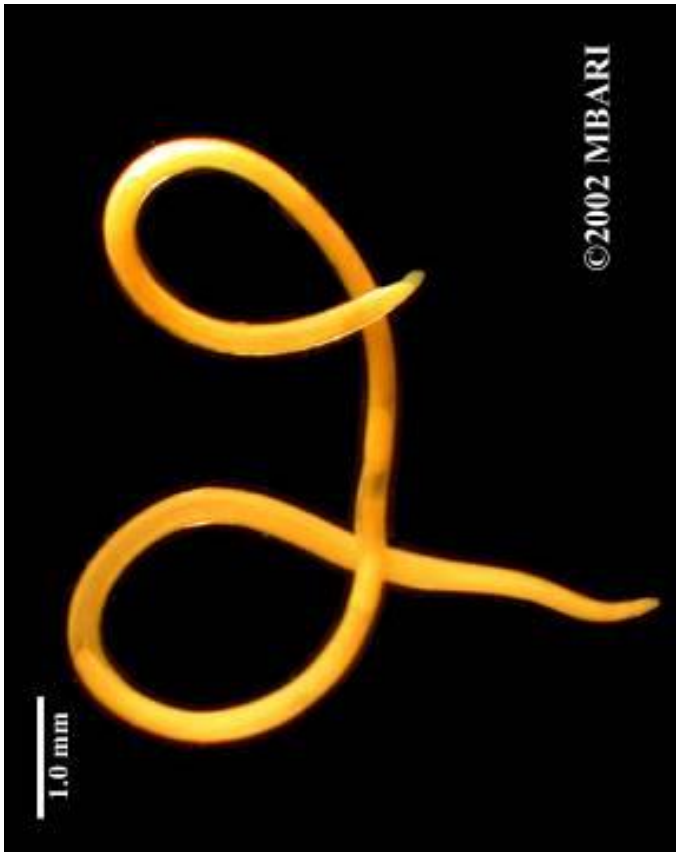
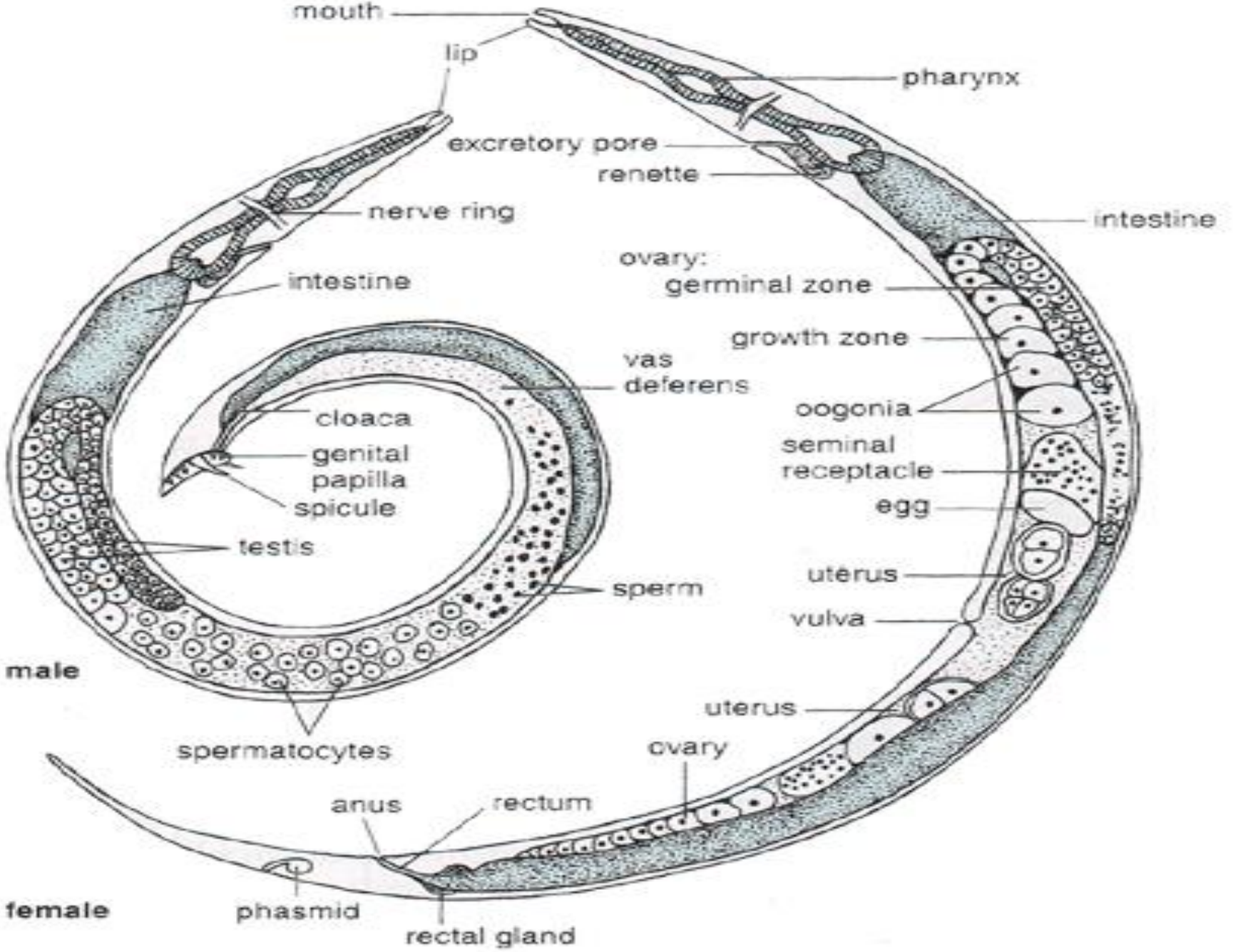
Introduction to Nematode

