



General features

- Unsegmented, elongated, cylindrical body that is round in cross section
- Both ends are pointed
- Bilaterally symmetrical
- Size vary from 2 mm to 1 meter
- Body is covered with tough cuticle
- Sexes are separate
 - male smaller than female



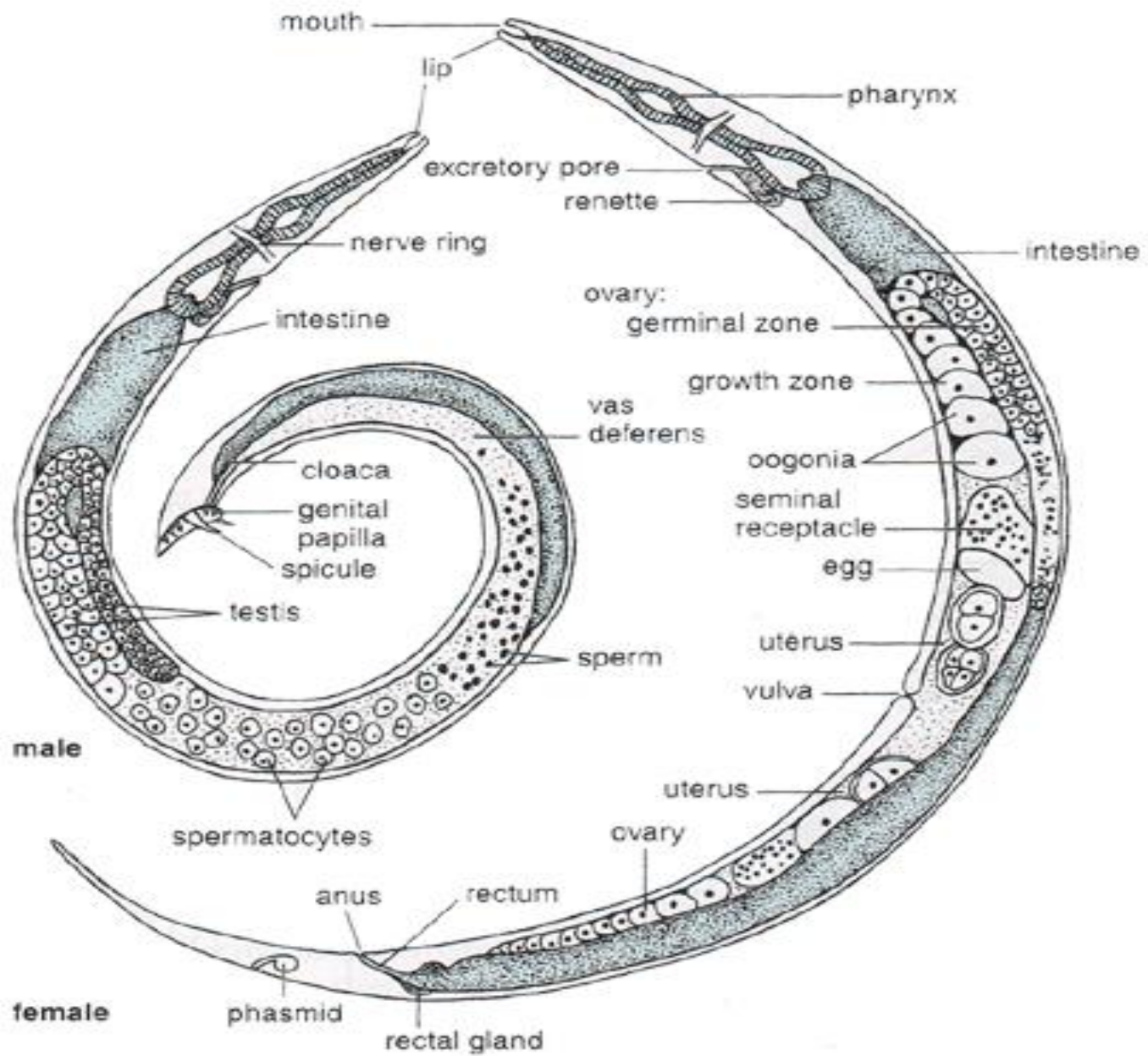


Alimentary system

- Complete - mouth, digestive tract & anus
- Mouth – teeth or cutting plates (buccal capsule)
- Digestive tract – esophagus & intestine
 - Esophagus – cellular or muscular, may be bulbous posteriorly
 - Intestine – lined up with single layer of cuboidal or columnar epithelium
- Anus – opens at
 - posterior end along with cloaca in male
 - sub-terminally in female

Reproductive system

- Male reproductive system
 - Single convoluted tubule –
 - single testis, vas deferens, seminal vesicle & ejaculatory duct which opens in cloaca
 - Accessory copulatory organs – 2 spicules at posterior end



Female reproductive system

- Single or double convoluted tubule
 - Single or two ovaries
 - Oviduct
 - Seminal receptacle
 - Uterus
 - Vagina
 - Vulva

Laying down of eggs/larva

- Oviparous
 - Lays eggs
 - *A.lumbricoides*, *T.trichuria* – unsegmented ovum
 - *A.doudenale*, *N.americanus* – segmented ovum
 - *E.vermicularis* – eggs containing larva
- Viviparous
 - Lays larva
 - *W.bancrofti*
 - *B.malayi*
 - *T.spiralis*
- Ovoviviparous
 - Lays eggs containing larvae
 - *S.stercolaris*

