MORFOLÓGÍA DE ADULTOS Y LARVAS DE HELMINTOS PARÁSITOS
**Onchocerca volvulus**

**MORFOLOGÍA DE ADULTOS Y LARVAS DE HELMINTOS PARÁSITOS**

**HEADS**
- A. lumbricoides: Three tips
- E. vermicularis: Bulbous oesophagus
- A. duodenale: Buccal capsule with 2 pairs of teeth
- N. americanus: Buccal capsule with cutting plates
- W. bancrofti: Bluntly rounded

**TAILS**
- A. duodenale: Bursa with dorsal ray - shallow cleft - tips tridigitate
- N. americanus: Bursa with dorsal ray - deep cleft - tips bifid. Spicule fused and barbed
- T. trichiura: Head attenuated from tail

**LARVAE**
- Rhabditiform: Bulbous oesophagus
- Filariform: Straight oesophagus

**Microfilaria Sheathed**
- W. bancrofti: Nuclei do not reach tip of tail

**Microfilaria Unsheathed**
- D. perstans: Nuclei to tip of tail
- M. ozzardi: Nuclei almost to tip of tail
- D. streptocerca: Tail blunt - curved like "shepherd's crook"
- O. volvulus: Not found in blood

**IN TISSUE**
- L. loa: Nuclei reach tip of tail
- T. spiralis in muscle
- B. malayi: Long sheath - two discrete nuclei in tip of tail
- O. volvulus in tissue
HUEVOS DE HELMINTOS PARÁSITOS

**A. lumbricoides**
- Normal
- Decorticated
- Embryonated
- Unfertilised

**T. trichiura**

**E. vermicularis**
- Fresh
- Developed

**A. duodenale**

**Taenia spp**

**H. nana**

**H. diminuta**

**D. latum**

**S. haematobium**

**S. mansoni**

**S. japonicum**

**C. sinensis**

**P. westermani**

**F. hepatica & F. buski**

**RBC**

Scale: 0 - 200
General morphology

Long, cylindrical, unsegmented, generally tapering at each end.
Possess a body cavity and alimentary tract.
Sexes generally separate.

Cuticle non-nucleated
generally smooth
may have sensory papillae
bosses
spines or
tubercles

Subcuticular tissue
with somatic muscular bands
in four groups

ALIMENTARY SYSTEM
MOUTH may have lips
papillae
buccal capsule with teeth or cutting plates

OESOPHAGUS may be cellular or muscular
may be bulbous posteriorly

ALIMENTARY CANAL a simple tube

ANUS in ♀
CLOACA in ♂

EXCRETORY SYSTEM
MOUTH

CENTRAL EXCRETORY PORE

EXCRETORY CANALS in thickenings of subcutaneous tissues

NERVOUS SYSTEM
MOUTH

RING OF GANGLIA

NERVE TRUNKS (6) with transverse commissures

Reproductive system

♀
VULVA
VAGINA
UTERI (paired)
OVARIES (usually paired)
ANUS

♂
TESTES
SEMINAL VESICLE
SPICULE
PAPILLAE, pre-anal and post-anal, sometimes present
(Basis for spp. identification in some cases.)
May have copulatory BURSIA

Uterus becomes coiled, full of own or larval filling body cavity
SEMINAL RECEPTACLE
oviduct
OVARY
A. NO INTERMEDIATE HOST REQUIRED