General features

- Unsegmented, elongated, cylindrical body that is round in cross section
- Both ends are pointed
- Bilaterally symmetrical
- Size vary from 5 mm to 1 meter
- Body is covered with tough cuticle
- Sexes are separate, male smaller than female

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lip
pharynx
excretory pore
renette
nerve ring
intestine
ovary:
germinal zone
intestine
growth zone
vas
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cloaca
seminal
receptacle
genital
papilla
egg
spicule
testis
uterus
sperm
vulva
male
uterus
spermatocytes
ovary
anus
rectum
female
phasmid
rectal gland

Alimentary system

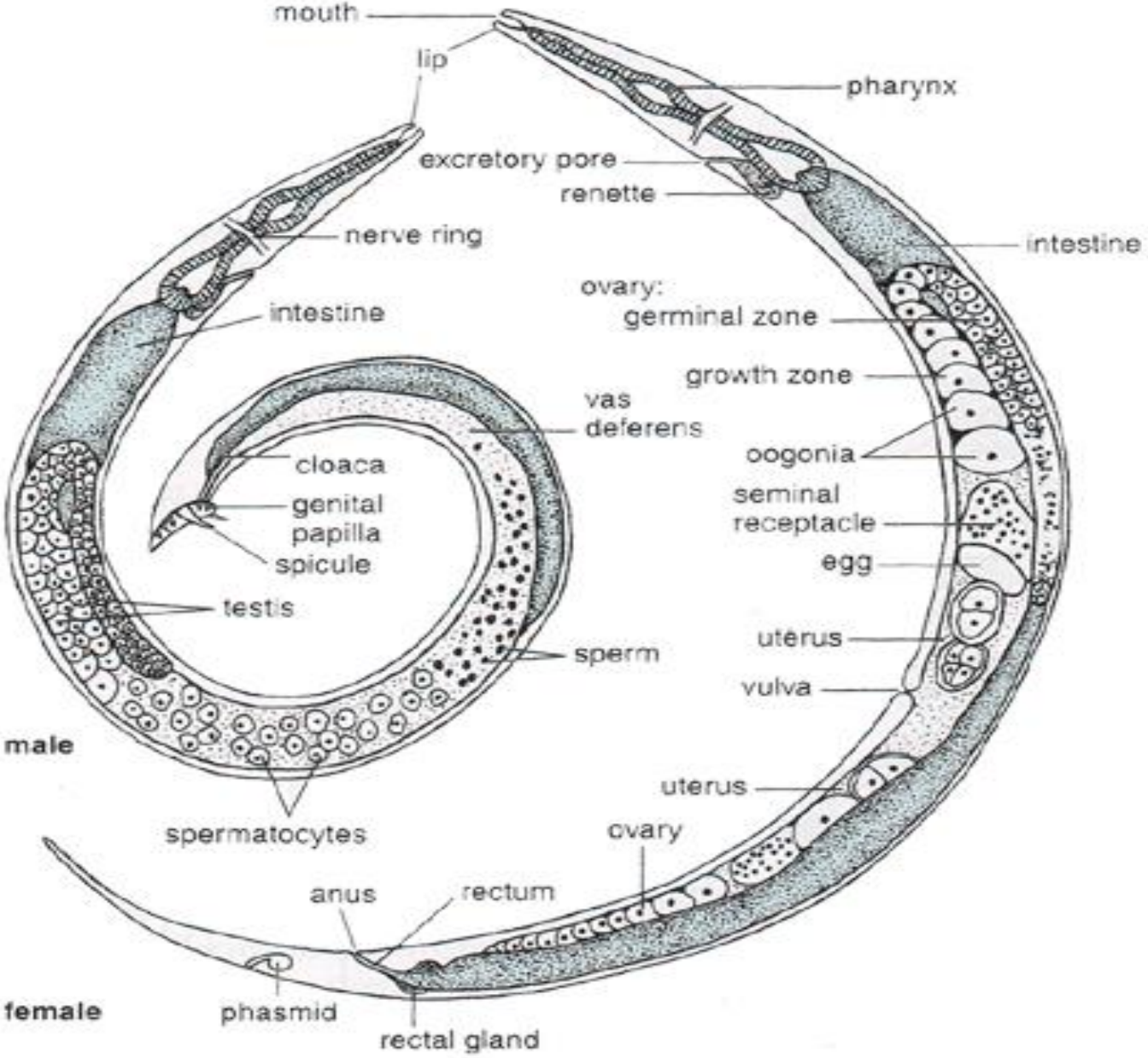
- Complete - mouth, digestive tract & anus
- Mouth – teeth or cutting plates (buccal capsule)
- Digestive tract – esophagus & intestine
  - Esophagus – cellular or muscular, may be bulbous posteriorly
  - Intestine – lined up with single layer of cuboidal or columnar epithelium
- Anus – opens at posterior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