Classification - Habitat

Intestinal nematode

- *Ancylostoma duodenale*
- *Ascaris lumbricoides*
- *Strongyloides stercoralis*
- *Trichinella spiralis*
- *Trichuris trichiura*
- *Enterobius vermicularis*

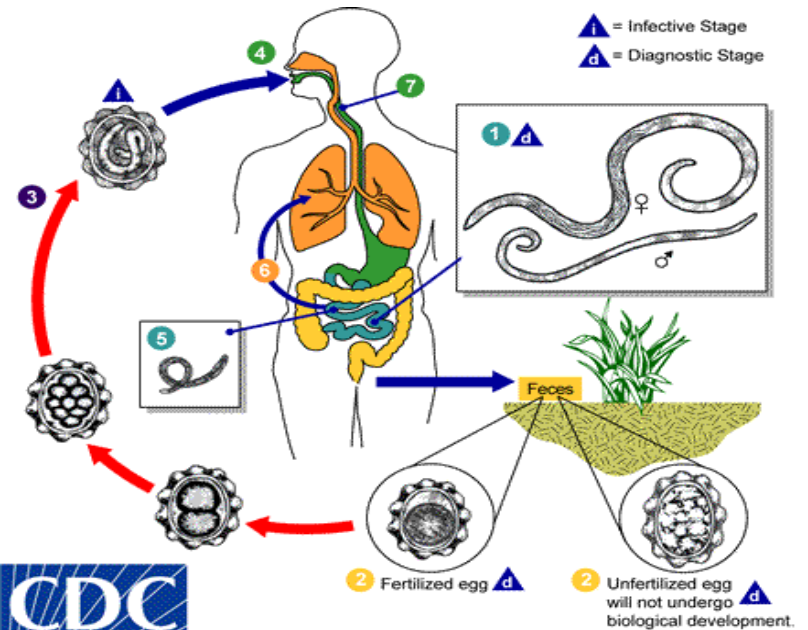
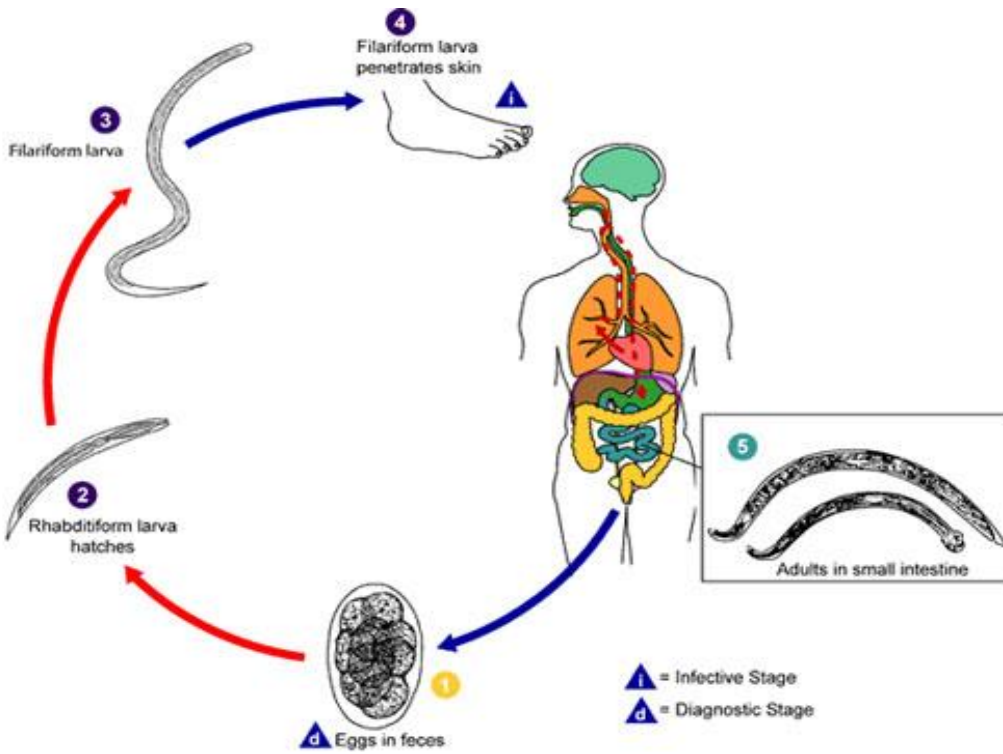
Tissue (somatic) nematode

