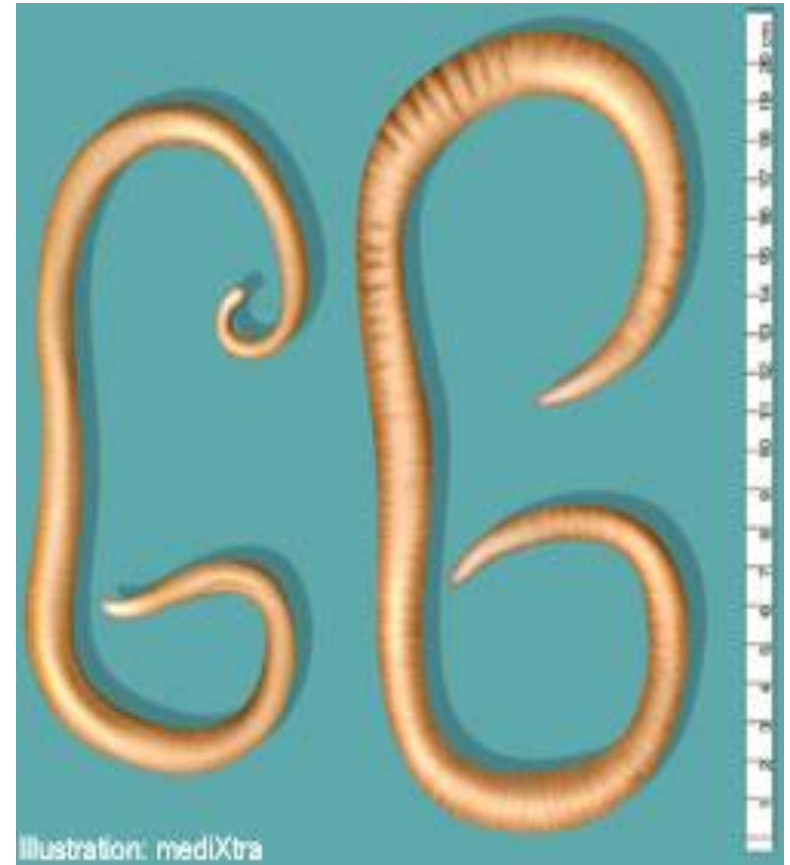
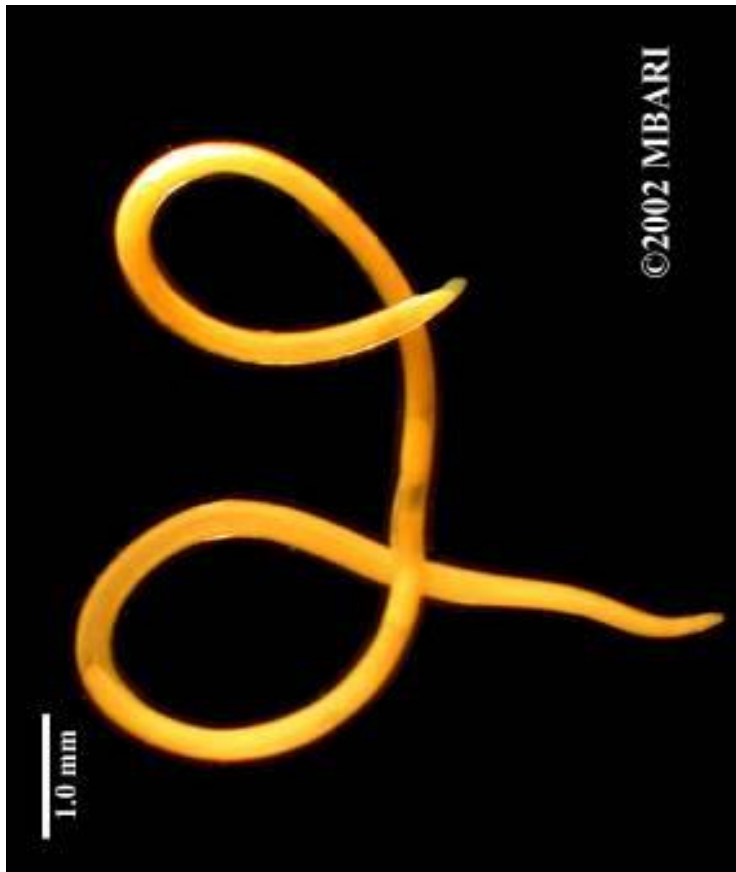