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 and gubernaculum at dorsal end

Female reproductive system

- Single or double convoluted tubule
  - Single or two ovaries
  - Oviduct
  - Seminal receptacle
  - Uterus
  - Vagina
  - Vulva
- Genital pore – open at middle of the body or near the mouth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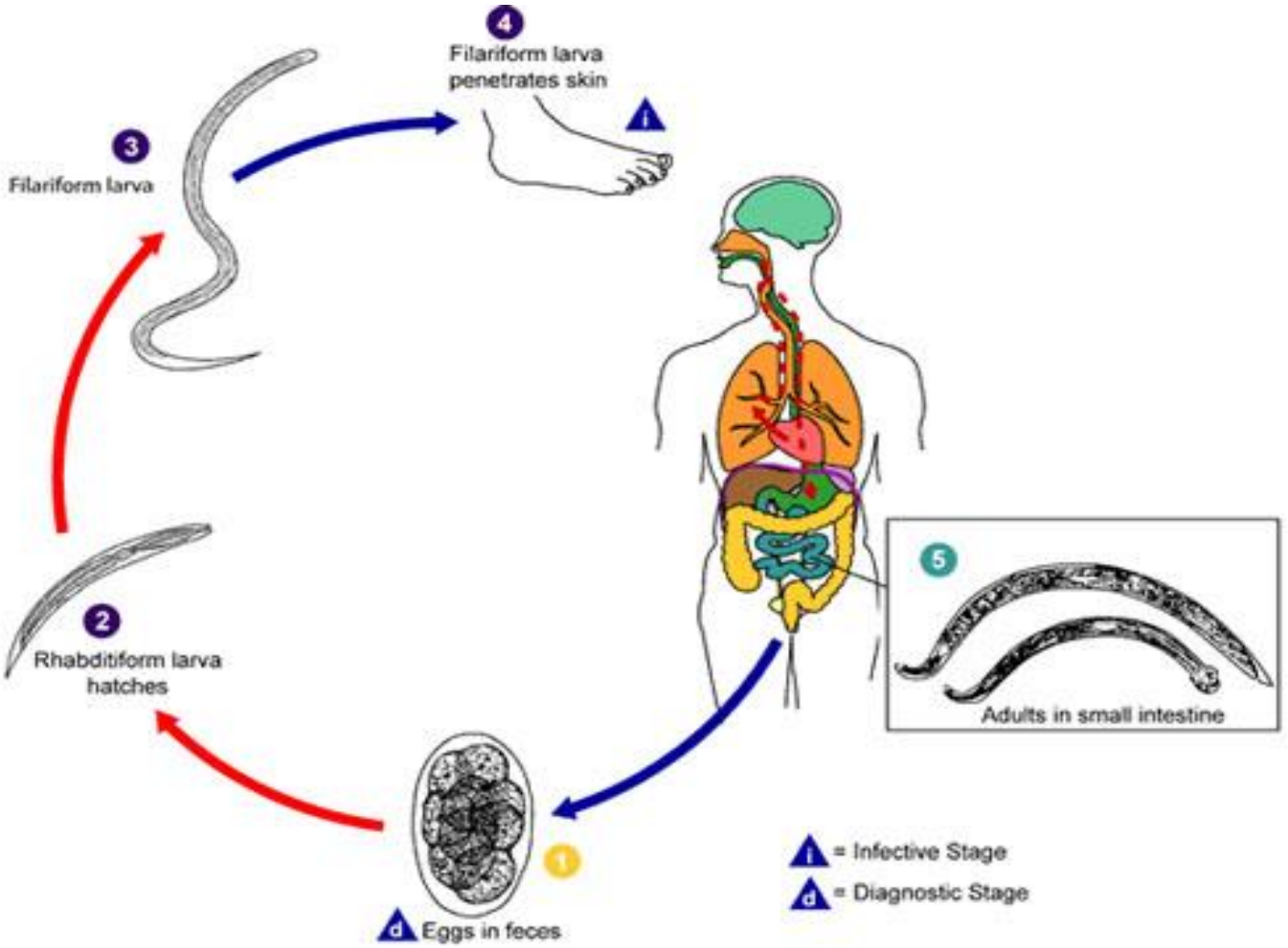
Laying down of eggs/larva