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

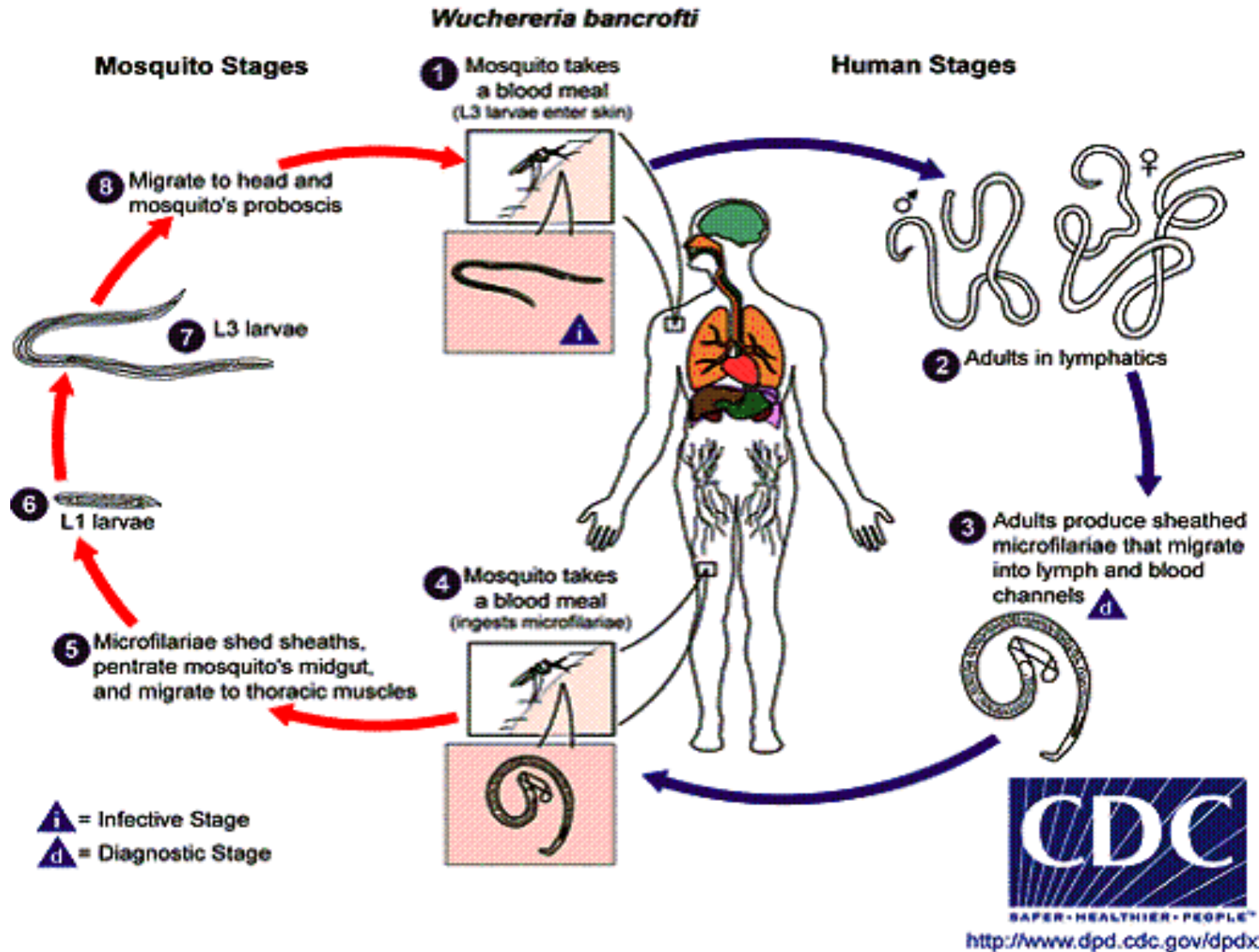
Size of worms

- Millimeter
 - *T.spiralis* – 1-4 mm
 - *S.stercoralis* - 2-3 mm
 - *A.duodenale* – 8-10 mm
 - *E.vermicularis* – 4 – 12 mm
- Centimeter
 - *T.trichiura* – 4-5 cm
 - *A.lumbricoides* – 15-30 cm
- Meter
 - *D.medenenensis* – 1 meter

Life cycle



Life cycle – tissue nematode



Pathogenicity

- G-I disturbances
- Malnutrition
- Anemia
- Appendicitis
- Skin manifestation – ground itch, creeping eruption
- Disseminated infection
- Muscle spasm, oedema
- Elephantiasis

Lab diagnosis

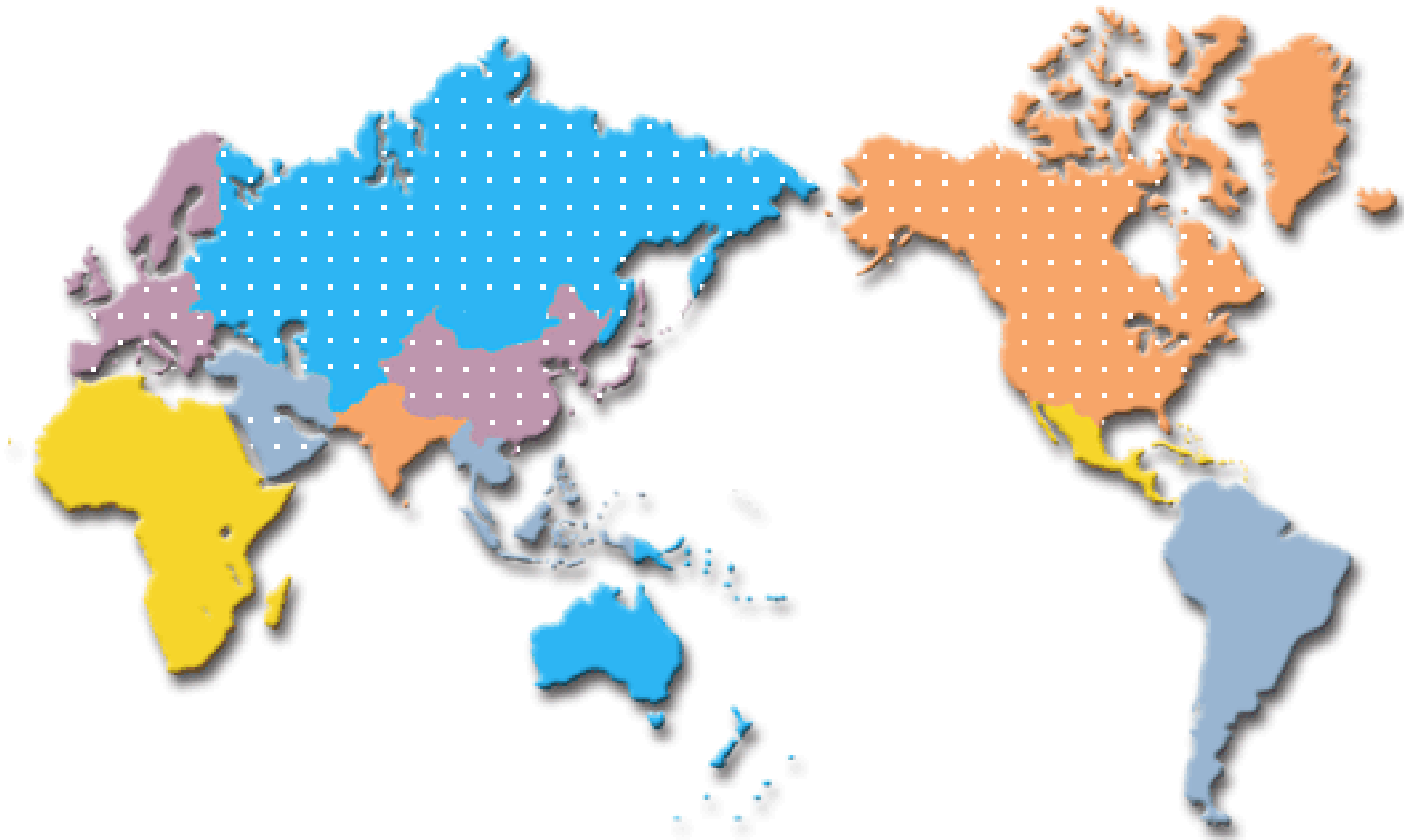
- Stool examination
 - Macroscopic
 - Microscopic
 - Concentration technique
- Serology
- Blood examination
 - Eosinophilia
 - PBS - microfilaria