Ascaris lumbricoides

Common name : Round worm

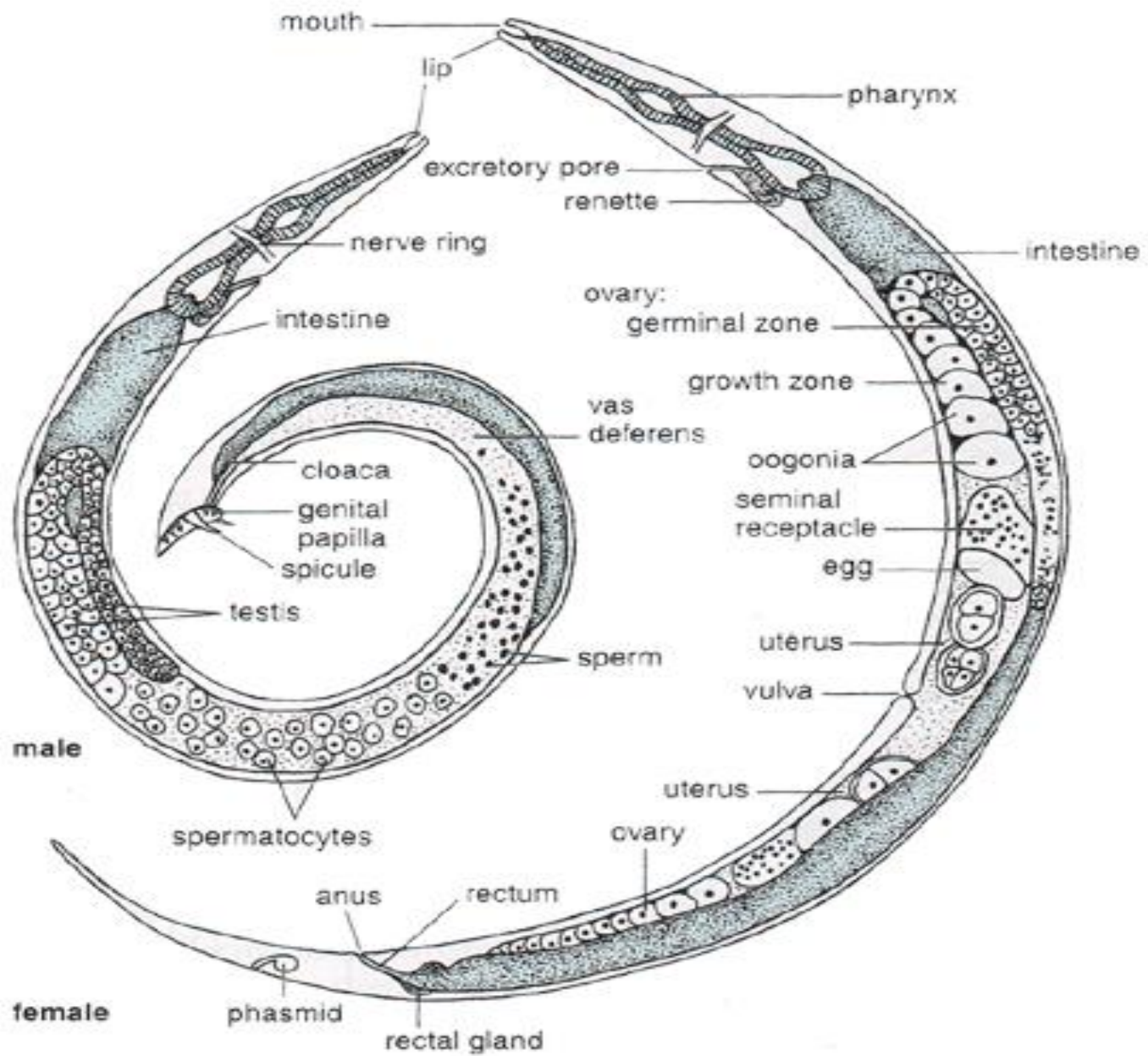
Nematode



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



