

Enterobius vermicularis :

Oxyuriasis, pinworm infection.

The adult female worm is about 10 mm. long with a long pointed tail. Humans are the only host, they inhabit the large intestine, the gravid female (laden with 10-15,000 eggs) migrates to the perianal area where it lays the eggs. The eggs mature rapidly and are infective several hours after passage. When the eggs are ingested, the larvae hatch in the duodenum, moult twice into adults in the jejunum and move to the large bowel. The cycle from ingestion to migration to the perianal skin takes about 6 weeks.

The infection is self-limiting unless auto-infection continues.

Innocuous infection, pruritis ani due to the migration of the gravid female worms, this may interfere with sleep.

Occasionally they may be found in the appendix but they are seldom the cause of appendicitis.

Infection may be associated with lower social classes but it happens in all other classes. It is mainly a disease of children.

Emotional stress of the conscientious mother who tries to hide it from her friends.

Infection is faeco-oral helped by the scratching, auto-infection and passing it onto friends and other members of the family.

Eggs may be found in dust samples of home and school, but fortunately most of them are dead.

Diagnosis :

Clinical presentation, worms may be seen by the mother, visualising eggs on cello tape (best collected in the morning before defaecation), more than one examination may be necessary for establishing the diagnosis. The eggs are identified by their asymmetrical shape and well developed embryo. The eggs can often be found under the fingernails of children.

Treatment : Vermox (mebendazole). Other members of the family may have to be treated, the mother is reassured that it occurs in the best of families. Strict hygiene to prevent re-infection, a second dose 2 weeks later may be used to eradicate any re-infection.

Trichuris trichiura :

Whipworm, anterior three-fifths thin, 3-5 cm in length, eggs per day 3,000-10,000. Eggs are lemon shaped or tea-tray like. Humans are the main host.

Life cycle :

Eggs are passed in the faeces, the embryo develops in the egg outside the body in moist soil, when ingested the embryo escapes in the small intestine and penetrates a villus. It develops into the adult in 30-90 days, when mature it moves to the caecum where it embeds its anterior end into the mucosa and derives nourishment. It lives mainly in the caecum, it may be found in the colon in heavy infestations. Life span is 4-6 years. It is very prevalent in the world especially in tropical countries, where it may be 80%. Children are more infected (unhygienic habits).

Symptoms :

Infection is usually non-symptomatic, with heavy infestation there may be blood streaked diarrhoea, abdominal pain and tenderness, nausea and vomiting, anaemia (0.005 ml lost daily per worm, probably some blood is sucked, but bleeding at site of attachment may also contribute) and weight loss, rectal prolapse occasionally due to frequent stools and straining. Eosinophilia is rare.

Diagnosis :

Characteristic eggs in the faeces.

Treatment :

Mebendazole. This is poorly absorbed and well tolerated. Hygiene and proper disposal of human excrements.

Ascaris lumbricoides :

Up to 30 cm. in length, it is white or pink in colour, the egg has a thick coarse transparent hyaline shell, there is an outer coarsely mammillated albuminous covering, infertile eggs are longer and narrower and have a thin shell (with an irregular coating of albumin) full of amorphous protoplasm. These are also found even when the male is present.

Life cycle :

The worm lives in the small intestine, nourishment from digested food, a female can produce 200,000 eggs per day, with a productive capacity of 25 million eggs.

The eggs are passed in the faeces and become infective (with larva formed) under appropriate soil conditions in 3 weeks.

When eggs are ingested they hatch in the small intestine, the released larva penetrates the intestinal wall and reaches the circulation via venules or lymphatics, lodge in the pulmonary capillaries, break into the alveoli, undergo 2 moults, ascend the trachea. swallowed, 4th moult in the intestine, adult worms, which may live 18 months.

25% of the earth population is estimated to harbour this worm, most prevalent in children (immunity or hygiene). It is most prevalent with bad sanitation conditions.

Infection is faeco-oral, where human faeces are used as fertiliser it may be acquired through eating contaminated vegetables.