Trichinella spiralis

History

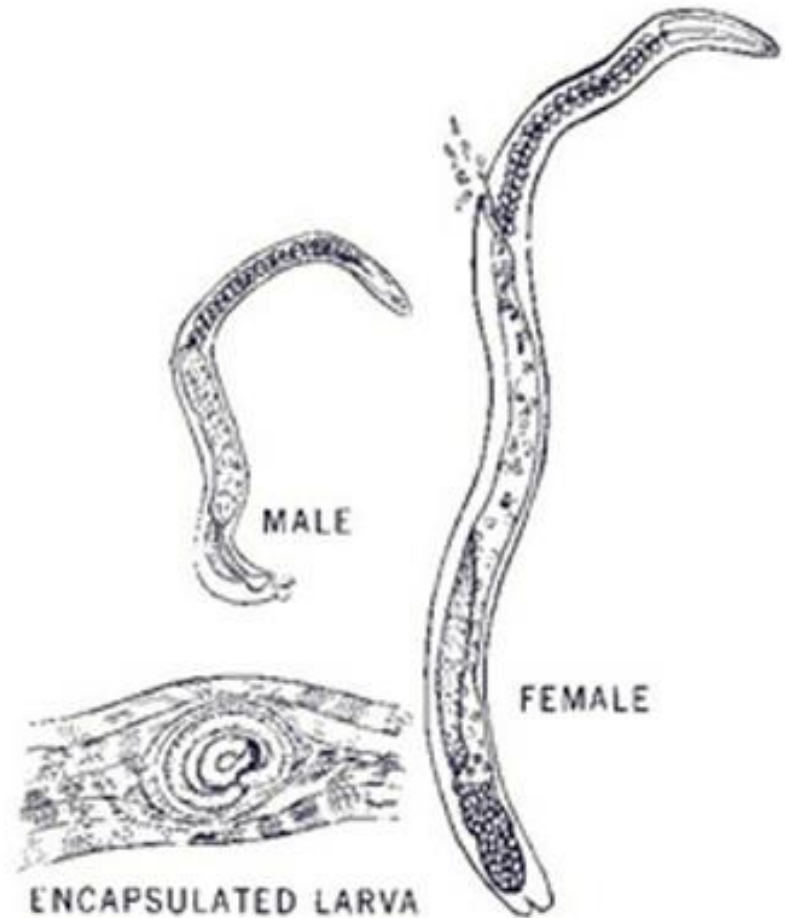
- Tiderman-1821 - Germany described disease
- Herrick – 1909 – described morphology of worm