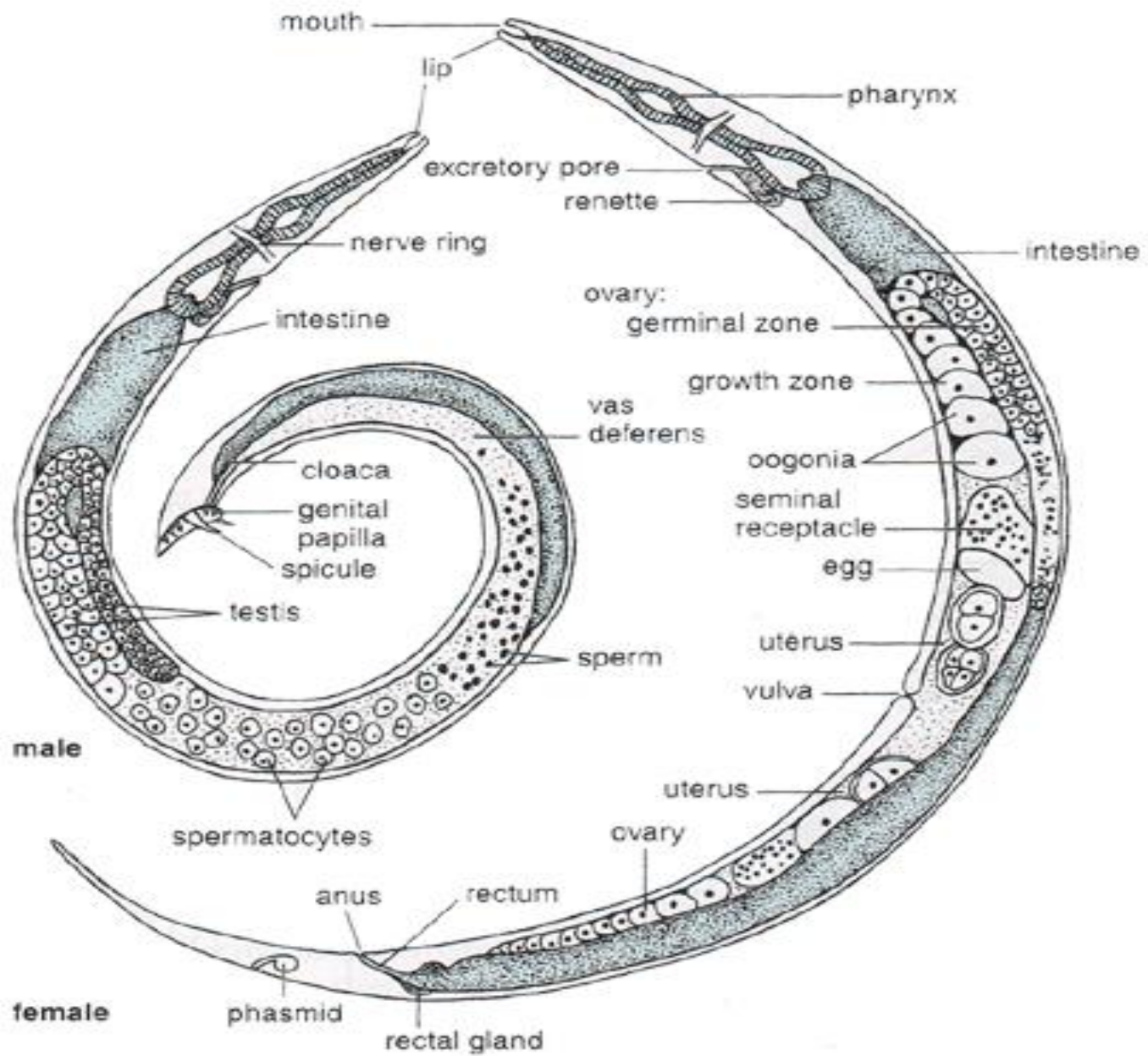


Alimentary system

- 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