Symptoms and pathology :

Low infestation (5-10 worms), is usually asymptomatic (alarming passage of the worm with the faeces).

There may be vague abdominal pain, there may be pulmonary symptoms during larval migration especially in heavy infestations, with eosinophilia and other allergic manifestations.

They may cause intestinal obstruction, they may block the appendix or the ampulla of Vater. They may penetrate the intestinal wall and cause peritonitis, they may even continue their journey and come out of the body at the umbilicus (children) or inguinal region (adults). They may be vomited.

It has an adverse effect on the nutritional status of children probably by suppressing appetite or interfering with digestion.

Diagnosis :

Passage of worm, look for eggs in the faeces.

Treatment :

Piperazine, it relaxes the worm and allows peristalsis to eject the worm outside .
Hygiene for prevention.

Safe and effective treatment, given on two consecutive days.

Visceral larva migrans :

Due to presence of larvae that are not natural to the human host

Toxocara canis and cati :

These are parasites of the cat and dog; adult worm (10 cm) pass eggs in the faeces of the host to be eaten by other dogs or cats, where they hatch in the small intestine migrate to blood, liver, lungs, bronchi, swallowed and mature in the small intestine.

If the eggs are ingested by humans, the larvae become distributed in the organs of the body e.g. lungs, liver causing eosinophilic granulomas.

Transplacental passage of larvae occurs in dogs.

Symptoms and pathology :

Lesions are most frequent in the liver consisting of eosinophils, lymphocytes and giant cells surrounding the larva. Such lesions have been found in the brain, eye, kidney, lungs, and cardiac muscle. It is mainly encountered in young children (playing with pets). There is usually an increase in blood globulins.

Light infection may go unnoticed, but heavy severe infection has been known to cause death

(Although rare).

Affection of the eye may lead to choroiditis or iritis (Nematode endophthalmitis).

Diagnosis :

Clinically : triad of eosinophilia, hepatomegaly and hyper-globulinaemia. Pneumonitis is often present.

Actual demonstration of the larvae is the most definitive diagnosis.

Stool examination is of no use as the parasite never finishes its life cycle in the human.

Serology is not very useful because of false positives 10-15%.

Treatment :

The infection is usually self limiting and only severe cases are treated with thiabendazole and steroids for allergic manifestations and eye involvement.

Pets should be dewormed regularly, young children should be protected against contact with infected cats or dogs.

Hookworms :

The main two species pathogenic to Humans are :

Ankylostoma duodenale, Necator americanus.

The adult worm is about 1 cm in length, *N. americanus* has a pair of semilunar cutting plates dorsally in the mouth with a concave dorsal median tooth, *A. duodenale* has two ventral pairs of teeth. The egg has a thin transparent shell, it is already embryonated when passed in the faeces (2-8 cell stage).

Life cycle :

Eggs are passed in the faeces and hatch rapidly in moist soil, into rhabditiform larvae, which feed actively on bacteria and debris in the soil, they develop into filariform non-feeding infective larvae which penetrate skin mainly dorsum of feet or between the toes (thigmotaxis), otherwise they die.

Larvae are about 250-500 microns long.

Gain access to blood or lymphatics then to lungs, trachea and then swallowed to settle in duodenum, this journey takes about 1 week.

Tropical and subtropical regions, but *A. duodenale* is also present in Northern Europe. About 500 million people are infected in the world, accounting for a loss of 1 million litres of blood daily.

Symptomatology and pathology :

Itch in skin at site of entry with erythema, **pneumonitis** if there is lots of larvae passing through the lungs, a **gastroenteritis** may develop when the mature male and female worms establish themselves in the intestinal tract, it is self limiting. The worms may live several years in the upper small intestine with no symptoms, but may cause **anaemia**. They are anchored to the mucosa and suck blood. **Occult blood** may be present due to bleeding from the GIT.

Early in the infection **eosinophilia** and leucocytosis are marked.

A. duodenale can persist for 6-8 years, while *N. americanus* disappear within 2 years.

Diagnosis :

Eggs in fresh faeces (embryonated).

