Helminths

Platyhelminths: include:

- Trematodes

- Cestodes

- Nemahelminthes: include: Nematodes

Trematodes

- General features
- The trematodes (or flukes) are leaf shaped with an outer cover called the **tegument** which may be smooth or spiny.
- There are two suckers or attachment organs, an anterior oral sucker and a posterior ventral sucker .
- Most trematodes are **hermaphroditic** and most of the body consists of reproductive organs and their associated structures.
- The digestive system is well developed; they generally feed on intestinal debris, blood, mucus and other tissues, depending on the host environment
- Trematodes require an intermediate host in their life cycle with vertebrates being the definitive host. Larval stages may occur in either invertebrate or vertebrate hosts.

Classification

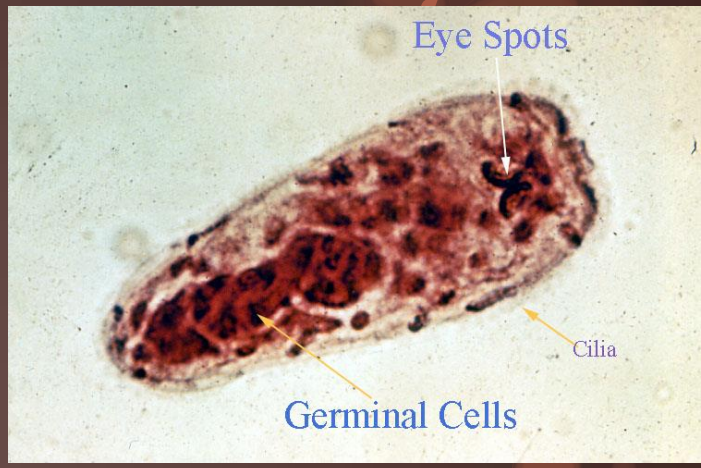
- • Monogenea, which typically are external parasites of fish with direct life cycles
- • Aspidogastrea, these are endoparasites with the entire ventral surface as an adhesive organ
- • Digenea, these are endoparasites with simpler adhesive organs and life cycles involving one or more intermediate hosts (indirect life-cycle).

- The Digenean trematodes have a complex life cycle, with rare exceptions, always involve a mollusk host. There may be six larval stages – the miracidium, sporocyst, redia, cercaria, mesocercaria (rare) and the metacercaria (the majority have 4 or 5 stages).
- Trematode eggs have a smooth hard shell and the majority of them are operculate.

- **Intestinal Flukes**
- The principal intestinal fluke infecting humans is *Fasciolopsis buski*
- **Tissue Flukes**
- The human liver plays host to two major flukes, both of which live in the bile ducts. *Fasciola hepatica* (*Fasciola gigantica* has a similar life-cycle to *Fasciola hepatica* . The Chinese Liver Fluke, *Clonorchis sinensis* is a smaller fluke which also lives in the bile ducts.
- **The Blood Flukes**
- The schistosomes : a unique feature enjoyed by Schistosomes among the trematodes is that they are dioecious(sexes separate).

Larval stages

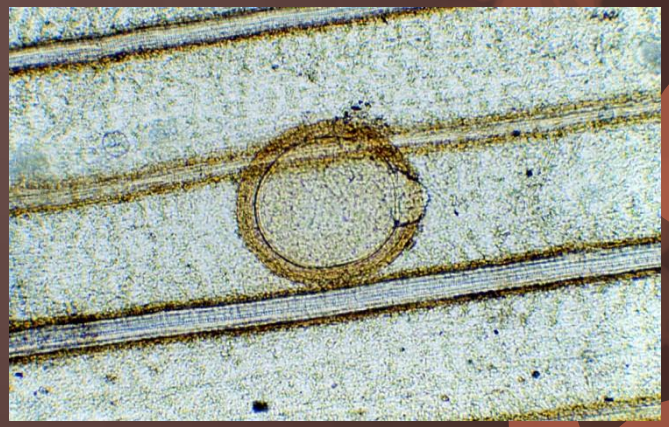
- Miracidium - This larval stage is ciliated and slightly oval in shape. It has 2 simple eyespots and lateral papillae which protrude outwards and serve as sensory organs.



- Redia - At this larval stage, it retains a very simple worm structure. In some ways, it still resembles a sac. It has a pharynx but no esophagus or intestine. Developing cercariae are visible in the rest of its body. .

