

Fasciola hepatica : The Sheep Liver Fluke

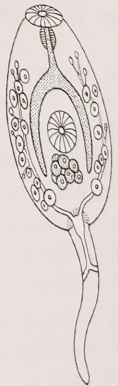
The trematodes, belonging to the class Trematoda, are all parasitic. They are commonly called 'flatworms' or 'flukes' (Anglo Saxon, **fluc** = flat), on account of their flat, leaf-like form. Flukes inhabit liver and bile duct of vertebrates like cattle, sheep, goat, rabbit, pig, dog and man. *Fasciola hepatica* is the common liverfluke of sheep. *F. gigantica* (= *F. indica*), the liver fluke of cattle, is however a more familiar species in India. *Fasciolopsis buski* occurs as an intestinal parasite in man and pig, while *Clonorchis* (= *Opisthorchis*) *sinensis*, the Chinese liver fluke is the causative organism of **clonorchiasis** in human beings in Oriental countries like Japan, Vietnam, Korea and South-eastern China. The present account mostly relates to *Fasciola hepatica*, the sheep liver fluke which is one of the most widely studied trematodes. Its structure and life history are well-known, but physiology is not much understood, because it is difficult to keep the parasites outside their hosts in a situation where they may be observed and used in experiments.

Fasciola hepatica

SYSTEMATIC POSITION

Phylum
Class
Order
Family
Genus
Species

Platyhelminthes
Trematoda
Digenea
Fasciolidae
Fasciola
hepatica





Fasciola hepatica, the sheep liver fluke was the first digenetic trematode whose life history was completely worked out by **Thomas** in 1883. It has a cosmopolitan distribution throughout sheep and cattle raising areas of the world. It is of great parasitological and pathological importance as it is the causative organism of **fascioliasis**, a disease that causes immense damage to the liver-tissues and bile ducts of sheep.

HABITS AND HABITAT

Fasciola hepatica (L., **fasciola**, small bandage+ Gr., **hepar**, liver) is an endoparasite which completes its life history in two hosts. Adult *F. hepatica* is known as the sheep liver fluke because it occurs in the liver and bile passages of sheep, the primary host. It may also occur in some other vertebrates, like goat, horse, dog, ass, ox, deer, antelope, rabbit, elephant, man, monkey, etc. A single sheep may harbour as many as 200 adult flukes in its liver, which may consequently cease to function normally. This effect is known as **liver rot**. *F. hepatica* spends a part of its life history in an intermediate host, a freshwater gastropod, which is either *Limnea truncatula* or some specific species of *Planorbis* or *Bulinus*.

EXTERNAL MORPHOLOGY

Structure of a fluke is more or less similar to that of a planarian.

1. Shape and size. Body of *F. hepatica* is soft, oval in outline, dorsoventrally flattened and leaf-like. It is about 1.8 to 3 cm long. Maximum width is about 0.4 to 1.5 cm, which is a little in front of the middle region of body. From this region, body tapers away anteriorly as well as posteriorly. Anterior end is somewhat broad and rounded, while posterior end is bluntly pointed.

2. Colouration. Colour is usually pinkish, but the transparency of body wall enables the observer to see the blackish or brownish vitelline glands along the lateral margins, and the alimentary canal,

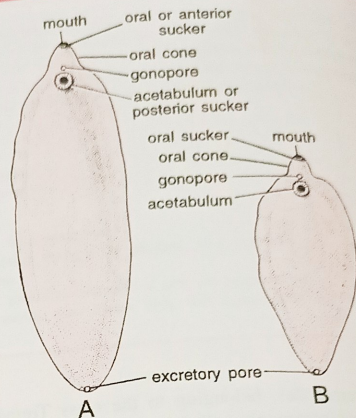


Fig. 1. Liver flukes. A. *Fasciola gigantica*. B. *Fasciola hepatica*. External features in ventral view.

which appears brownish due to ingested bile of the host.

3. Oral cone. Anterior end of body is drawn out into a prominent conical projection, termed the **oral cone** or **head lobe**, bearing at its tip a somewhat triangular aperture, the **mouth**.

4. Suckers. There are two small suckers, anterior and ventral. Both are devoid of hooks and spines.

(a) **Anterior sucker.** Mouth is situated at the centre and bottom of a cup-shaped muscular organ, known as the **anterior** or **oral sucker**. It has a diameter of about 1 mm. Muscles of oral sucker radiate from margin of mouth to the periphery of sucker. Oral sucker acts as an ideal suctional organ serving for adhesion as well as ingestion.