- 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
- Ovoviviparous
  - Lays eggs containing larvae which immediately hatch out
    - S.stercolaris

Life cycle


4
Filariform larva
penetrates skin
i
3
Filariform larva
2
Rhabditiform larva
hatches
5
Adults in small intestine
1
d
Eggs in feces
i = Infective Stage
d = Diagnostic Stage

Classification of Nematodes

Intestinal

Small intestine

- Ascaris lumbricoids
- Ancylostoma duodenale
- Necator Americans
- Strongyloide stercoralis
- Trichinella spiralis

Caecum

- Enterobius vermicularis
- Trichuris trichiura

Somatic

Lymphatic system

- Wuchereria bancrofti
- Brugia malayi

Subcutaneous tissue

- Loa loa
- Onchocerca volvulus
- D. medinensis

Trichinella spiralis

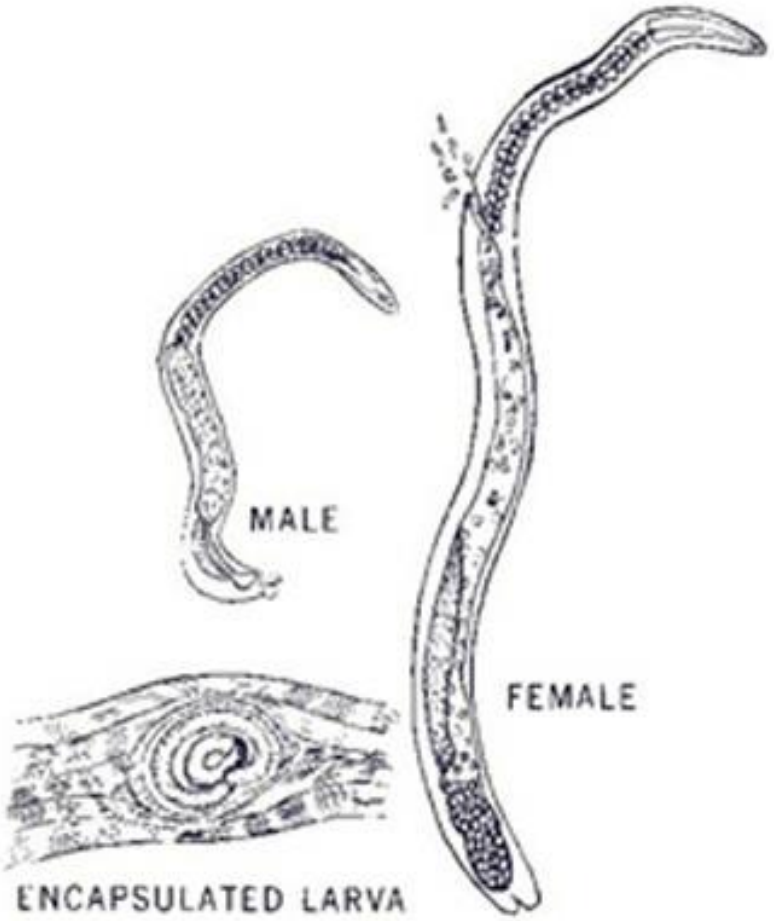
History