Treatment :

Mebendazole. Mass treatment may be used if rate of infestation is > 50%. **Sanitation** is the main method of control.

Treat **anaemia** with iron, if transfusion is necessary use packed RBC to avoid hypervolaemia.

Cutaneous larva migrans :

Strongyloides stercoralis :

Humans are the principal host. In the parasitic stage no male has been described (parthenogenesis). 2-3 mm long.

Life cycle :

The adult female worm is a filariform nematode that burrows in the mucosa of upper I.T. laying eggs and getting nourishment.

The deposited eggs hatch into rhabditiform (rod shaped) larvae that gain access to the lumen and out in the faeces. Eggs are rarely found in the faeces. The parasite has three types of life cycle :

1)- Direct cycle : (like hookworm) after 2-3 days in the soil, the rhabditiform larva changes to infective filariform larva which penetrates skin of host, to blood - lungs-glottis- swallowed to GIT, develops to adult. The whole process takes 30 days.

2)- Indirect cycle : the rhabditiform larva develops into free living larva male and female sexes. After fertilisation the eggs develop into rhabditiform larvae, which may become infective filariform larvae or repeat the free living cycle.

3)- Autoinfection : the larvae may develop to infective filariform larvae in the intestine and reinfect the host by penetrating the mucosa or the perianal skin. This is one of the few examples of a helminth multiplying within the host, this explains the persistence of the infection in people living in non-endemic areas. Infection can last for 40 years.

Prevalent in tropical and subtropical regions. warm and wet soil conditions with poor sanitation.

Symptoms and pathology :

Symptoms are negligible in light infestation, heavy load D & V , abdominal pain, weight loss, skin rashes.

As a result of autoinfection larvae may become disseminated all over the body (hyperinfection syndrome which may be fatal, this is usually associated with steroid use). Adult worms may be found in extra intestinal places.

Diagnosis :

Presence of motile rhabditiform larvae in fresh faeces (hookworm larvae are rarely found in faeces, they can be differentiated morphologically). They may be found in duodenal aspirates.

Eosinophilia is usually present 10-20%, but not in hyperinfection syndrome. Most patients have antibodies against *S. stercoralis*.

Treatment :

Thiabendazole (Mintezol). Sanitary disposal of human waste, avoid skin contamination with potentially infective soil.

Balantidium coli :

Large intestinal protozoon, ciliate, cytostome and cytophyge, macronucleus (vegetative function) and micronucleus (reproduction). Incidence in humans is low but high in hogs, where there are no hogs rodents may serve as reservoir.

Trophozoite, cyst (no division as in amoebae).

Causes diarrhoea, may be similar to amoebic dysentery.

Diagnosis by demonstration of cysts in faeces.

Treatment : iodoquinol, tetracycline, flagyl.

Giardia lamblia :

Flagellate. Kite shaped, concavo-convex with ventral suckers, 2 nuclei with prominent karyosomes owl appearance, 4 pairs of flagella.

The cyst has 2-4 nuclei, and many structures of the trophozoite.

Inhabit upper intestinal tract, may cause malabsorption, foul smelly stools, many cysts are passed in stools, trophozoites are better seen in duodenal aspirates and enterotest..

Children are most commonly affected

Malabsorption is due to damage to villi whether mechanical or toxic is not known

Treatment : Flagyl.