<table>
<thead>
<tr>
<th>EMBRYONATED OVA TO ENVIRONMENT</th>
<th>INFECTION BY</th>
<th>INSIDE MAN</th>
<th>SPECIES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>INGESTION</td>
<td>DEVELOP TO ADULT IN INTESTINE</td>
<td>Enterobius vermicularis</td>
</tr>
<tr>
<td>NON-EMBRYONATED OVA TO ENVIRONMENT</td>
<td>INGESTION</td>
<td>DEVELOP TO ADULT IN INTESTINE</td>
<td>Trichuris trichiura</td>
</tr>
<tr>
<td>MATURE IN DAMP SOIL</td>
<td>INGESTION</td>
<td>DEVELOP TO ADULT IN INTESTINE</td>
<td>Ascaris lumbricoides</td>
</tr>
<tr>
<td>MATURE, HATCH, ENCRYPTED ON VEGETATION</td>
<td>INGESTION ENCYSTED</td>
<td>DEVELOP TO ADULT IN INTESTINE</td>
<td>Trichostrongyulus spp.</td>
</tr>
<tr>
<td>MATURE AND HATCH IN DAMP SOIL</td>
<td>PIERCING SKIN</td>
<td>DEVELOP TO ADULT IN INTESTINE</td>
<td>Haemonchus contortus</td>
</tr>
<tr>
<td>OVA LAID IN TISSUES IN LIVER</td>
<td>INGESTION OF INFECTED TISSUE</td>
<td>LARVAL CYCLE</td>
<td>Hookworms i.e. Ancylostoma duodenale, Necator americanus</td>
</tr>
<tr>
<td>LARVAE RE-ENTER HOST</td>
<td>PIERCING MUCOSA OR ANAL SKIN</td>
<td>LARVAL CYCLE</td>
<td>Strongyloides stercoralis</td>
</tr>
<tr>
<td>INTESTINAL WALL LARVAE TO GUT LUMEN</td>
<td>INFECTION OF INFECTED BEETLES</td>
<td>INTESTINE TO LIVER</td>
<td>Capillaria hepatica</td>
</tr>
<tr>
<td>LARVAE TO ENVIRONMENT INFECT NEW HOST</td>
<td>PIERCING SKIN</td>
<td>LARVAL CYCLE</td>
<td></td>
</tr>
<tr>
<td>BECOME FREE LIVING LARVAE FROM FREE CYCLE</td>
<td>PIERCING SKIN</td>
<td>DEVELOP TO ADULT IN INTESTINE</td>
<td></td>
</tr>
</tbody>
</table>

B. INTERMEDIATE HOST(S) REQUIRED

<table>
<thead>
<tr>
<th>EMBRYONATED OVA TO ENVIRONMENT</th>
<th>INFECTION OF MAN BY</th>
<th>INSIDE MAN</th>
<th>SPECIES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>INGESTED BY BEETLES</td>
<td>INTESTINE TO BUCCAL CAVITY</td>
<td>Gongylonema pulchrum</td>
</tr>
<tr>
<td></td>
<td>INGESTED BY EARTHWORMS</td>
<td>INTESTINE TO LUNGS</td>
<td>Metastrongyulus elongatus</td>
</tr>
<tr>
<td></td>
<td>INGESTED BY BEETLES</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>HATCH IN SOIL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Nematoda (Cont.)

**Life cycle in general: B, Intermediate host(s) required, continued.**

<table>
<thead>
<tr>
<th>OUTSIDE MAN</th>
<th>INTERMEDIATE HOST</th>
<th>INFECTION OF MAN BY</th>
<th>INSIDE MAN OR OTHER HOST</th>
<th>SPECIES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NON-EMBRYONATED OVA TO ENVIRONMENT</strong></td>
<td>Ingested by leech</td>
<td>Ingestion of fish</td>
<td>Intestinal to renal pelvis</td>
<td>Dioctophyma renale</td>
</tr>
<tr>
<td>Mature and hatch in damp soil</td>
<td>Larvae developed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ingested by</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cyclops</td>
<td>Ingestion of infected flesh</td>
<td>Mature in stomach wall</td>
<td>Gnathostoma spinigerum</td>
</tr>
<tr>
<td></td>
<td>Larvae develop</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cyclops ingested by</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fish, Frogs, Snakes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LARVIPAROUS</strong></td>
<td>Ingested by Insects</td>
<td>Bite of insect</td>
<td>Mature in lymph vessels</td>
<td>Filarial worms</td>
</tr>
<tr>
<td>In blood or tissue juices</td>
<td>Cyclical development</td>
<td></td>
<td>Subcutaneous tissue</td>
<td>Wuchereria bancrofti; Brugia malayi; Loa loa; Onchocerca volvulus</td>
</tr>
<tr>
<td>Through skin to water</td>
<td>Ingested by Cyclops</td>
<td>Ingestion of cyclops</td>
<td>Retroperitoneal then subcutaneous tissue</td>
<td>Dracunculus medinensis</td>
</tr>
<tr>
<td>Via Blood to Infected muscle</td>
<td>Mature in bowel, larviposits in wall</td>
<td></td>
<td></td>
<td>Trichinella spiralis</td>
</tr>
</tbody>
</table>