*

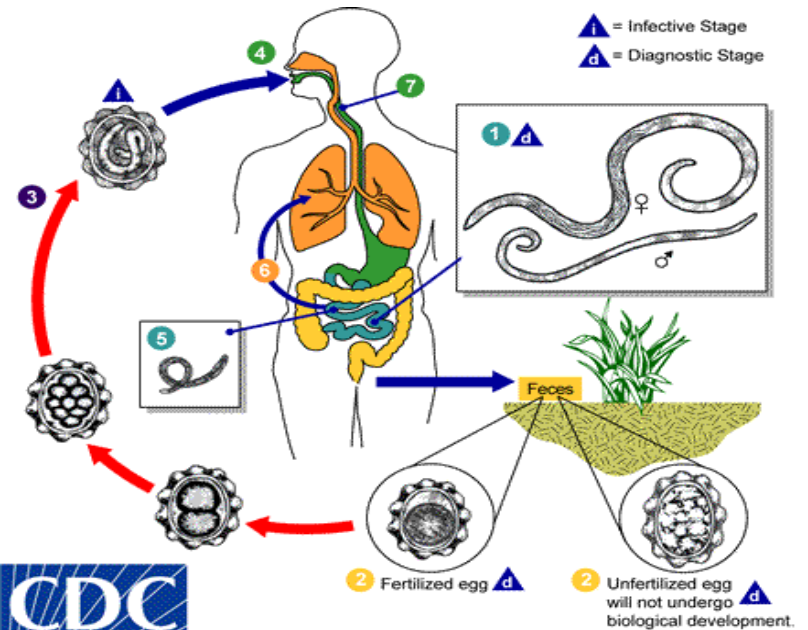
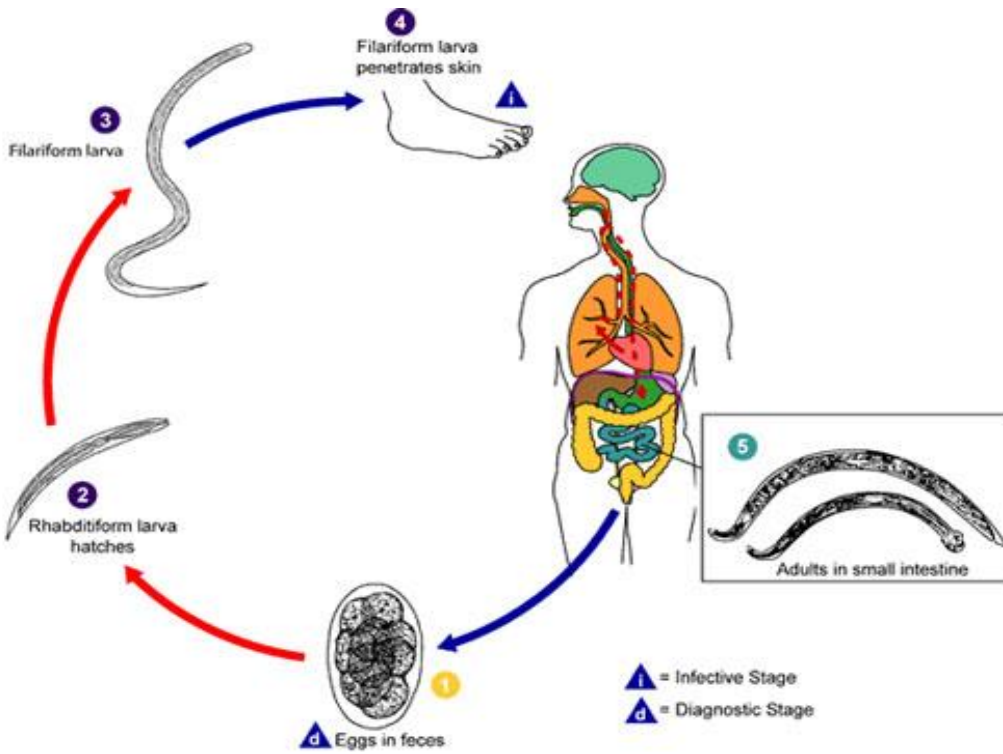
Tissue (somatic) nematode