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

Habitat

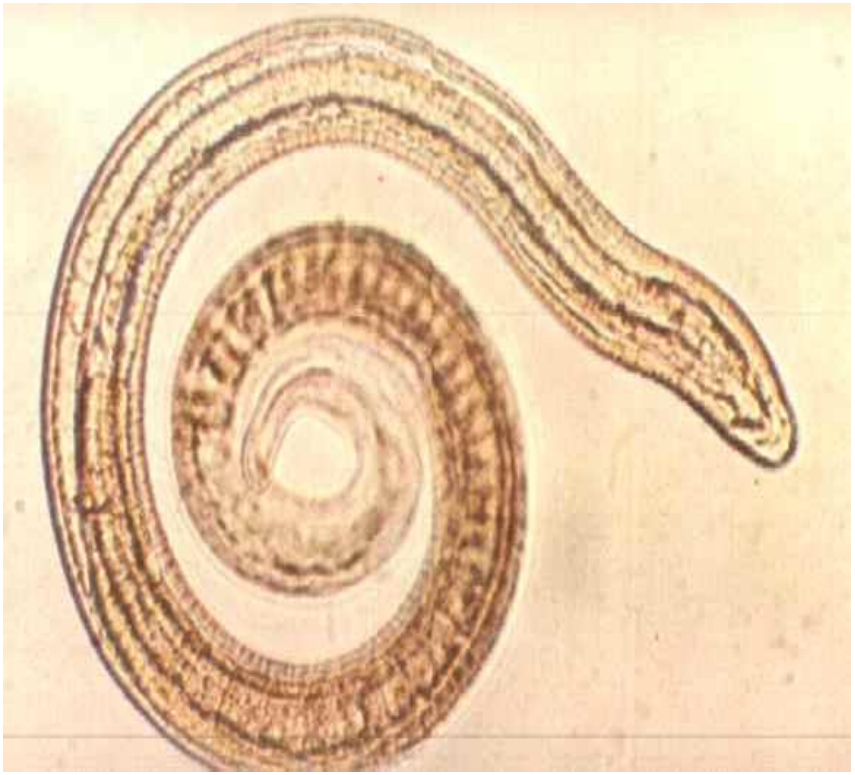
- Adult worms residing in intestine produce larva

- Larva are encapsulated in tissue i.e.. striated muscles



Morphology

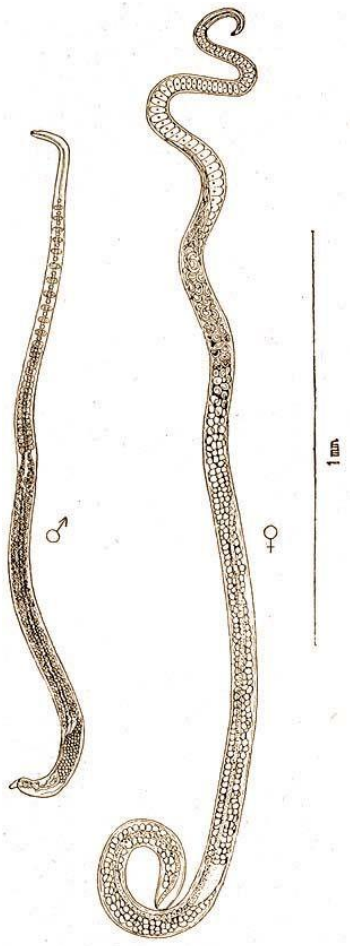
- One of smallest of nematode
- Whitish & thread like
- Just visible to naked eye
- Esophagus occupies one third to half of body
- Joins intestine to end posteriorly in anus
- Worm wider posteriorly than anteriorly



Morphology (contd)

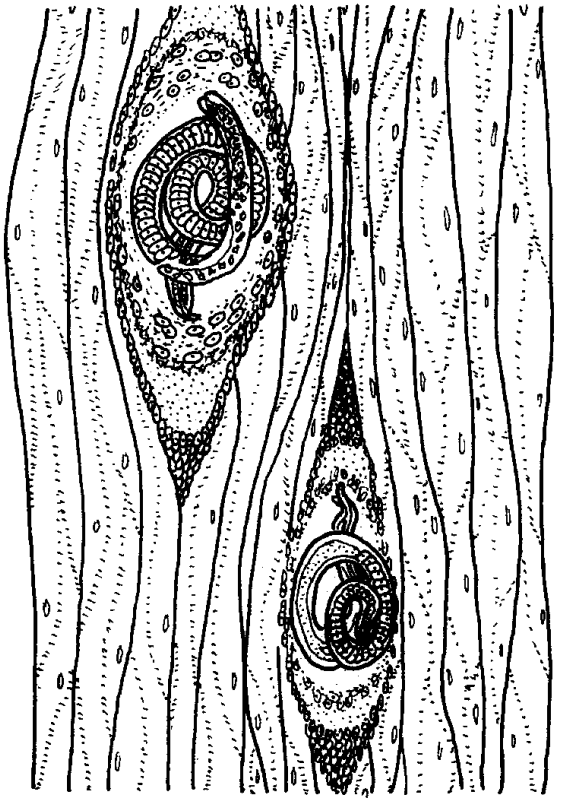
- Male :
  - 1.4 mm to 1.6 mm × 0.03 mm in diameter
  - Lacks copulatory sheath
  - Two conical papillae on either side of tail
  - Dies after fertilization of female

- Female :
  - 3-4 mm L × 0.04 mm diameter
  - Viviparous
  - Life span – 4 months
  - 1000 to 1500 larva