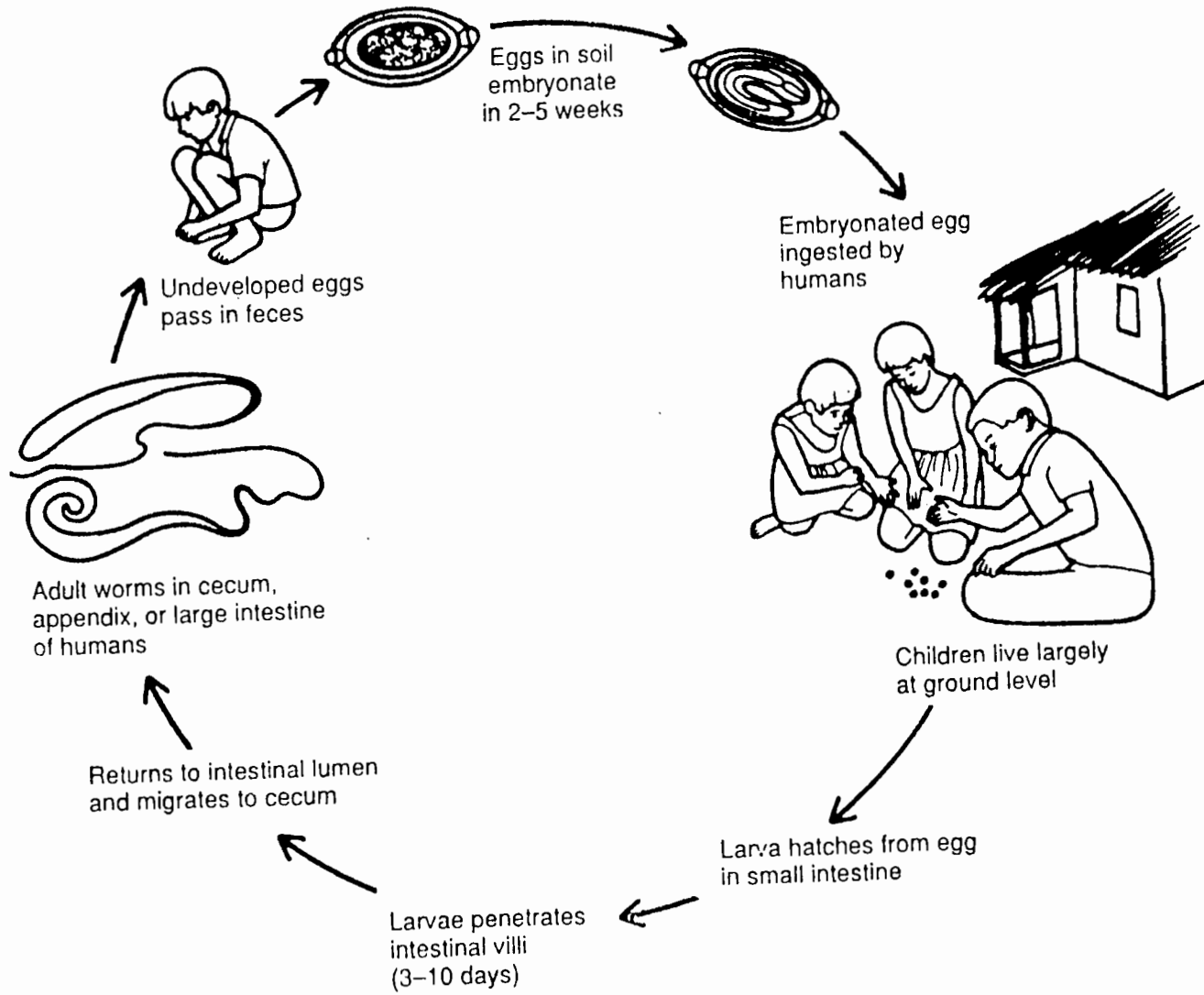