Geographical distribution



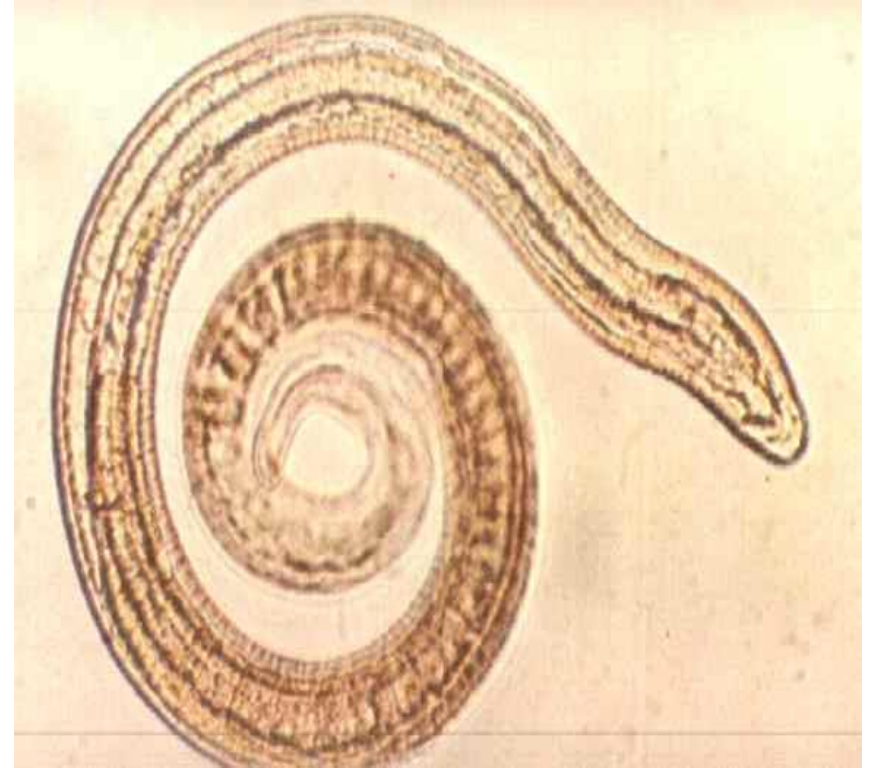
Habitat

- Adult worms residing in intestine produce larva
- Larva are encapsulated in tissue i.e.. striated muscles



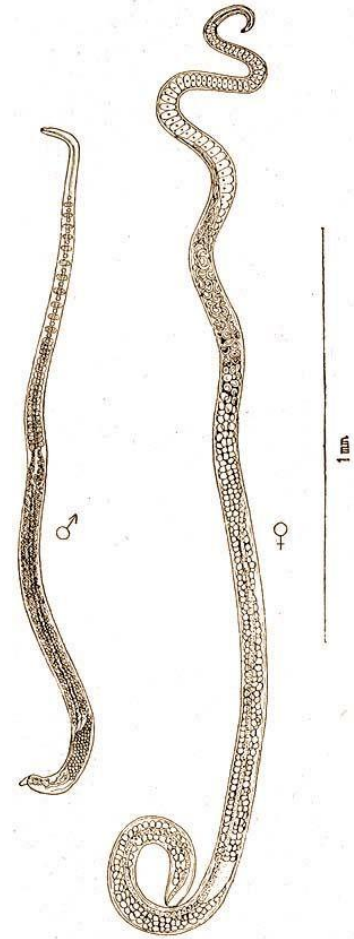
Morphology

- One of smallest of nematode
- Whitish & thread like
- Just visible to naked eye
- Esophagus occupies one third to half of body
- Joins intestine to end posteriorly in anus
- Worm wider posteriorly than anteriorly



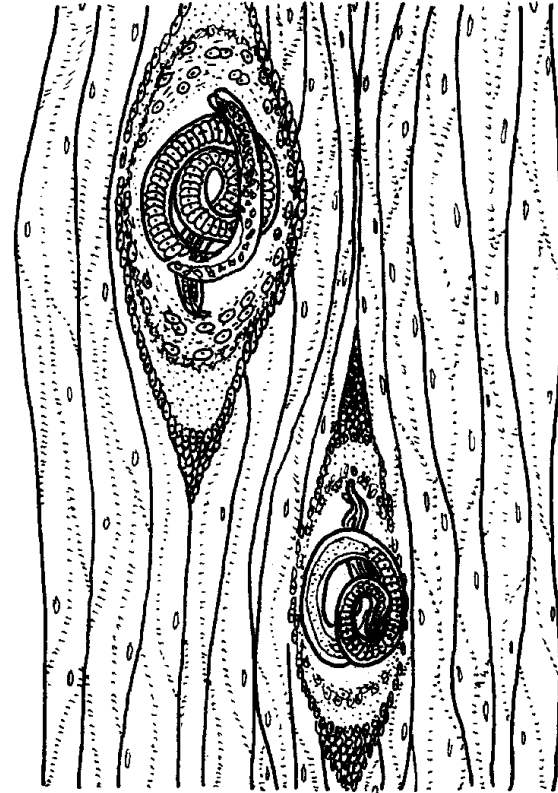
Morphology (contd)

- Male :
 - 1.4 mm to 1.6 mm × 0.03 mm in diameter
 - Lacks copulatory sheath
 - Two conical papillae on either side of tail
 - Dies after fertilization of female
- Female :
 - 3-4 mm L × 0.04 mm diameter
 - Viviparous
 - Life span – 4 months
 - 1000 to 1500 larva



Larvae

- $100\ \mu \times 6\ \mu$
- Produced in intestine
- Carried out by circulation to all parts of body
- Invade striated muscles, encapulate there
- Form a lemon shaped cyst, larva remains coiled inside it
- Lies longitudinally along muscle fibers