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

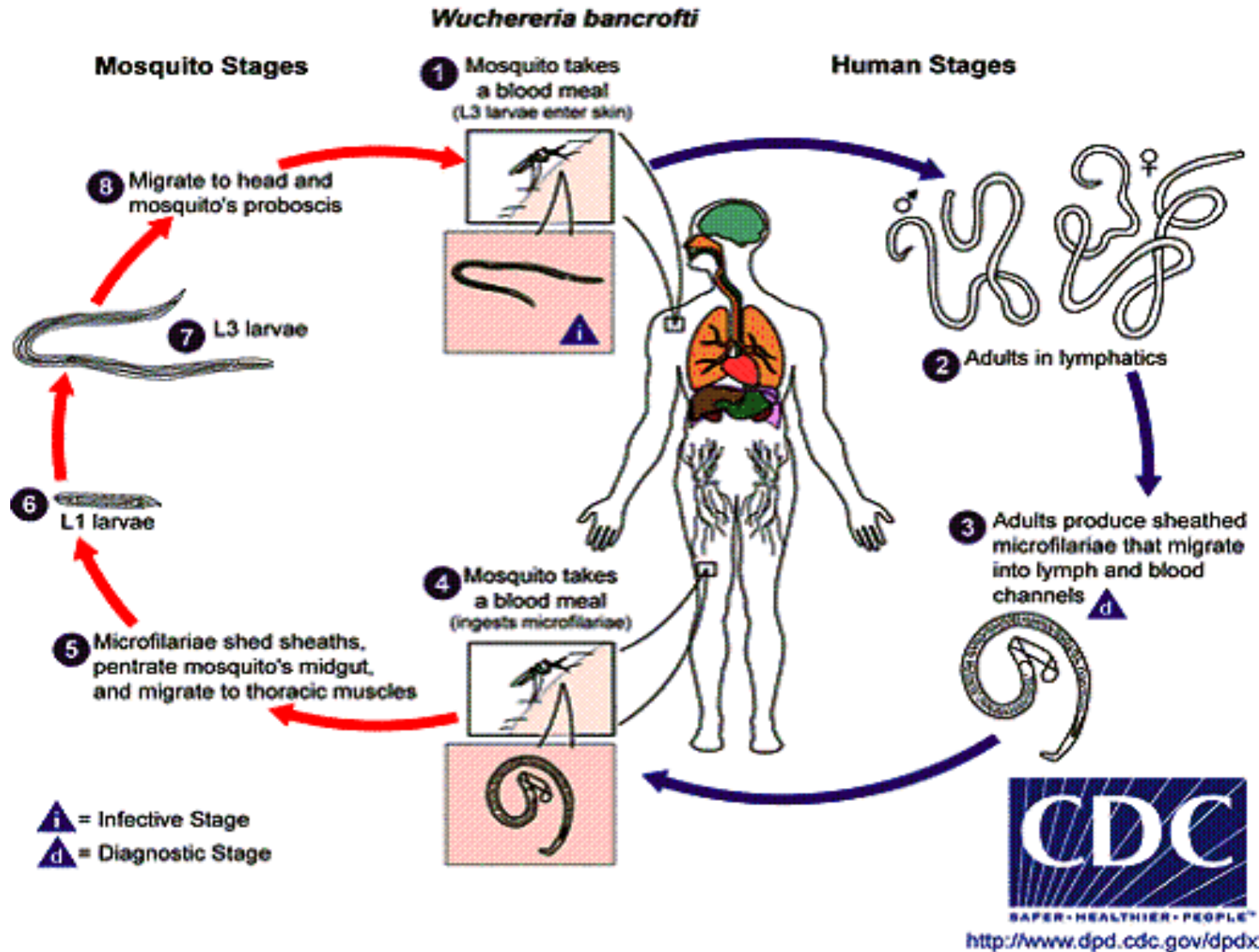
Size of worms

- 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

Introduction

- Largest nematode of human intestine
- Globally, the most common intestinal nematode infection
- More than 1 billion cases
- Common name : Round worm

Habitat

- Adult worm – in lumen of small intestine, 85 % in jejunum, 15 % in ileum
- Maintain their position there by muscle tone
- Move forward by means of spiral movement (against peristalsis)

Morphology

- Appearance : when freshly passed in intestine, light brown or pink in color
- Female – larger than male
- Shape – rounded, taper at both ends, anterior end thinner than posterior



- mouth opens at anterior end, has 3 well developed toothed lips – 1 dorsal & 2 ventral
- Body filled with irritating fluid – ascarion
- Fluid has got irritant action, when leak causes allergic manifestation
- Life span – 1-2 years