### C, Life cycle obscure

<table>
<thead>
<tr>
<th>OUTSIDE MAN</th>
<th>CONJECTURAL CYCLE</th>
<th>INSIDE MAN AND OTHER HOSTS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EMBRYONATED OVA TO ENVIRONMENT</strong></td>
<td>Beetles 2nd Intermediate host</td>
<td>Matures in intestine</td>
<td>Physaloptera caucasia; Thelazia callipaeda</td>
</tr>
<tr>
<td>Fly</td>
<td></td>
<td>Matures in conjunctiva</td>
<td></td>
</tr>
<tr>
<td><strong>NON-EMBRYONATED OVA TO ENVIRONMENT</strong></td>
<td>Matures and hatches in soil</td>
<td>Matures in intestine</td>
<td>Ternidens deminutus; Oesophagostomum ariostomum</td>
</tr>
<tr>
<td>larvae swallowed</td>
<td>Matures in wall of caecum then in lumen</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Phasmid Nematodes

Strongyloides stercoralis

**Morphology**

**PARASITIC**

♀

2.2 x 0.3 mm.

FILIFORM

- Simple mouth
- Long oesophagus
- Midgut
- Oviduct
- Ovary
- Vulva
- Anus
- Pointed posteriorly

- Actual size

**FREE-LIVING**

♂

0.7 x 0.4 mm.

- Short oesophagus
- Midgut
- Testes
- Stout
- Ovary
- Vulva
- Filiform: 600 x 20 μ.
- Short oesophagus: bulbous posteriorly

♀

1 x 0.5 mm.

- Unembryonated: 50 x 30 μ.
- Ovum

**OVIPosition in MUCOSA**

30-40 per day

**LARVAE**

- Rhabditiform: 250 x 20 μ.
- Notched tail (absent in hookworm)

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Life Cycle, Pathology, Occurrence: See Plate 5
**Phasmid Nematodes (Cont.)**

**General morphology**

- Slightly curved
- Taper anteriorly
- Creamy-grey colour

**ADULT ♀**

**BUCCAL CAPSULE**

- Oesophagus expanded posteriorly

**ADULT ♂**

**OVUM**

- Unembryonated
- 60 x 40 µ

**COPULATORY BURSA**

- (See below)

**Particular morphology**

<table>
<thead>
<tr>
<th>Species</th>
<th>Size in mm.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ancylostoma duodenale</strong></td>
<td>♀ 8-11 x 0.45, ♂ 10-13 x 0.6</td>
</tr>
<tr>
<td><strong>A. braziliense</strong></td>
<td>♀ 7.5-8.5 x 0.35, ♂ 9-10.5 x 0.375</td>
</tr>
<tr>
<td><strong>A. caninum</strong></td>
<td>♀ 10 x 0.4, ♂ 14 x 0.6</td>
</tr>
<tr>
<td><strong>Necator americanus</strong></td>
<td>♀ 7-9 x 0.3, ♂ 9-11 x 0.4</td>
</tr>
</tbody>
</table>

**BUCCAL CAPSULE**

- Two fused teeth, outer the larger
- 2 inconspicuous teeth

**COPULATORY BURSA**

- Spicules
- Dorsal ray. Shallow cleft
- Tips tridentate

- As broad as long
- Rays stunted

- Large, flame-shaped
- Rays long and slender

- Spicules fused and borbed
- Dorsal ray. Deep cleft
- Tips bifid
Phasmid Nematodes (Cont)

Toxocara canis
(THE DOG ROUND WORM)

Morphology

3 Lips round mouth
Cervical alae
Curved tail
Specific papillary arrangement

Life cycle

In incompatible host, larval hatch in intestine
Gain circulation
Fail to break into lung alveoli
Carried to viscera

LARVAL CYCLE
(like Ascaris)

Blood
Intestine
Mature in Intestine

Lung - respiratory tract

New host

Mature in soil

Puppies

Visceral larva migrans
(See Plate 110)

Toxocara cati
(THE CAT ROUND WORM)

Morphology

Cycle like Ascaris or Toxocara canis

65-70 μ

Man incompatible host
Visceral larva migrans
(See Plate 110)
**Enterobius vermicularis.** (Thread, pin or seat worm)

**Syn. Oxyuris vermicularis.**

**PATHOLOGY**

1. Pruritus ani and vulvae.
2. Occasionally associated with obstructive appendicitis.
3. Eosinophilia up to 10%.

**LABORATORY DIAGNOSIS**

OVA in perianal scrapings.

in finger nail scrapings.