(b) **Ventral sucker.** About 3 to 4 mm behind the oral sucker, situated mid-ventrally, is another bowl-like adhesive sucker, the **ventral** or **posterior sucker**, also known as **acetabulum**. It is without an aperture and has a diameter of about 1.6 mm.

5. Apertures. In addition to **mouth**, there are two more permanent apertures on body. A small common **genital aperture** or **gonopore**

situated mid-ventrally a little in front of the acetabulum. A single **excretory pore** lies at the posterior end, slightly towards the ventral surface. During breeding season, a temporary **opening of Laurer's canal** appears on dorsal surface, a little anterior to the middle of body. The alimentary canal being incomplete as there is no **anus**.

6. Scales. Body of liver fluke is covered with **tegument** (cuticle), from which project numerous minute backwardly directed **spinules** or **scales**. These anchor the body to the walls of host's bile duct, protect the body and help in locomotion.

BODY WALL

Unlike turbellarians, a ciliated epidermis is absent in trematodes. Body wall of *Fasciola* consists of the following succession of layers : (i) tegument, (ii) basement membrane, (iii) musculature and (iv) mesenchyme.

[I] Tegument

Body is covered externally by a thick, non-ciliated cytoplasmic syncytium, the **tegument**. When observed earlier with the ordinary light microscope, it appeared non-cellular and homogeneous and was regarded as a non-living **cuticle**. However, recent studies made with electron microscope, by **Threadgold** (1963) and others, have revealed that it contains mitochondria, endoplasmic reticulum, vacuoles and pinocytotic vesicles. Thus, the old term 'cuticle' is rejected in favour of 'epidermis' or 'tegument' for this outer cytoplasmic layer. It is continuous with the cytoplasmic processes of certain **tegument secreting cells** (earlier cuticle secreting cells) lying in mesenchyme.

Tegument is thick, tough and capable of withstanding the action of host's digestive juices. It thus serves as an ideal body covering of the endoparasite. Further, it bears all over numerous microscopic and broad backwardly directed **spinules** or **spines** or **scales**, which anchor the fluke in host's bile passage, render protection to body and facilitate locomotion.

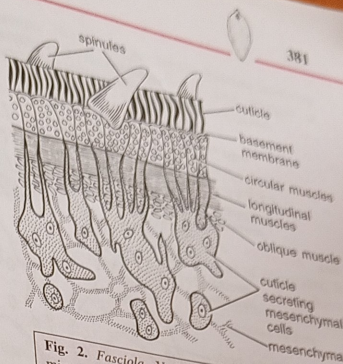


Fig. 2. *Fasciola*. V. L. S. body wall under light microscope.

[II] Basement Membrane

Immediately beneath tegument, the light microscope shows a thin but well-defined acidophilic basement membrane. However, with electron microscope only its outer edge is visible, while inner edge appears to merge imperceptibly with underlying tissues. Inside the basement membrane are the integumentary muscles.

[III] Musculature

Body wall musculature or integumentary muscles include an outer **circular layer** and an inner **longitudinal layer**. In Digenea (*Fasciola*), a third layer of **oblique** or **diagonal muscle fibres** is also present inside the longitudinal layer. In suckers, muscles form stout bundles of **radial fibres**, imparting radial striations to them. All muscle fibres are smooth.

[IV] Mesenchyme or Parenchyma

This peculiar tissue of mesodermal origin surrounds the various internal organs serving as a sort of packing material between them. It consists of numerous loosely arranged, irregular, uninucleate and binucleate cells with large fluid-filled intercellular spaces. Some of these cells are large and have processes extending to the base of the tegument which they are believed to secrete.

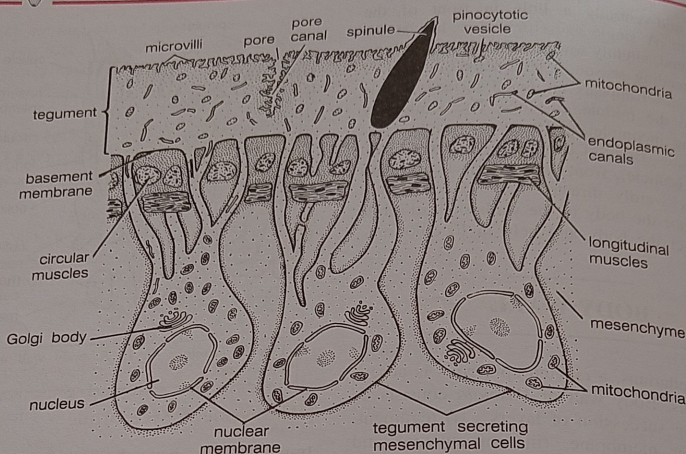


Fig. 3. *Fasciola*. V. L. S. Body wall under electron microscope.