Male

- 15 to 30 cm in length
- 2 – 4 mm in diameter
- Tail end is curved ventrally in form of hook
- Tail – conical tip
- Genital pore opens into a cloaca from where 2 curved copulatory spicules protrude
- Testis –single in form of convoluted tube



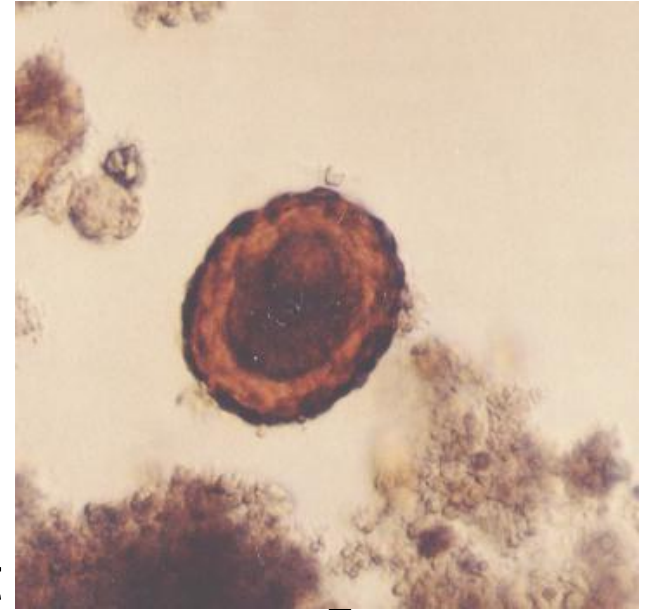
Female

- Longer & stouter
- 30 to 40 cm in length
- 3-6 mm in diameter
- Posterior end is straight & conical
- Anus – sub terminal, opens on ventral aspect of tail end in form of a transverse slit
- Ovaries – paired
- Vulva – situated on ventral surface at junction of anterior and middle third, is narrower & called as vulval waist



Fertilized Eggs

- Round & oval
- 60-75 × 40-50 μ
- Yellow brown – bile stained
- Surrounded by thick translucent albuminous coat
- Some eggs do not have outer layer – decorticated eggs
- Inside – large conspicuous unsegmented ovum with a clear, crescentic space at both poles
- Float in saturated salt solution



- **Unfertilized egg :**

- Elliptical & longer than fertilized

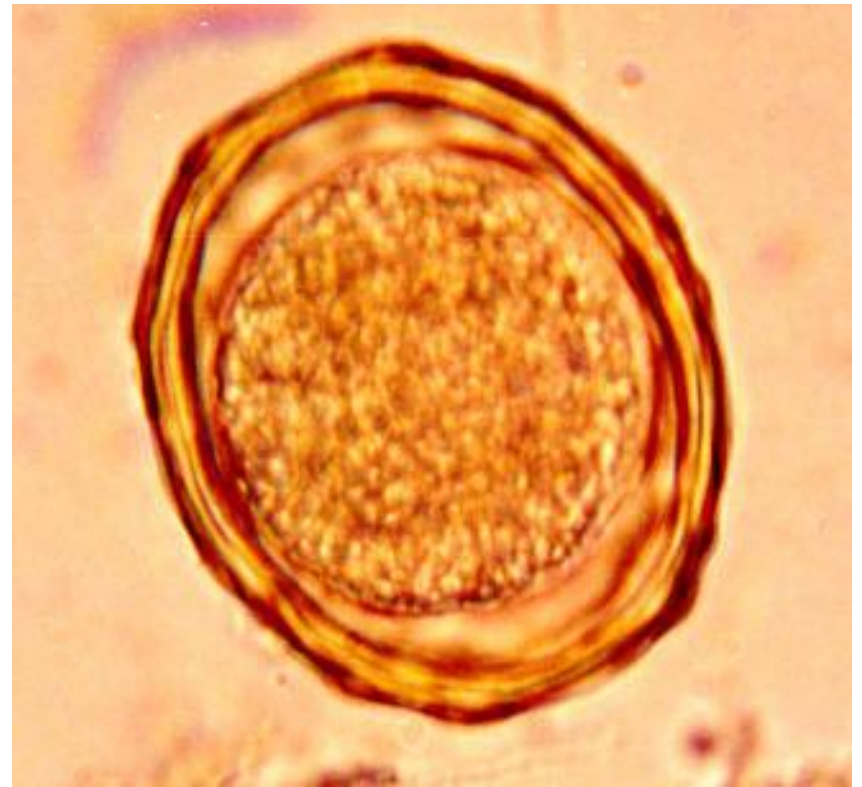
- 80 × 45 μ

- Contains a small atrophied ovum with highly retractile granules of various sizes