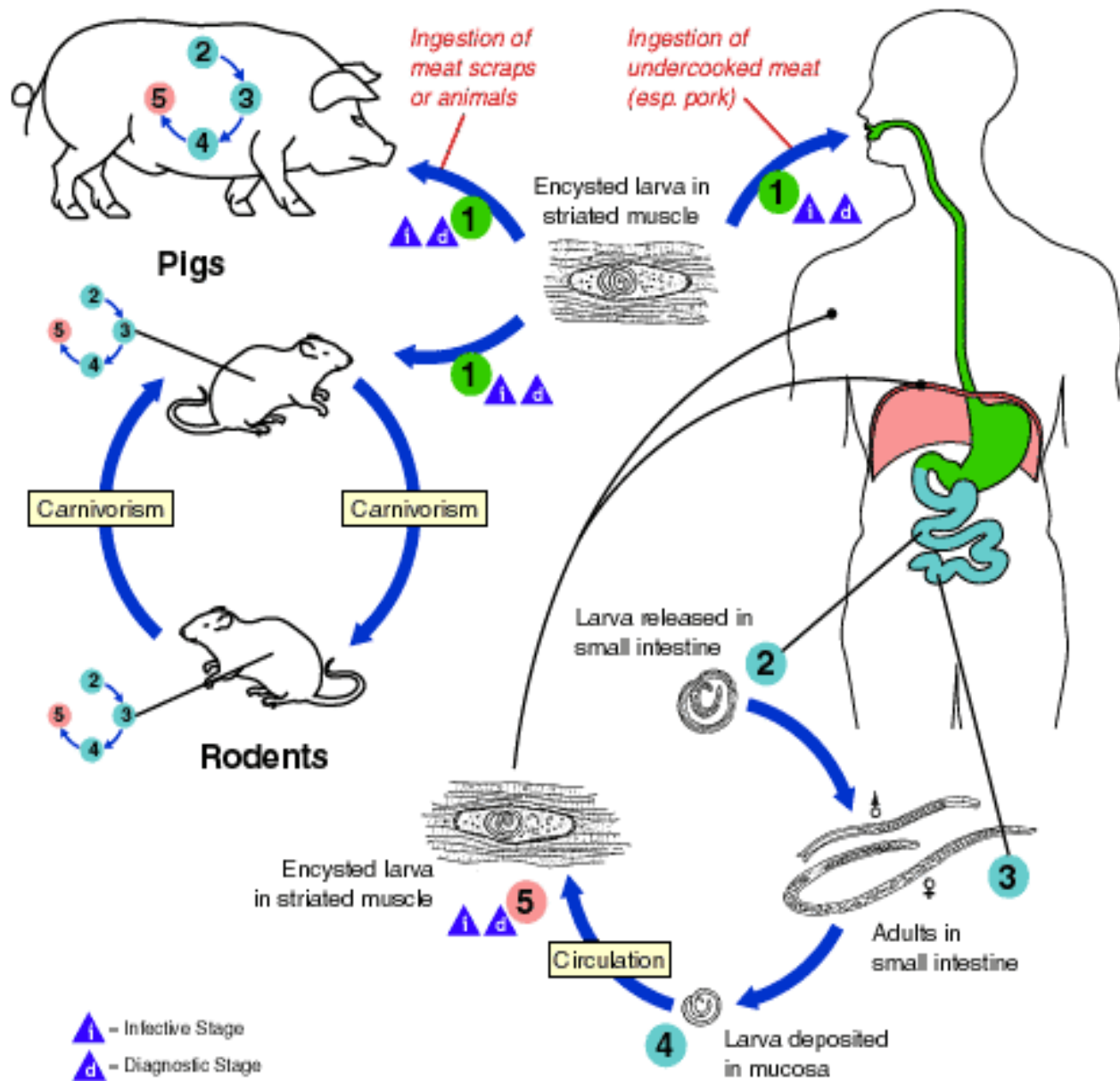


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Life cycle

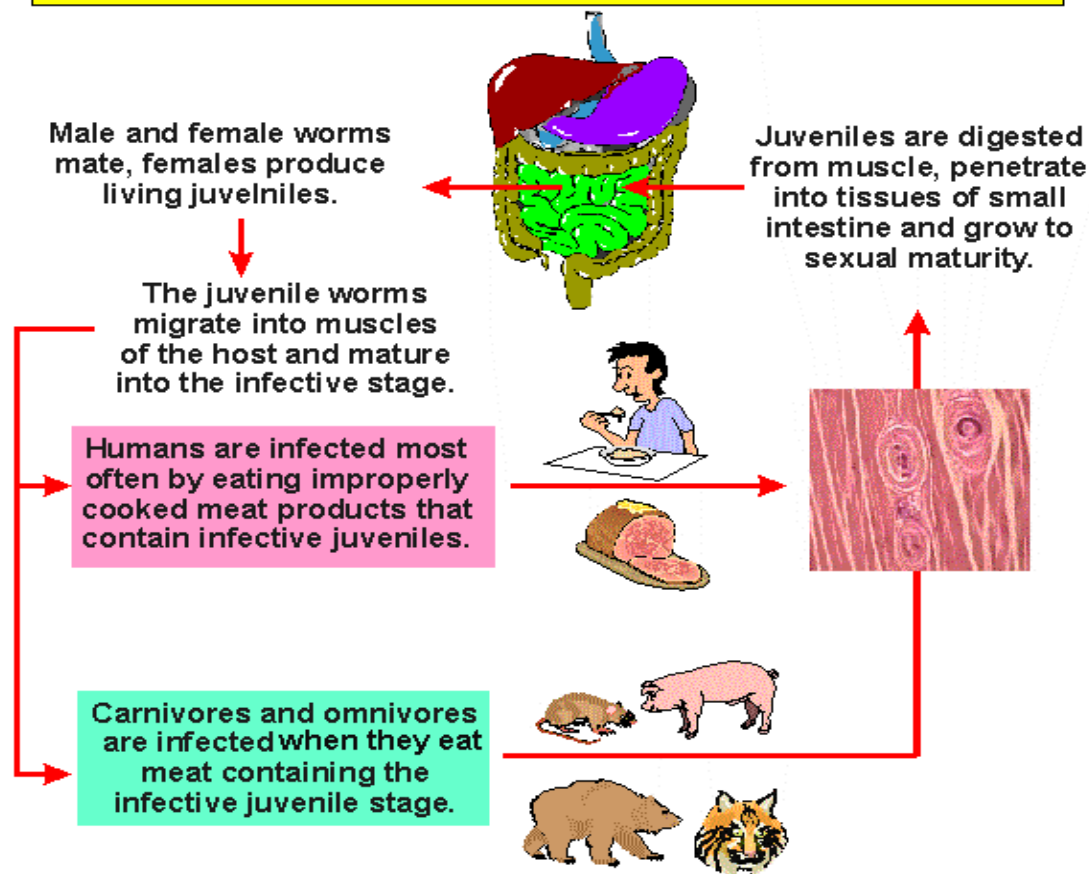
- Only one host is required to complete life cycle
- Primary host – rat, pig or other carnivores which also serve as reservoir host for man
- Transmission – occurs in nature from
 - Rat to Rat/Pig
 - Pig to pig/rat
 - Pig to other carnivores/human
 - Human – dead end