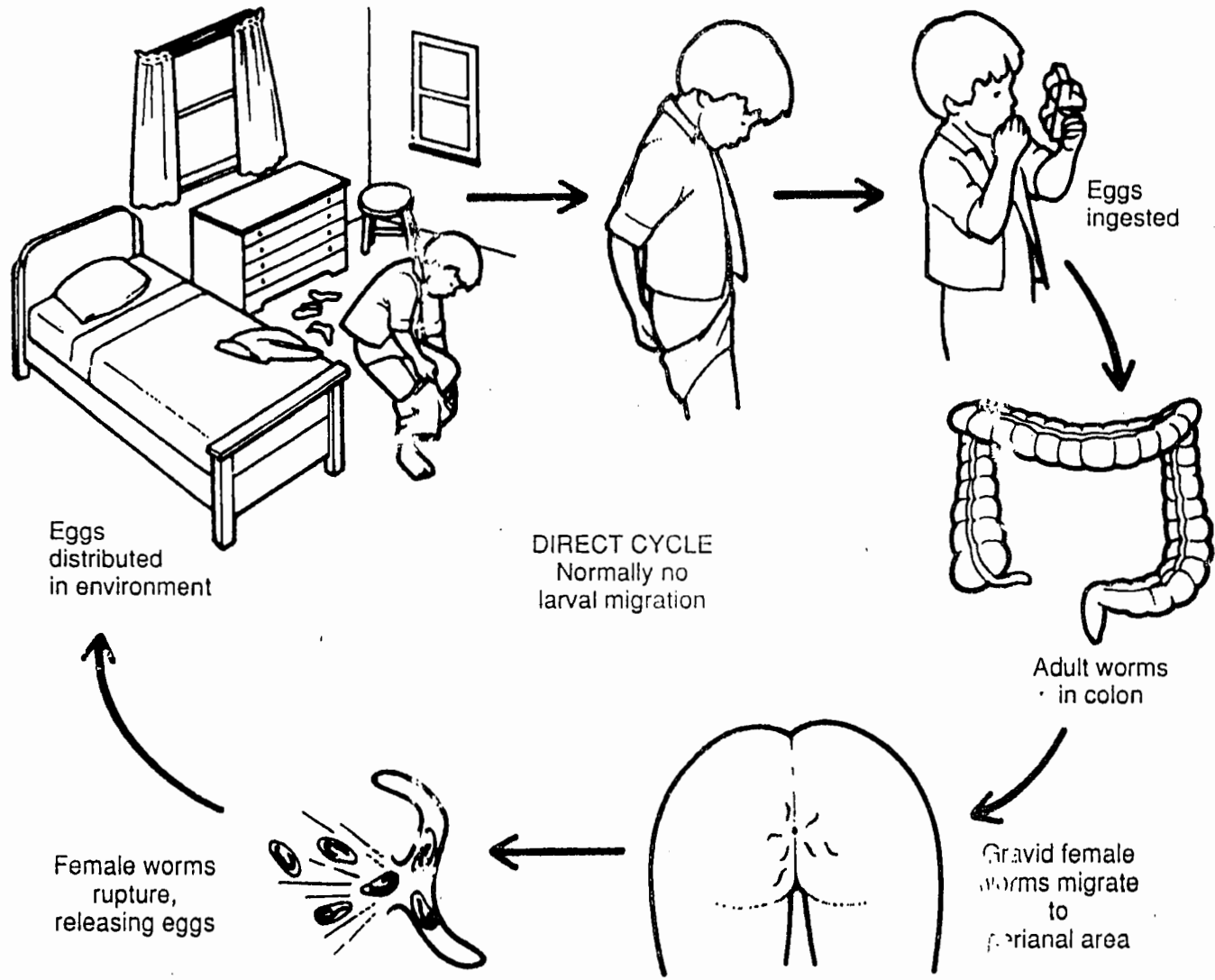