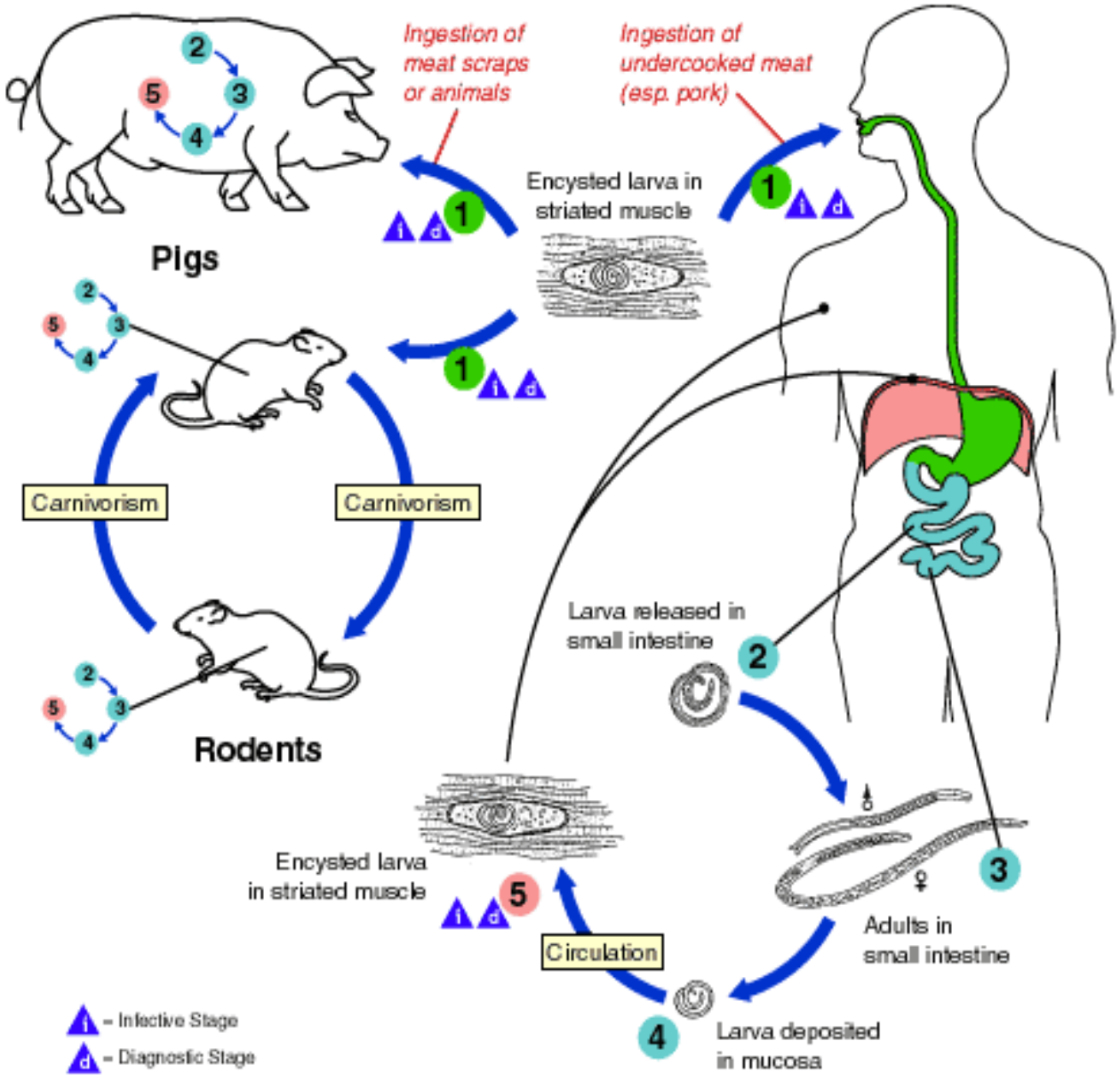
Larvae

- 100 µ × 6 µ
- 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



Life cycle

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


Ingestion of meat scraps or animals
Ingestion of undercooked meat (esp. pork)
Encysted larva in striated muscle
Pigs
Carnivorism
Carnivorism
Rodents
Larva released in small intestine
Encysted larva in striated muscle
Adults in small intestine
Circulation
Larva deposited in mucosa
i = Infective Stage
d = Diagnostic Stage

Life cycle

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

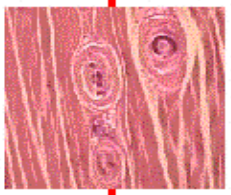
The Life Cycle of *Trichinella spiralis*
(causing trichinosis or trichnellosis in human)

Male and female worms mate, females produce living juvelniles.

Juveniles are digested from muscle, penetrate into tissues of small intestine and grow to sexual maturity.