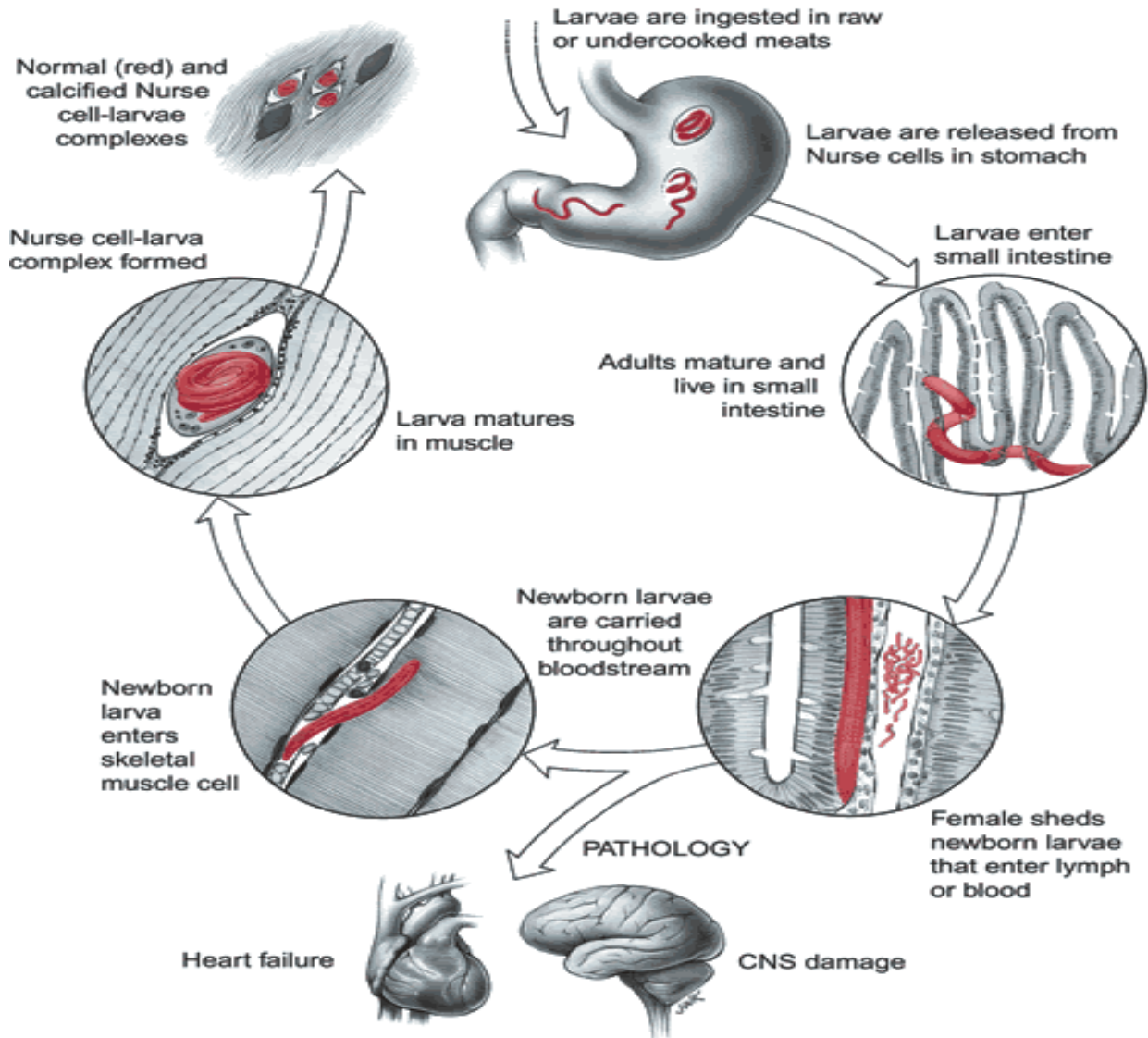
Life cycle

- Source of infection : undercooked or uncooked meat containing encysted larva
- Mode of infection : ingestion

The Life Cycle of *Trichinella spiralis* (causing trichinosis or trichinellosis in human)



(Parasites and Parasitological Resources)



Number to remember...

