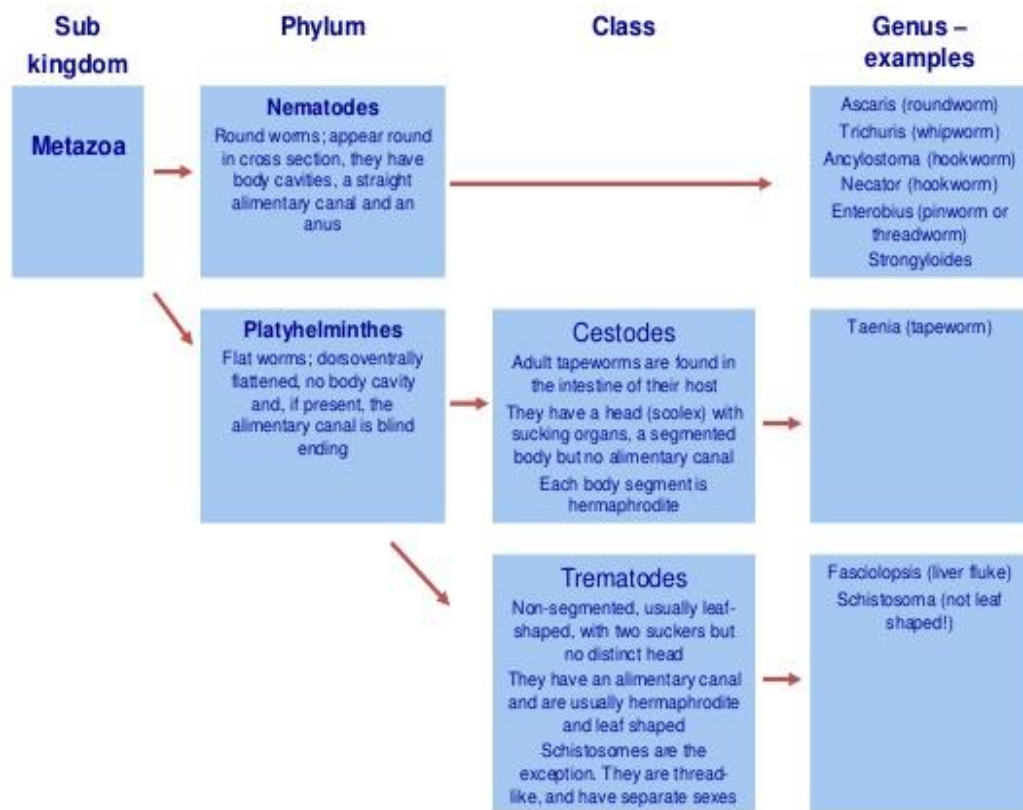


Helminths: Structure, Classification, Growth, and Development

Classification of Helminths



Phylum: Platyhelminthes (flatworms)

- Class 1 Monogenea
- Class 2 Cestoda (tapeworms) (*Diphyllobothrium*, *Taenia*, *Echinococcus*)
- Class 3 Aspidogastrea
- Class 4 Digenea (flukes or trematodes) (*Fasciolopsis*, *Fasciola*, *Paragonimus*)

Phylum Nematoda (roundworms)

- Order 1 Rhabditida (*Strongyloides*)
- Order 2 Strongylida (*Necator*, *Ancylostoma*, etc)
- Order 3 Ascaridida (*Ascaris*, *Toxocara*, etc)
- Order 4 Oxyurida (*Enterobius*)
- Order 5 Spirurida (*Dracunculus*, *Wuchereria*, *Brugia*, *Loa*, *Onchocerca*)
- Order 6 Enoplida (*Trichinella*, *Trichuris*)

Helminth

Introduction

is a general term meaning worm. The helminths are invertebrates characterized by elongated, flat or round bodies.

Helminths - worms - are some of the world's commonest parasites. They belong to two major groups of animals, the flatworms or **1-Platyhelminthes (flukes and tapeworms)** and the **roundworms or 2- Nematoda**. All are relatively large and some are very large, exceeding one meter in length.

Their bodies have well-developed organ systems, especially reproductive organs, and most helminths are active feeders. The bodies of flatworms are flattened and covered by a plasma membrane, whereas roundworms are cylindrical and covered by a tough cuticle. Flatworms are usually hermaphroditic whereas roundworms have separate sexes; both have an immense reproductive capacity.