- Cercaria - this stage, resembles a small adult with a tail, which it loses upon penetration of the second intermediate host. The tail has dorsal and ventral fins on it to aid in locomotion. It is brownish in color. Unlike an adult, it has two eyespots, penetration glands and a stylet at its anterior end, and a cuticle with small spines.

- Metacercaria - this form, is encysted and does not look like a fluke. It has lost larval organs such as the eyespots, the stylet, and the tail. The round cyst has very thick walls and within it, the maturing fluke is visible as are its suckers.



Liver fluke

- Fasciola hepatica also known as the **common liver fluke** or **sheep liver**
- The disease caused by the fluke is called fascioliasis (also known as fasciolosis.(
- They are large leaf-shaped parasites about 2–3cm long.
- There are two suckers, an anterior oral sucker(1mm) surrounding the mouth and a ventral sucker (acetabulum) (1.6mm) on the ventral surface.
- The outer tegument is covered in tiny spines which face backwards enabling them to attach themselves along with their suckers to the tissues.

- It is possessing both ovaries and testes, which are highly branched and occupy a large part of the body. The adult is grayish brown in colour when fresh,with a flattened body that usually shows the dark outline of the blood filled caeca.

- The anterior end of the parasite forms a conical projection that broadens at the shoulders, then gradually narrows towards the posterior end.

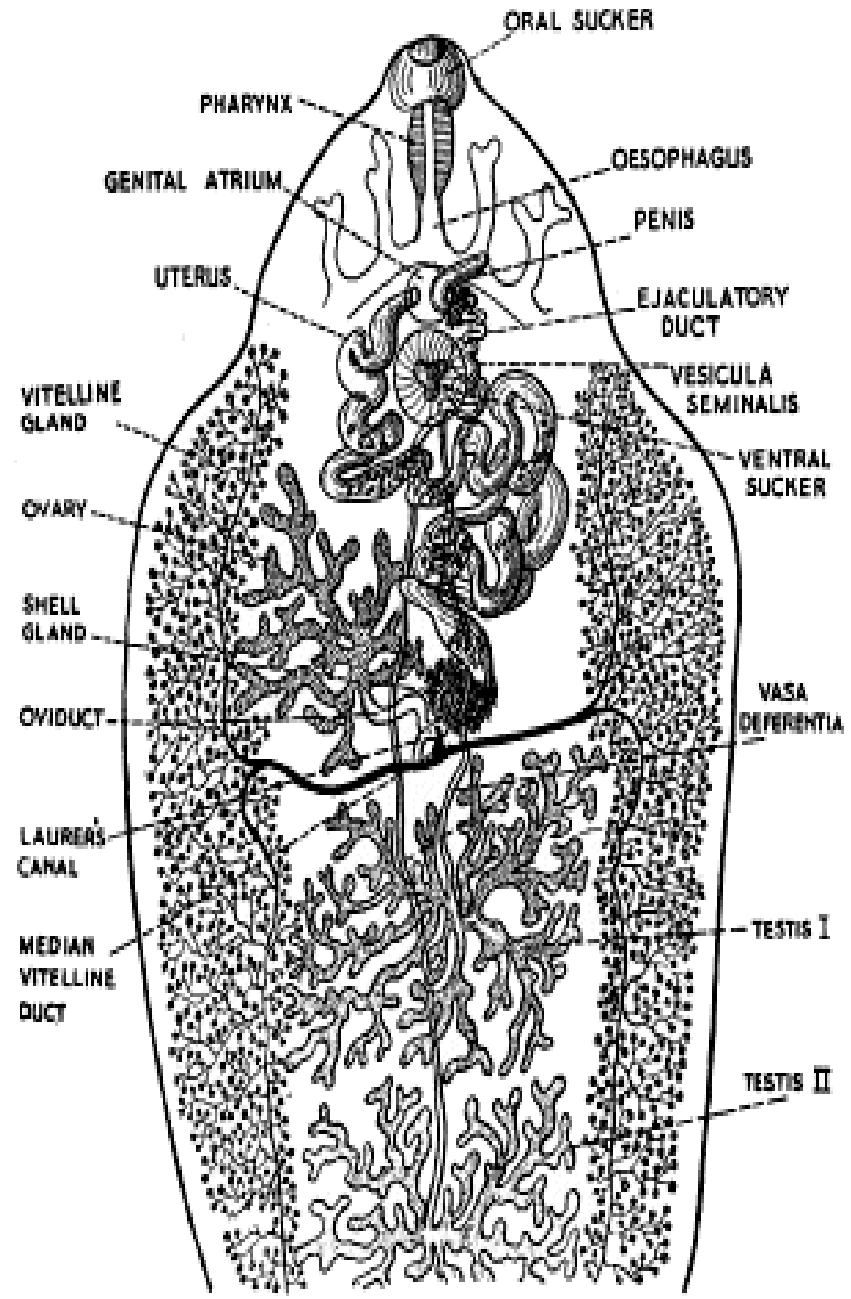
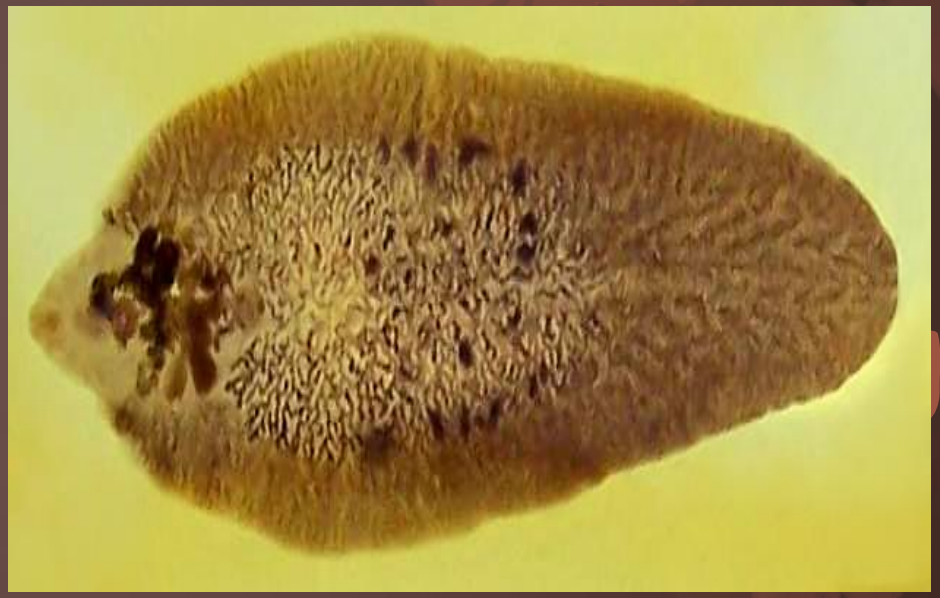