- Heavier – do not float in saturated salt solution



Corticated & decorticated eggs



Life cycle

- One host
- Man is definite host

Development outside body

- Fertilized eggs – passed along with faeces
- Not infective when freshly passed
- Develop in moist & warm condition to rhabditiform larva – 10 -14 days
- Development may be delayed up to 3 weeks to 4 months if proper condition not provided

What happened inside body ??

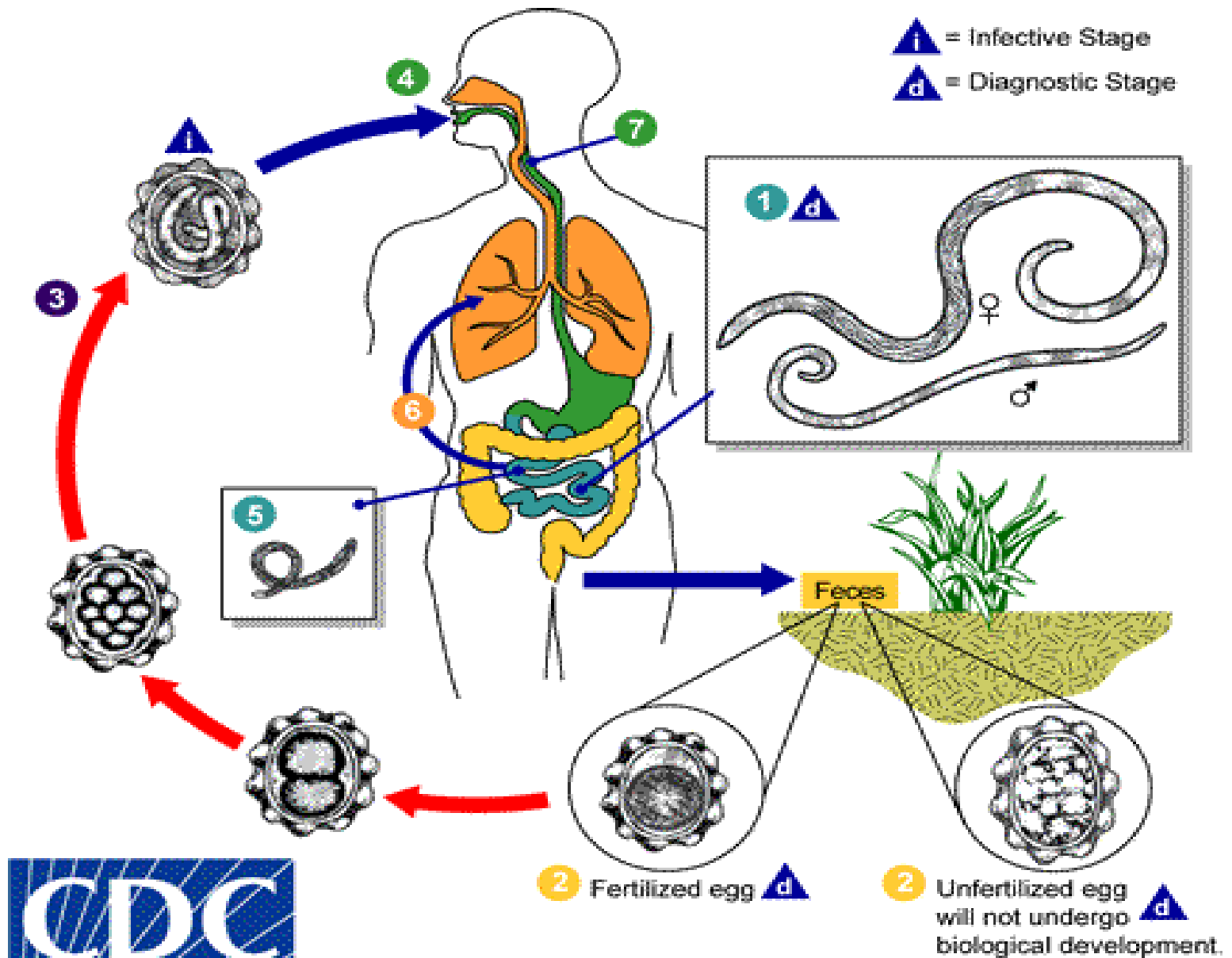
- Infection occurs by ingestion of ripped egg along with food, water or vegetables
- Escape gastric juice due to presence of shell
- Egg shell gets softened by digestive juice in duodenum
- Stimulates enclosed larva into activity
- It causes a rent in egg shell, rhabditiform larva comes out