The most serious helminth infections are acquired in poor tropical and subtropical areas, but some also occur in the developed world; other, less serious. Exposure to infection is influenced by **climate, hygiene, food preferences, and contact with vectors**.

Many potential infections are eliminated by host defenses; others become established and may persist for prolonged periods, even years. Although infections are often asymptomatic, severe pathology can occur. Because worms are large and often migrate through the body, they can damage the host's tissues directly by their activity or metabolism. Damage also occurs indirectly as a result of host defense mechanisms. Almost all organ systems can be affected.

Transmission of Infection

Helminths are transmitted to humans in many different ways. The simplest is by

1-accidental ingestion of infective eggs (*Ascaris*, *Echinococcus*, *Enterobius*, *Trichuris*) or larvae (some hookworms).

Other worms have larvae that actively

2- penetrate the skin (hookworms, schistosomes, *Strongyloides*).

In several cases, infection requires 3-an intermediate host vector. In some cases the intermediate vector transmits infective stages when it bites the host to take a blood meal (the arthropod vectors of filarial worms);

in other cases, 4-the larvae are contained in the tissues of the intermediate host and are taken in when a human eats that host (*Clonorchis* in fish, tapeworms in meat and fish, *Trichinella* in meat).

The levels of infection in humans therefore depend on standards of hygiene (as eggs and larvae are often passed in urine or feces), on the climate (which may favor survival of infective stages), on the ways in which food is prepared, and on the degree of exposure to insect vectors.

Flukes (Trematodes)

Adult flukes are leaf-shaped flatworms. Prominent oral and ventral suckers help maintain position in situ. Flukes are hermaphroditic except for blood flukes, which are bisexual. The life-cycle includes a snail intermediate host.

Tapeworms (Cestodes)

Adult tapeworms are elongated, segmented, hermaphroditic flatworms that inhabit the intestinal lumen. Larval forms, which are cystic or solid, inhabit extraintestinal tissues.

Roundworms (Nematodes)

Adult and larval roundworms are bisexual, cylindrical worms. They inhabit intestinal and extraintestinal sites.

1- Flukes (Trematodes)

The structure of flukes is summarized in [Figures 86-1](#) and [86-2](#)

1- A dorsoventrally flattened body, bilateral symmetry, and a definite anterior end are features of platyhelminths in general and of trematodes specifically.

2- Flukes are leaf-shaped, ranging in length from a few millimeters to 7 to 8 cm.

3- Flukes possess an **oral sucker** around the mouth and a ventral **sucker or acetabulum** that can be used to **adhere to host tissues**.

4 -A body cavity is lacking.

5- Organs are embedded in specialized connective tissue or parenchyma. Layers of **somatic muscle** permeate the parenchyma and attach to the tegument. 6-Generalized life cycle of flukes. All cycles involve **snails as intermediate hosts**. -**Hermaphroditic flukes** - *Clonorchis sinensis*, *Fasciolopsis buski*, *Paragonimus westermani*, and *Heterophyes heterophyes*.

7- **Metacercariae** are infective for humans.

8- **Bisexual** flukes Flukes have a well-developed alimentary canal with a muscular pharynx and esophagus.

9- The intestine is usually a branched tube (secondary and tertiary branches may be present) consisting of a single layer of epithelial cells. The main branches may end blindly or open into an excretory vesicle