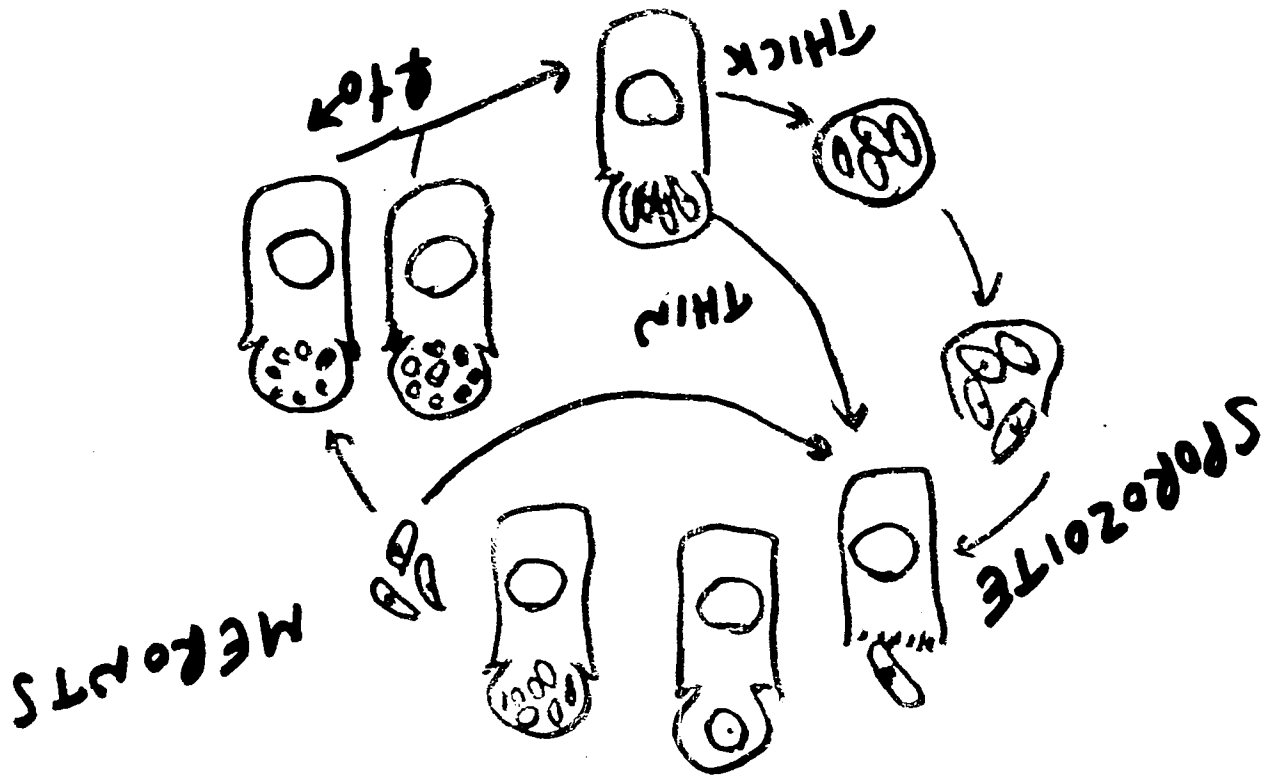