Fig. 65. FASCIOLA HEPATICA.—Diagram of the reproductive system.

- The alimentary canal consists of two main branches of the caeca with an elaborate system of secondary and tertiary lateral branches.
- The male and female reproductive systems are both very dendritic.
- The testes lie one behind the other in the middle portion of the body. The small, highly branched ovary is in front of anterior testis

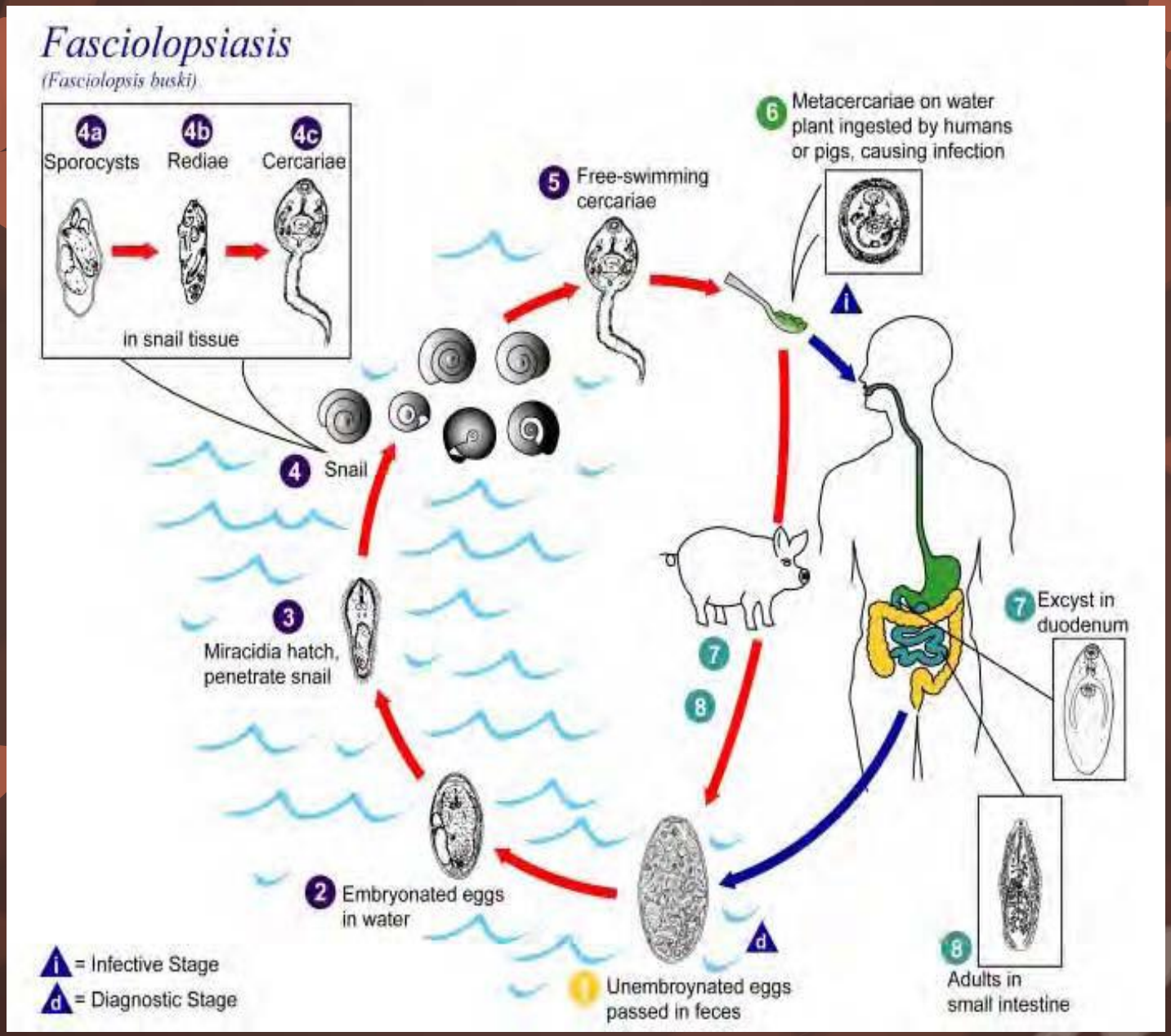


- The dendritic vitellaria lie in the lateral fields and have vitelline ducts leading to the ootype. The uterus, filled with eggs is confined to anterior third of the body.
- Ova are all thin shelled, ellipsoid, quinone colored (bile stained) with an operculum that is often inconspicuous.

Life cycle

- aquatic snail as an intermediate host such as *Lymniae* in which the parasite can reproduce asexually.
- From the snail, minute cercariae emerge and swim through pools of water in pasture, and encyst as metacercariae on near-by vegetation .
- the metacercariae are ingested by the ruminant, or in some cases, by humans eating un-cooked foods such as water-cress. Contact with low pH in the stomach causes the early immature juvenile to begin the process of excystment.

- In the duodenum, the parasite breaks free of the metacercariae and burrows through the intestinal lining into the peritoneal cavity .
- The newly excysted juvenile does not feed at this stage, but once it finds the liver parenchyma after a period of days, feeding will start
- The parasite browses on liver tissue for a period of up to ٥–٦ weeks and eventually finds its way to the bile duct where it matures into an adult and begins to produce eggs.
- Up to ٢٥,٠٠٠ eggs per day per fluke can be produced ،