- To produce adult worm intestine from larva : **2 days**
- To produce larva by adult female : **4 to 7 days**
- Life span of female : **4 months**
- Number of larvae produced : **1000 to 1500**
- Localization of larva :
 - Extra ocular muscles of eye
 - Tongue, deltoid, pectoral, intercostals & gastrocnemius & diaphragm
 - Muscle biopsy usually taken from deltoid muscles

Clinical disease

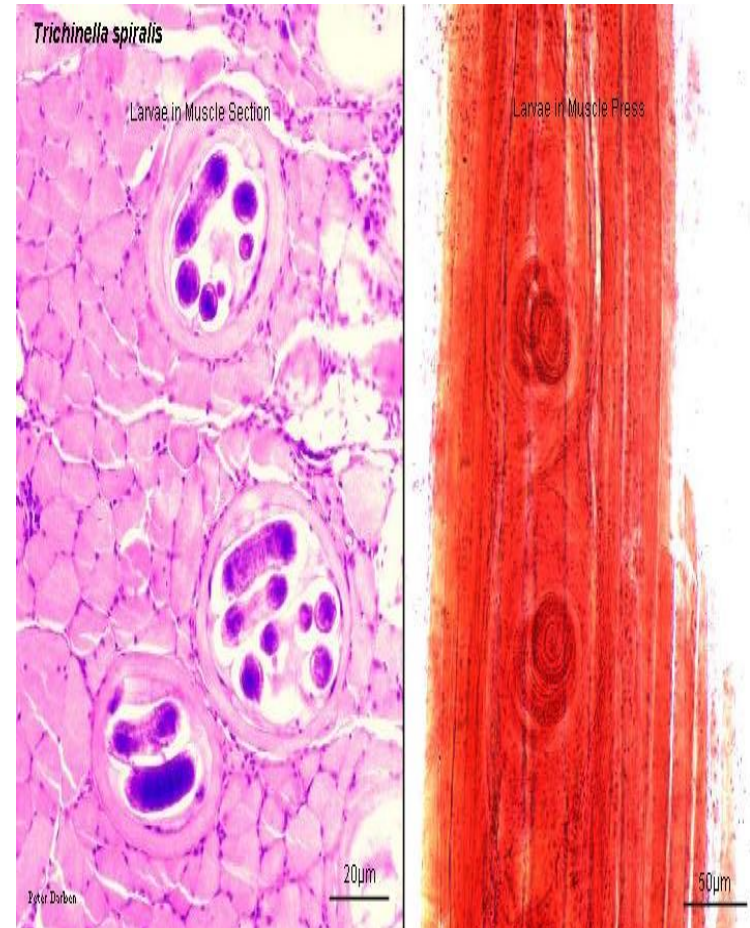
- Intestinal stage :
 - *Nausea, vomiting, diarrhea & abdominal pain*
- Migratory stage :
 - *Pneumonitis, muscle tenderness, neurological symptoms & **splinter hemorrhage in nail***
- Muscle stage :
 - Larval encystment leads to inflammation around infected muscles : **tenderness, spasm & edema**
 - Heavy parasitisation of muscles like diaphragm or intercostals may cause **death due to respiratory or cardiac failure**

Laboratory diagnosis

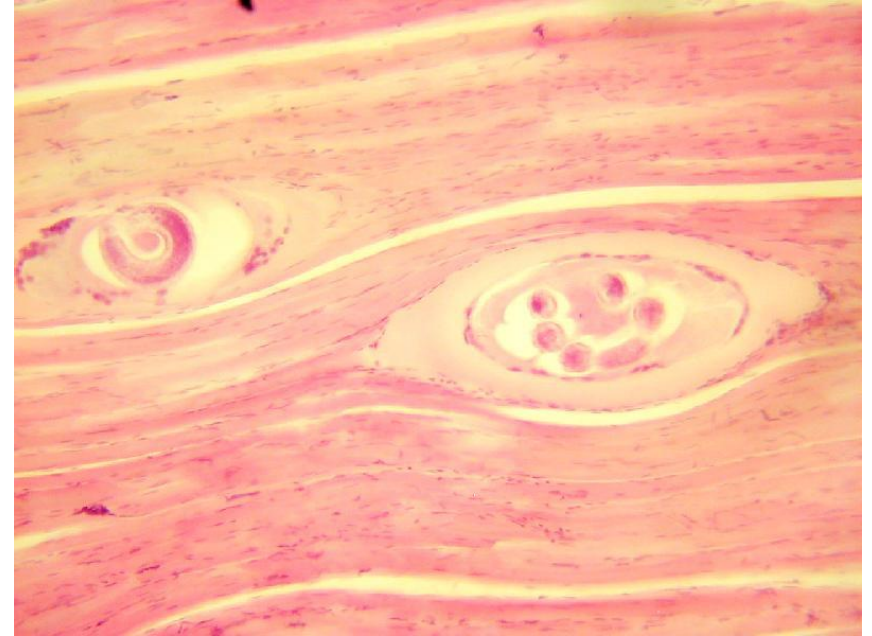
- History : group of peoples are affected or outbreak may be traced to consumption of improperly cooked meat
- Muscle biopsy
- Serology
- Blood examination

Muscle biopsy

- Site : deltoid or gastrocnemius
- Part of muscle tissue is first digested by artificial gastric juice & sediment obtained is observed
- Section are prepared & stained by HE



Muscle biopsy



Other investigations...

- Serology
 - ELISA antibody detection : positive after 3 weeks of illness, may persist for life time
- Blood examination :
 - Marked eosinophilia

THANK YOU