Figure 6-4. Life cycle of *Trichuris trichiura*.



CRYPTOSPORIDIUM PARVUM



ISOSPORA BELL



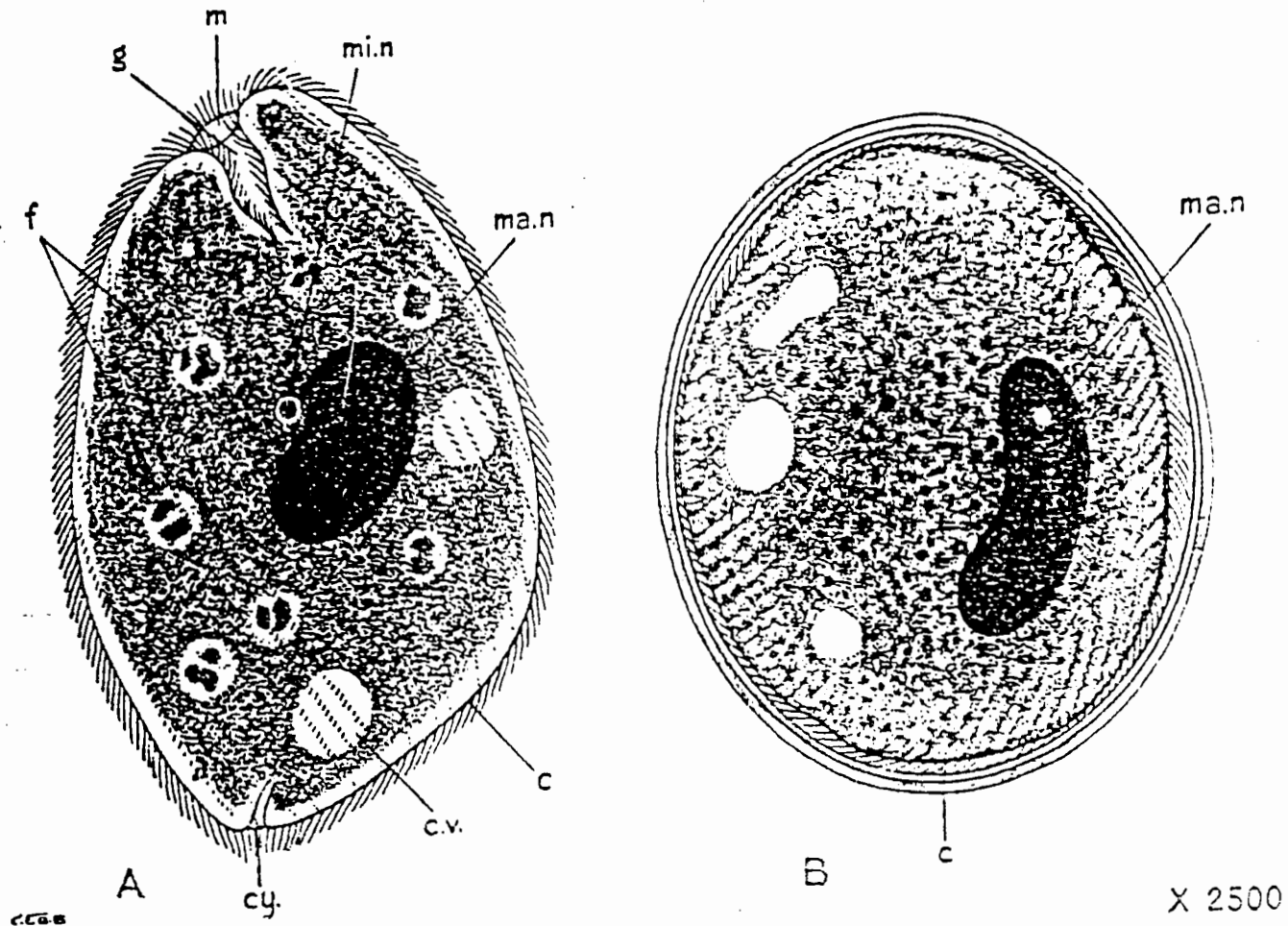


Figure 3-9. Schematic representation of *Balantidium coli*. A. trophozoite. B. Cyst. c = cilia; cy = cytophyge; c.v. = contractile vacuole; f = food vacuole; g = gullet; m = mouth; ma. n = macronucleus; mi. n = micronucleus. (Modified from Dobell and O'Connor, 1921.)