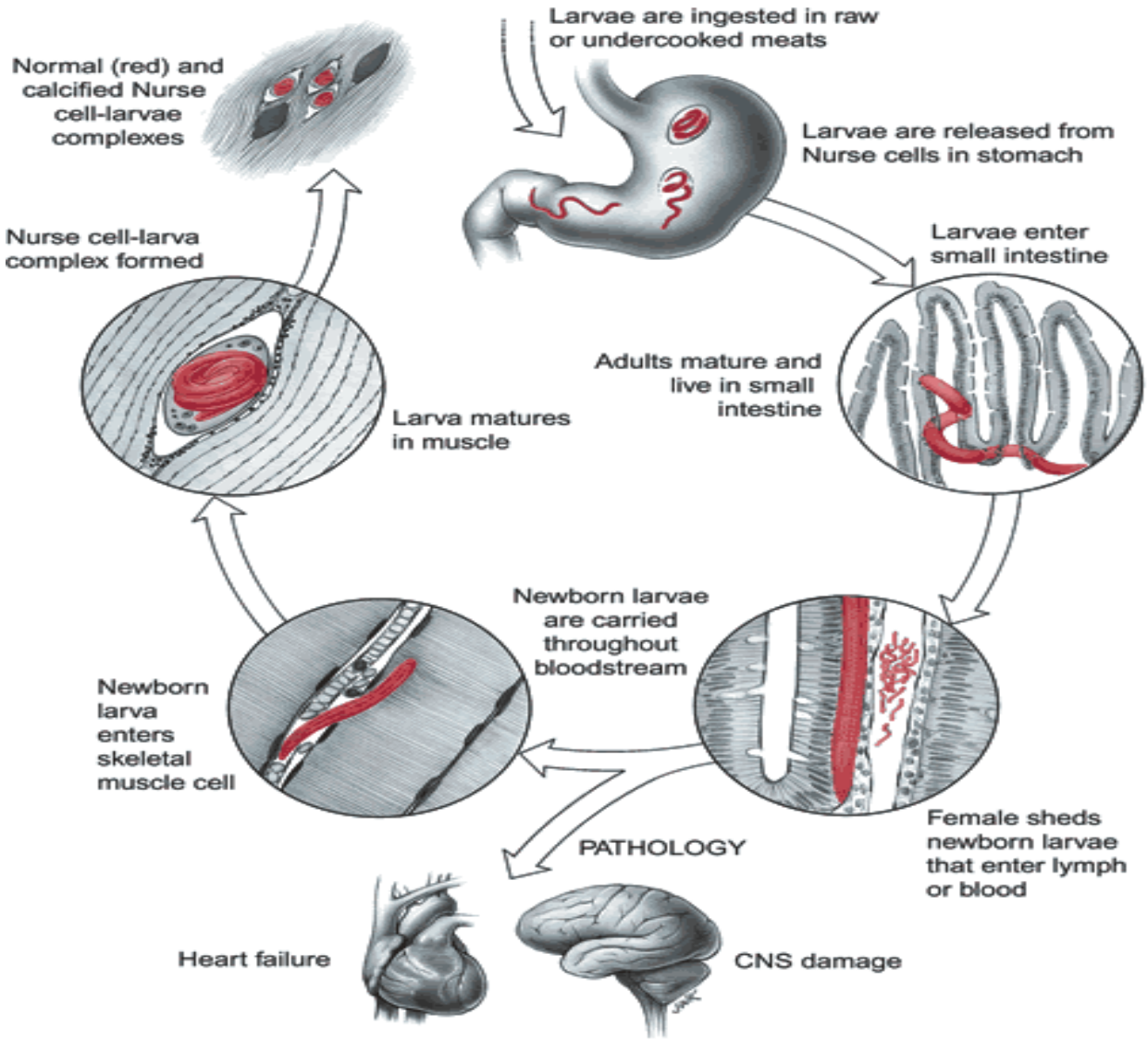
The juvenile worms migrate into muscles of the host and mature into the infective stage.

Humans are infected most often by eating improperly cooked meat products that contain infective juveniles.



Carnivores and omnivores are infected when they eat meat containing the infective juvenile stage.