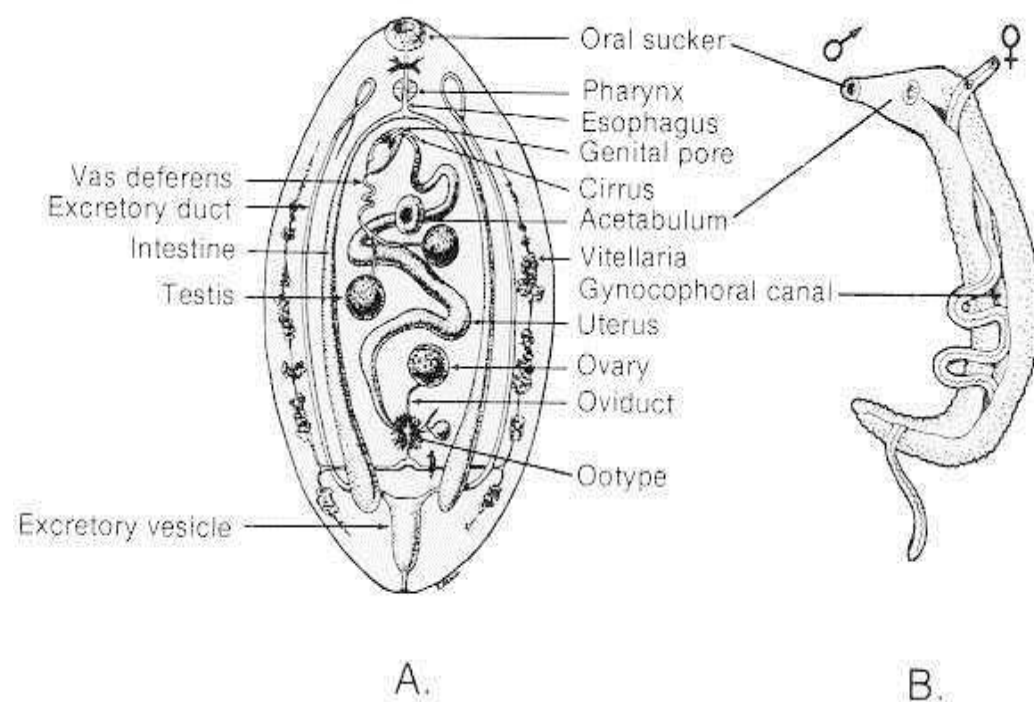


Figure 86-1

Structure of flukes. (A) Hermaphroditic fluke. (B) Bisexual fluke

10- The excretory vesicle also accepts the two main lateral collecting ducts of the excretory system, which is of a protonephridial type with flame cells. A flame cell is a hollow, terminal excretory cell that contains a beating (flamelike) group of cilia. These cells, anchored in the parenchyma, direct tissue filtrate through canals into the two main collecting ducts.

11- Except for the blood flukes, trematodes are hermaphroditic, having both male and female reproductive organs in the same individual.

12-The **male organ** consists usually of **two testes** with **accessory glands** and ducts leading to a **cirrus, or penis equivalent**, that extends into the common genital atrium.

13-The **female gonad** consists of a **single ovary** with a **seminal receptacle** and **vitellaria**, or **yolk glands**, that connect with the **oviduct** as it expands into an **ootype**. The **tubular uterus** extends from the ootype and opens into the **genital atrium**.

14-Both **self- and cross-fertilization** occur. The components of the egg are assembled in the ootype. Eggs pass through the uterus into the genital atrium and exit ventrally through the genital pore.

15-Fluke eggs, except for those of schistosomes, are **operculated** .

16-The blood flukes or schistosomes are the only bisexual flukes that infect humans ([Fig. 86-1](#)). Although the sexes are separate, the general body structure is the same as that of hermaphroditic flukes.

17-Within the definitive host, the male and female worms inhabit the lumen of blood vessels. The female lies within a tegumental fold, on the ventral surface of the male.

18-a **generalized life cycle** of digenetic flukes runs the following course.

a-Eggs are passed in the feces, urine, or sputum of humans and reach an aquatic environment.

b-The eggs hatch, releasing ciliated larvae, or **miracidia**, which either penetrate or are eaten by a **snail intermediate host**.

c- In rare instances land snails may serve as intermediate hosts. A saclike sporocyst or redia stage develops from a miracidium within the tissues of the snail.

d-The sporocyst gives rise either to **rediae** or to a **sporocyst stage**.

e- In turn, **cercariae** develop asexually and migrate out of the snail tissues to the external environment, which is usually aquatic.

f-The **cercariae**, which may possess a tail for swimming. They either penetrate the definitive host and transform directly into **adults**, or penetrate a second intermediate host and develop as **encysted metacercariae**, or they encyst on a substrate, such as vegetation, and develop there as **metacercariae**.

f-When a **metacercarial cyst** is ingested, digestion of the cyst liberates an immature fluke that migrates to a specific organ site and develops into an **adult**

worm.