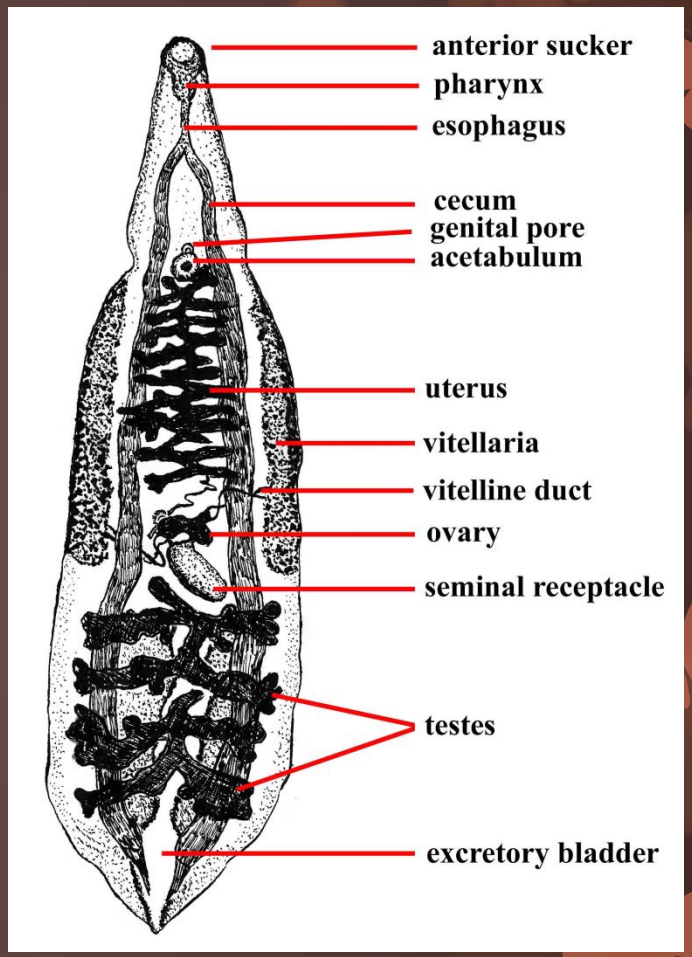

Fasciolopsiasis
(Fasciolopsis buski)
4a Sporocysts
4b Rediae
4c Cercariae
in snail tissue
4 Snail
3 Miracidia hatch, penetrate snail
2 Embryonated eggs in water
1 Unembroynated eggs passed in feces
5 Free-swimming cercariae
6 Metacercariae on water plant ingested by humans or pigs, causing infection
7 Excyst in duodenum
8 Adults in small intestine
i = Infective Stage
d = Diagnostic Stage

- **Laboratory Diagnosis**
- Definitive diagnosis is made by observing the ova in feces
- Where identification cannot be made from the size of the ova, clinical information and the source of infection may help to provide a diagnosis

Clonorchis sinensis

- ***This parasite lives in the liver of humans, and is found mainly in the common bile duct and gall bladder, feeding on bile .***
- *C. sinensis* is a very narrow fluke, 10-25 mm. in length, flattened dorsal-ventrally, with Trematode characteristics such as an oral/anterior sucker, a ventral sucker (also known as the acetabulum), no blood circulatory system, and no body cavity.
- The fluke is tapered at the anterior end and rounded at the posterior end. The intestine is bifurcated and ends blindly.
- A thick and elastic cuticle lacks any kind of spines or scales and can either be a translucent gray color or yellow color (due to absorption of bile)

- its branched testes, lobed ovary, and follicular vitellaria are apparent as is the long and convoluted uterus. The pharynx and esophagus are also visible.