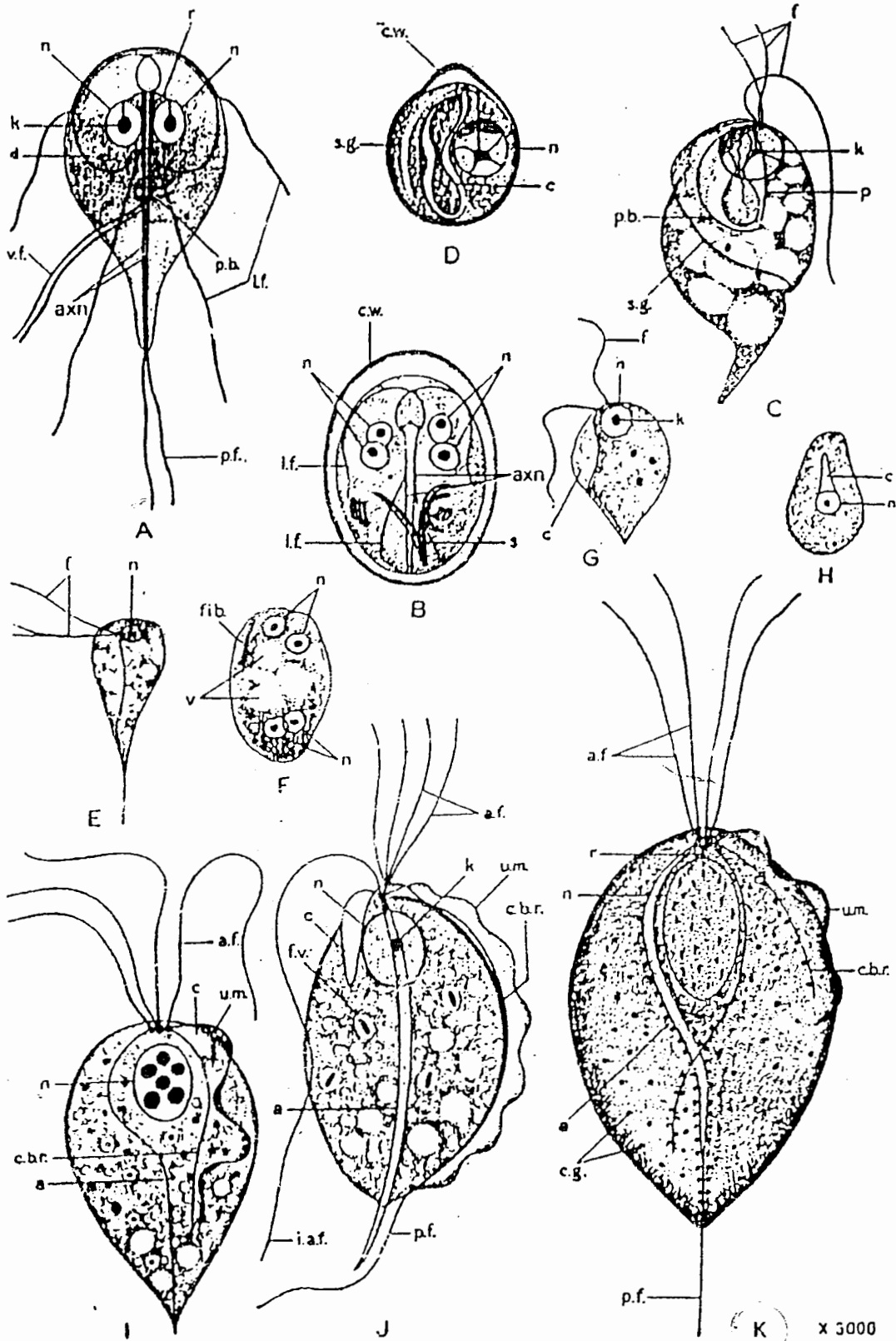


Figure 3-11. The intestinal and atrial flagellates of humans. A. *Giardia lamblia* trophozoite viewed from dorsal surface. B. *Giardia lamblia* cyst. C. *Chilomastix mesnili* trophozoite, ventral view. D. *Chilomastix mesnili* cyst, ventral view. E. *Enteromonas hominis* trophozoite. F. *Enteromonas hominis* quadrinucleated cyst. G. *Retortamonas intestinalis* trophozoite. H. *Retortamonas intestinalis* cyst. I. *Trichomonas tenax* trophozoite. J. *Trichomonas hominis* trophozoite. K. *Trichomonas vaginalis* trophozoite. a = axostyle; axn = axoneme; a.f. = anterior flagella; c = cytostome; c.b.r. = chromatoid basal rod; c.g. = chromatin granules; c.w. = cyst wall; d = sucking disk; f = flagellum; f.v. = food vacuole; fib. = fibril; i.a.f. = inferior anterior flagellum; k = karyosome; l.f. = lateral flagella; n = nucleus; p = parastyle; p.b. = parabasal body; p.f. = posterior flagellum; r = rhizoplast; s = shield; s.g. = spiral groove; u.m. = undulating membrane; v = vacuole; v.f. = ventral flagella