(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 parasitasation of muscles like diaphragm or intercostals may cause **death due to respiratory or cardiac failure**

PROGRESSIVE SYMPTOMS OF TRICHINELLOSIS

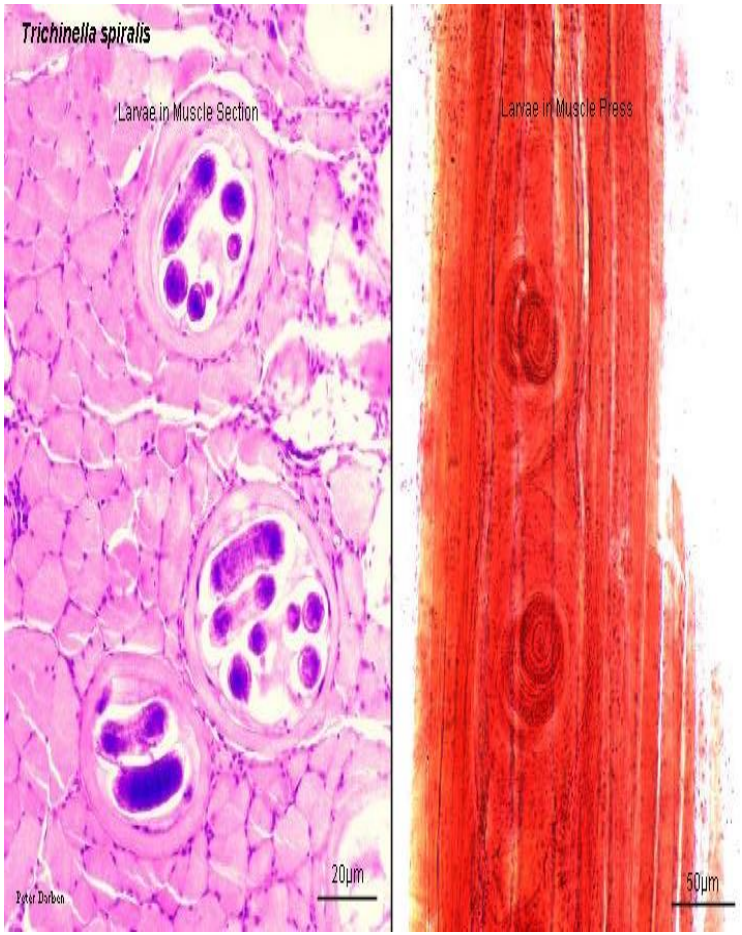
TIME post-infection	Stage of infection	Progressive disease symptoms
12 hrs-2 days	initial penetration and development of larval stages	First symptoms, mild nondescript
30 -32 hrs 5 - 7 days	copulation and female penetration of mucosa	intestinal inflammation and pain, nausea, vomiting, diarrhoea. terminates with facial edema and fever
5 days - 6 wks	New born larvae released into tissues and start migration	focal or localized oedema -face and hands. pneumonia, pleurisy, encephalitis, meningitis, nephritis, deafness, peritonitis. Death from myocarditis.
10 days - 6 wks	larvae start to penetrate muscle cells	muscular pain, breathing difficulties, swelling of masseter muscles, weak pulse and low blood pressure, damage to heart. Death as a result of heart failure, respiratory failure, toxaemia or kidney damage.

Laboratory diagnosis

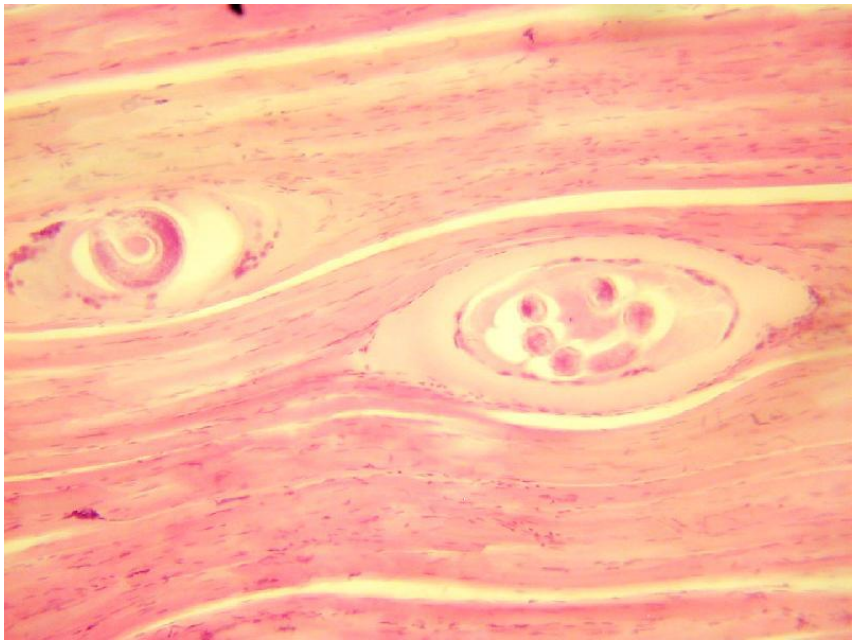
- History : group of peoples are affected or outbreak may be traced to consumption of improperly cooked meat
- Muscle biopsy
- Serology
- Blood examination

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