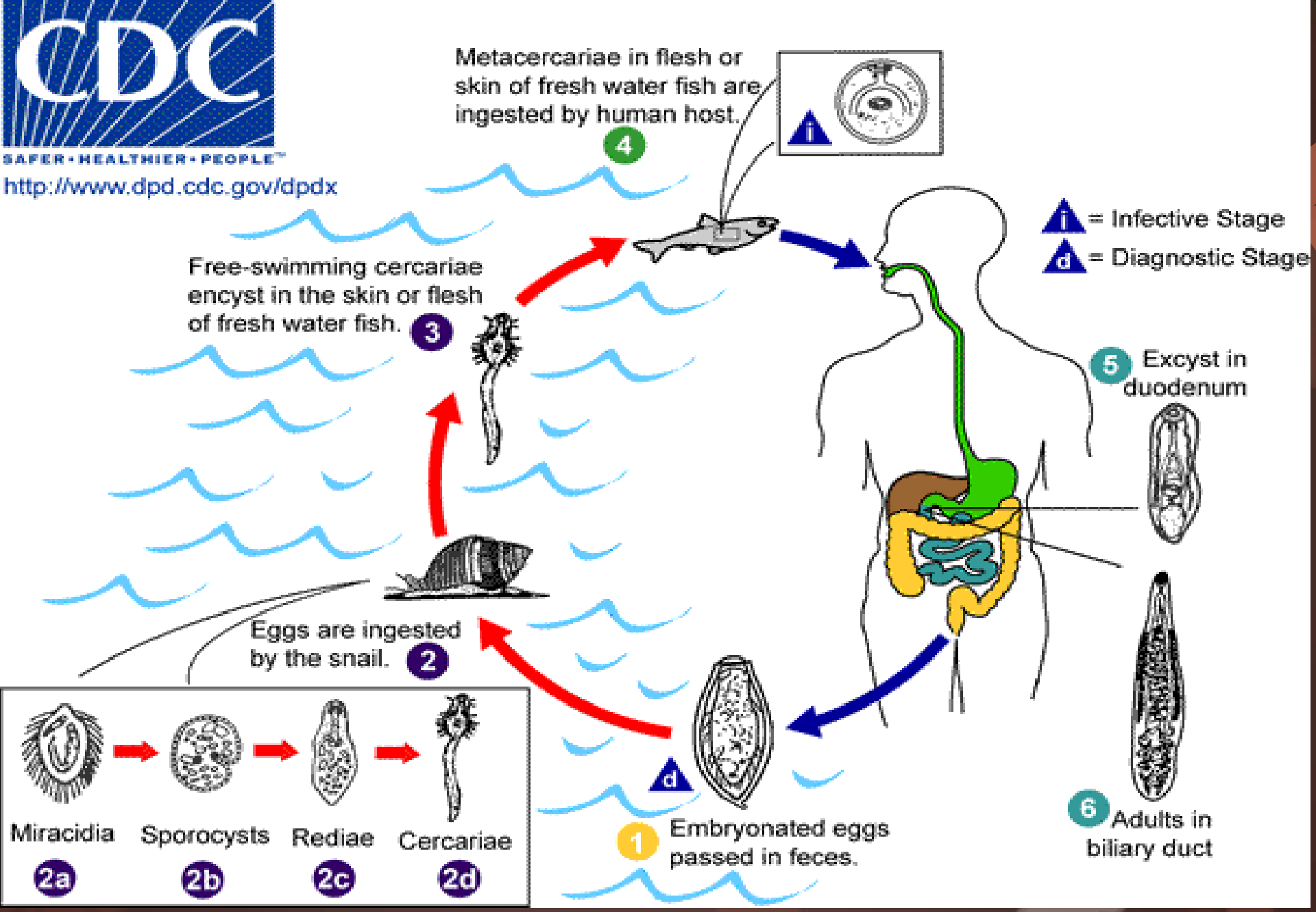


- The egg is oval-shaped, 26-30 micrometers in length, and has a thick yellow-brown shell surrounding it.
- The *C. sinensis* egg has an operculum covering the anterior end with a conspicuous rim that protrudes from the sides of the egg.
- On the posterior side, each egg has either a small knob or a little curved spine.

- Life cycle
- **First intermediate host**
- Freshwater snail , often serves as a first intermediate host for *Clonorchis sinensis* in China, Japan, Korea
- Once inside of the snail body, the miracidium hatches from the egg, and parasitically grows inside of the snail.
- The miracidium develops into a sporocyst, which in turn house the asexual reproduction of redia, the next stage.
- The redia themselves house the asexual reproduction of free-swimming cercaria .

- **Second intermediate host**
- they seek out a fish. Boring their way into the fish's body, they again become parasites of their new hosts .
- Once inside of the fish muscle, the cercaria create a protective metacercarial cyst with which to encapsulate their bodies .
- This protective cyst proves useful when the fish muscle is consumed by a human.
- **Definitive host** The acid-resistant cyst enables the metacercaria to avoid being digested by the human gastric acids, and allows the metacercaria to reach the small intestine unharmed .

- Reaching the small intestines, the metacercaria navigate toward the human liver, which becomes its final habitat .
- Clonorchis feed on human bile created by the liver. In the human liver, the mature Clonorchis reaches its stage of sexual reproduction .
- The hermaphroditic adults produce eggs every 1-30 seconds, resulting in the rapid multiplication of inhabitants in the liver.


CDC
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http://www.dpd.cdc.gov/dpdx
Metacercariae in flesh or skin of fresh water fish are ingested by human host. 4
i = Infective Stage
d = Diagnostic Stage
Free-swimming cercariae encyst in the skin or flesh of fresh water fish. 3
5 Excyst in duodenum
Eggs are ingested by the snail. 2
Miracidia 2a
Sporocysts 2b
Rediae 2c
Cercariae 2d
1 Embryonated eggs passed in feces.
6 Adults in biliary duct

- **Pathogenesis**
- Acute infections may be characterized by fever, diarrhea, epigastric pain, enlargement and tenderness of liver and sometimes jaundice.
- The invasion by these worms in the gall bladder may cause cholecystitis, due to flukes becoming impacted in the common bile duct.
- **Laboratory Diagnosis**
- Definitive diagnosis is made by observing the characteristic ova in feces following an iodine stained, formol-ether concentration method of the feces or from duodenal aspirates when there is complete obstructive jaundice or from the Entero-Test.