ADULTS in stool after purge or enema.

**Geographical distribution**: Cosmopolitan

(usually group infection: schools and institutions.)
**Strongyloides stercoralis**

**Geographical distribution:** Cosmopolitan (Sporadic in temperate zones)

- **Rhabditiform larva**
  - 250 x 20 µ
- **Filariform larva**
  - 600 x 20 µ

Fertilised eggs enter mucosa, lay eggs which hatch to rhabditiform larvae, these then make their way to bowel lumen.

**PATHOLOGY**

**DIRECT CYCLE**

1. **Invasion of body by larvae**
   - (a) Skin Local dermatitis
   - (b) Viscera Localised pneumonitis from migratory larvae
   - (c) General Allergic reaction and eosinophilia

2. **Invasion of body by mature adults**
   - (a) May be some inflammation of intestinal mucosa producing diarrhoea
   - (b) Occasionally pneumonitis

**INDIRECT CYCLE**

- **FREE LIVING**
  - Under unfavourable environmental conditions, larvae metamorphose to infective filariform larvae.
  - 12-24 hrs

- **NEW HOST**
  - Same host
  - Same host

- **SINK**

**LABORATORY DIAGNOSIS**

- Larvae in fresh faeces (occasionally in sputum)

**20180930 - Manoj**
**Ascaris lumbricoides** (The round worm)

**PATHOLOGY**

- **LARVAE**
  - Allergy, eosinophilia and pneumonitis. Occasionally ectopic larvae in other organs with local inflammation and necrosis. (One form of larva migrans, see Plate 110.)

- **ADULTS**
  - Obstruction of intestine, biliary ducts and trachea have been reported.

**LABORATORY DIAGNOSIS**

Recovery of ova from faeces. Rarely embryos may be found in sputum.

**Geographical distribution = World wide.**

**DVA**

- Normal form
- Decorticated
- Embryonated
- Unfertilised

- Head of adult to show arrangement of the three lips.

Mature in 1-2 weeks. Visible months - years.

- Adult life span

- Larvae penetrate mucosa – enter lymphatics and venules – to right heart and lungs – break out into alveoli – moult twice – ascend respiratory tree – descend oesophagus to mature in the intestine.
Ascaris lumbricoides Linnaeus

(Ascaris Roundworm)

General Information. Known since ancient times as one of the most common and largest worms parasitizing man, this species matures in the small intestine. Using mice and rats as experimental hosts, Stewart (1916) discovered that the larvae migrate through the lungs before establishing themselves in the intestine. Ascaris infections in man can be expected wherever sanitation is lax.

Adult Structure

External Features. Using either fresh or preserved worms, select a female which has a larger average size than the male and a relatively uncurved tail. The head end is more blunt. The lateral lines are faint bands extending nearly the full length of the body. Dorsal and ventral lines are more difficult to see. With the low power of a dissecting microscope or hand lens locate the mouth, anus, a short distance from the posterior end, and the vulva, or female opening located about a third of the body length from the anterior end. The excretory pore between the vulva and the anterior end can sometimes be found by gently squeezing the worm in this region, which results in forcing a very small amount of liquid through it. In a male note the curved tail and spicules often protruding from the cloaca. Why is this opening properly called cloaca instead of anus?

With a razor blade cut off the anterior end of an Ascaris and stand it upright in a drop of water on a slide. Examine under a dissecting binocular microscope. You will see two lateroventral lips which are alike, and one dorsal lip.

Draw the en face view of lips. Label lips and mouth.

Internal Anatomy. First place a female worm in a dissecting pan, then slit the dorsal side longitudinally to expose the organs. Pin out the body wall. Find the intestine and esophagus. Also find the short vagina leading to genital pore. The two uteri, extending from the vagina, connect to an oviduct and the terminal very slender ovary.

Open the dorsal side of a male to expose the intestine and reproductive structures. The very fine testis connects to a wider seminal vesicle which in turn joins the intestine near the cloacal opening. Look for fine, needle-like spicules associated with the cloacal opening. What is the use of these structures?

Drawings of internal structures may or may not be required depending upon the student's past experience with the anatomy of Ascaris and the attitude of the instructor.