In addition to its skeletal function, mesenchyme also serves as an important transport medium since flatworms are devoid of a blood vascular system.

DIGESTIVE SYSTEM

[I] Alimentary Canal

Fasciola hepatica has an incomplete alimentary canal as it lacks the anus. **Mouth** is situated at the anterior end surrounded by oral sucker. It leads into an ovoid **pharynx** having a small narrow lumen and thick walls provided with radial muscles and **pharyngeal glands**. It is followed by a short, narrow **oesophagus** which is lined by a single layer of epithelial cells and opens into the large **intestine**. Intestine at once forks into right and left main branches or limbs. Each branch terminates blindly near the rear end of body and

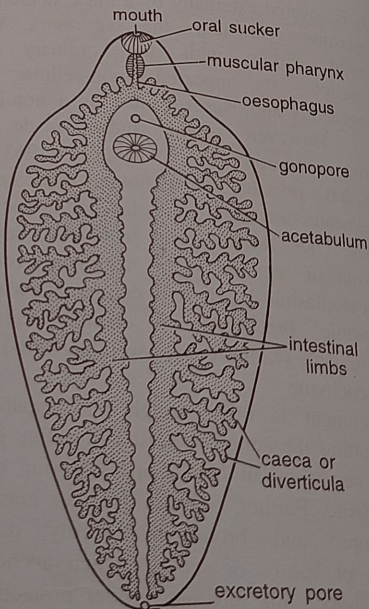
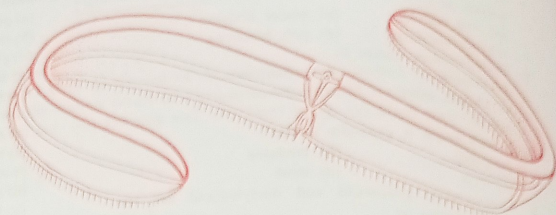
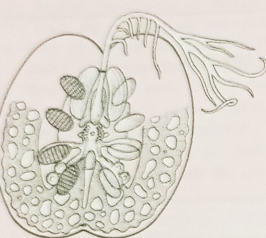


Fig. 4. *Fasciola*. Digestive system.

Ctenophora



Ctenophora is a small phylum of marine animals, which are commonly known as **sea walnuts** or **comb jellies**. The phylum takes its name from two Greek words, **ktenos** = comb and **phoros** = bearing, as they possess 8 comb-like plates for locomotion. In previous classifications, ctenophores have been placed in subphylum *Cnidaria* under the phylum *Coelenterata*. But, the present tendency is to consider them as a separate phylum. Ctenophores were recognized as a distinct group by Eschscholtz and placed under a distinct phylum by Hatschek.

A new species *Tamoya ohboya*, Bonaire Banded Box Jelly has been described in 2011. It was caught in the sea around Netherlands.

GENERAL CHARACTERS

1. Marine, solitary, free-swimming or pelagic. No polymorphism and no attached stages.
2. Body transparent. Symmetry **biradial** along an oral-aboral axis.
3. External surface with 8 vertical rows of **comb plates** of fused cilia, for locomotion. Hence the name **comb jellies**.
4. A pair of long, solid, retractile **tentacles** present.
5. Cell-tissue grade of body organization.
6. Body **acoelomate** and **triploblastic**, with an outer epidermis, inner gastrodermis, and middle jelly-like mesogloea with scattered cells and muscle fibres.
7. Digestive system with mouth, stomodaeum, complex gastrovascular canals and 2 aboral **anal pores**.
8. **Nematocysts** absent. Instead, special adhesive and sensory cells, called **colloblasts**, present on tentacles, help in food capture.

Ctenophora
skeletal, circulatory,
organs absent.
Nervous system, the
sensory organ, the
All **monoecious**
develop side by side
develop from endo-
Development usu-
cylindrical larva
Asexual repro-
generations abs-
Regeneration an-

CLASS

Phylum Ctenophora
species grouped in

CLASS 1. **Tenta**
Ctenophores with

Order 1. **C**
1. Body round
2. Tentacles b
Examples
Mertensia.

Order 2.
1. Body ova
2. Two larg
auricles
3. Pouched
without
Example

Order

1. Body e
2. Two m
Many
3. Four
rudim
Exam

Ord

1. Bod
2. Ten