Larvae into action...

- Rhabditiform larva penetrate gut wall
- Carried by portal circulation to liver where they stay for 3-4 days
- Pass out of liver, via right heart enter pulmonary circulation
- In capillaries of lung – grow 10 times bigger
- Moults twice
 - 1st – 5th to 6th day
 - 2nd – 10th day

Larvae running away.....

- Developed larva break through capillaries and reach lung alveoli – time : 10-15 days
- From lung alveoli... larvae crawl up the bronchi & trachea...propelled into larynx
- Larvae now either coughed out or swallowed...pass down through esophagus, stomach and return to upper part of intestine
- Another moulting take place & develop into adult worm



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<http://www.dpd.cdc.gov/dpdx>

Clinical disease

- Most of infections – light & asymptomatic
- In mild infection – abdominal discomfort, malnutrition and colicky pain
- **Effects due to migrating larvae :**
 - A transient pneumonitis along with Eosinophilia occurs – **Loeffler's pneumonia**
 - Allergic reaction – **urticaria, asthma**

Effects due to adult worm

- Local : **Nausea & vomiting**
- Spoliative action : worm derives nutrition by robbing host of its nutrition causing **malnutrition**
- Toxication : body fluid of ascaris when absorbed in blood, causes toxic effects and gives rise to **typhoid like fever**
- Mechanical effects : **obstruction or perforation** of intestine , occasionally obstruction of bile duct & pancreatic duct

Laboratory diagnosis

- Demonstration of adult worm :
 - When adult worm is spontaneously passed in stool or vomitus
 - Administration of anthelmintic may result in expulsion of worm



Demonstration of eggs

- Direct wet mount : by preparing saline preparation of stool
- Concentration technique not required as worm produces many eggs
- Both fertilized & unfertilized eggs may be present
- If only female : only unfertilized eggs
- In only male : no eggs

Concentration technique

- May be required when worm infestation light & eggs are scanty
- Concentration by sedimentation - unfertilized eggs
- Concentration by floatation - fertilized eggs
- Duodenal aspirate collected by duodenal intubation may help

Concentration method

- Sedimentation technique
 - Formal-ether technique
- Flootation technique
 - Saturated sodium chloride method
 - Zinc sulfate method

Formal – ether technique

- Mix 1 gm of stool – 10 ml of 10 % formal-saline – left for 10 min
- Strained through wire gauze or gauze piece in centrifuge tube
- Add 3 ml of ether to filtrate
- Centrifuge at 2000 rpm for 2 min
- Allow to settle
- Decant supernatant fluid with debris
- Make cover slip preparation from deposit
- Count the number of eggs

Saturated sodium chloride technique

- **1/4th of a 25 ml test tube is filled with saturated salt solution**
- **Add 1 gm of stool**
- **Mix and add more salt solution**
- **Tube is kept in vertical position – any debris collected on top is removed**
- **Tube is filled up to top (rim of tube)**
- **Cover slip is placed over it so that it is in contact with fluid**
- **Preparation is allowed to stand for 30-40 min**
- **It is lifted carefully by a straight pull upwards and placed on a slide face downwards**
- **Examine & count number of eggs**

Indirect evidence

- Blood examination
- Skin test with antigen
- Serological tests:
 - ELISA
 - IHA
 - Microprecipitation

Thank you