Cross Section. In the stained cross section locate the structures with the aid of the accompanying diagram. On the outside is the thick cuticle characteristic of nematodes. Immediately below this is the hypodermis which secretes the cuticle. The hypodermis is a syncytium of cellular material. Next is the prominent layer of muscle cells seen in cross section. Each consists of a contractile part and a larger vacuolated noncontractile portion which collectively fill much of the body interior. Why is the body cavity of nematodes called a pseudocoelome? Identify also dorsal line and ventral lines containing nerves, lateral lines with excretory canals, intestine, and sex organs in section. In the cross section of the female are the small ovary with central nuchis, oviduct with cavity, and uterus filled with eggs.

Draw the cross section and label. Draw an egg of Ascaris from a slide.

See any demonstrations which may be available.

Outline the plan of the life cycle.
Ascaris lumbricoides (hembra)
ESTRUCTURA INTERNA—Corte Transversal

54. Ascaris, cross-section anterior to vulva

Cross Section of Female Ascaris lumbricoides

Dorsal cord
Dorsal nerve
Contractile part
of muscle cell
Protoplasmic core of muscle cell
Oviduct
Uterus with eggs
Intestine
Pseudocoel
Muscle cell process
Ovary
Recess
Lateral cord
Excretory canal
Hypodermis
Cuticula
Ventral nerve
Ventral cord
Ascaris lumbricoides (macho)
ESTRUCTURA INTERNA - CORTE TRANSVERSAL

h) intestino
j) cutícula
k) hipodermis
l) músculos
m) nervio dorsal
n) nervio ventral
o) canal excretor lateral
r) células espermáticas
s) conducto deferente
t) testículos
u) pseudoceloma
Nematodos (hembra y macho)
ESTRUCTURA INTERNA - CORTE LONGITUDINAL

Diagram of male nematode posterior end

Types of female nematode genitalia
A. Monodelphic
B. Amphidelphic

Ascaris lumbricoides, female
Ascaris lumbricoides, male
The Hookworms

Ancylostoma duodenale
Old world
BUCCAL CAPSULE
2 pairs of teeth.
BURSA
Dorsal ray - shallow cleft - tips tridigitate.
OVUM
60 x 40 μ

Geographical distribution
Europe - N. Africa - India - S. E. Asia.

Mature adult in man 35 days

Pneumonitis
Occult blood

Maturation in soil 7 - 8 days
Rhabditiform
Eosinophilia
Anaemia

Enter circulation, and via heart, lungs respiratory tree and oesophagus reaches intestine.

Allergy
Ground itch

Geographical distribution
U.S.A. - Central America - Central & S.W. Africa - Oceania - S. E. Asia.

Necator americanus
New world
BUCCAL CAPSULE
Cutting plates.
BURSA
Dorsal ray - deep cleft - bifid tips - spicules fused and barbed.
OVUM
70 x 38 μ

Geographical distribution

ACY CIRCULATION

CYCLE AND PATHOLOGY IN MAN
1. Infection
   General allergic reactions - ground itch - cutaneous larva migrans in non-human ancylostomes.
2. Migration
   Lung involvement - localised pneumonitis - eosinophilia - allergy.
3. Localisation
   In jejunum - ingestion of blood by parasites - occult bleeding from intestinal mucosa - anaemia
   (and sequelae).

LABORATORY DIAGNOSIS
Ova in stools.
**Aphasmid Nematodes**

**TRICHINELLA SPIRALIS**

**Morphology**

**ADULT ♀**
- 2.8 - 3.2 mm.
- x 60 - 90 μ.
- Vagina
- Uterus
- (ova then larvae)
- Ovary (single)
- Anus

**LARVIPOSITION FOR**
- 4 - 16 weeks, about
- 1,500 per female

**LARVA**
- 100 x 6 μ.

**ADULT ♂**
- Simple mouth
- Nerve ring
- Oesophagus
- Pseudo-bulb
- Body cells
- Midgut

**Detail anteriorly**

**ACTUAL SIZE**

**LIFE CYCLE, PATHOLOGY, OCCURRENCE**

-- See Plates 7 - 8

**TRICHURIS TRICHIURA**

(The Whip worm)

**Morphology**

**♀**
- Vagina
- Vulva
- Uterus
- Coiled ovary (single)
- Simple cellular oesophagus

**♂**
- Simple mouth
- Spicule
- Cloaca
- Testes, tube-like

**ACTUAL SIZE**
- 3 - 5 cm.

**OVIPosition**
- 2,000 eggs per day

**OVum**
- Smooth
- Unembryonated

50 x 22 μ.
Cycle of development completed in single host (which is both definitive and intermediate.) Two hosts (carnivores) required to complete cycle.

Infected flesh is digested by gastric juices, the larvae are set free and develop into adults in duodenum. The gravid females burrow into mucosa and pass larvae which enter circulation and are disseminated throughout body.

Encysted larva

Geographical distribution: Cosmopolitan (frequent in temperate climates).

CONTINUED ON PLATE 8
**PATHOLOGY**

1. Generally none.
2. Very heavy infection - local inflammation - abdominal discomfort - diarrhoea - eosinophilia up to 25%.

**LABORATORY DIAGNOSIS**

OVA in stools.
**Wuchereria bancrofti**
270 x 8,5 μm

**Mansonella perstans**
200 x 5 μm

**Mansonella ozzardi**
205 x 5 μm

**Onchocerca volvulus**
320 x 7,5 μm

**Dirofilaria immitis**
300 x 6 μm
**Wuchereria bancrofti**

**PATHOLOGY.**

1. Proliferation of lining endothelium,
2. Surrounding infiltration of eosinophils
   - Macrophages
   - Lymphocytes
   - Giant cells
   - Filarial granulation
   - Tissue leading to
   - Obstruction
   - Secondary infection
   - Fibrosis
   - Calcification
   - Lymph varices
   - Lymphadenopathy
   - Elephantiasis
   - Hydrocele, Chyluria etc.

**LABORATORY DIAGNOSIS.**

1. Microfilariae in thick blood film (10 pm-2 am) stained, unstained (centrifuge concentration). Chylous exudate or chylous urine.
2. Histological examination of biopsy material.
3. Intradermal test with dirofilarial antigen (only group-specific).

Geographical distribution: Asia, Africa, S. America, Australasia.
**Loa loa** (The eye worm)

**Diurnal periodicity**

**Adult filaria migrate under conjunctiva.**

**Life span** 1-15 years

**Maturation time** 1 year

**Microfilariae invade subcutaneous tissue and become adults.**

**Gravid ♀ discharges mf. into blood vessels.**

**ALLERGY**

Chronic pruritis - papules may develop - skin may thicken - dead worms may form abscesses.

**Microfilariae found in peripheral blood.**

**Calabar swelling, allergic oedema and cellular infiltration.**

**Eosinophilia**

**ADULTS**

♂ 30 - 36 x 0·6 mm.
♀ 70 x 0·5 mm.

**Cuticular marking**

**MICROFILARIA**

Nuclei extend to tip of tail.

250 - 300 x 8 - 8.5 μ

Sheathed.

**Geographical distribution:** Equatorial, West and Central Africa.

**PATHOLOGY.**

Transient subcutaneous (calabar) swellings. Occasionally abscesses follow.

Eosinophilia (30 - 80%).

Adult may appear under conjunctiva.

**LABORATORY DIAGNOSIS.**

Microfilariae in blood.

Occasionally adult seen under conjunctiva or by biopsy of swelling.

Complement fixation or intradermal tests with direflarian antigen (group, not species, specific).
Onchocerca volvulus
(The blinding worm)

No periodicity

Subcutaneous nodule
Adult d & g filariae

Cellular reaction, then fibrosis.

Larvae mature to adults in subcutaneous tissue

Microfilariae migrate to other sites.
DO NOT ENTER BLOOD STREAM

DERMATITIS

Eye involvement

MICROFILARIA
Unsheathed - tail is tapered and nuclei free.
150 - 368 x 5 - 9 \( \mu \)

ADULTS
\( \sigma^\prime \): 10 - 42 \( \mu \) x 130 - 210 \( \mu \)
\( \omega \): 34 - 50 \( \mu \) x 270 - 400 \( \mu \)

Geographical distribution. Central America, Tropical Africa

PATHOLOGY.

Fibrous nodules develop around adults
Sometimes lymphatic obstruction (Elephantiasis) in Africa
Dermatitis from microfilariae
Inflammatory lesions of eye invaded by microfilariae
Allergic reactions (Eosinophilia, Urticaria)

LABORATORY DIAGNOSIS

Detection of adults in excised nodules
Microfilariae in shavings of skin
(Serological tests of little value)