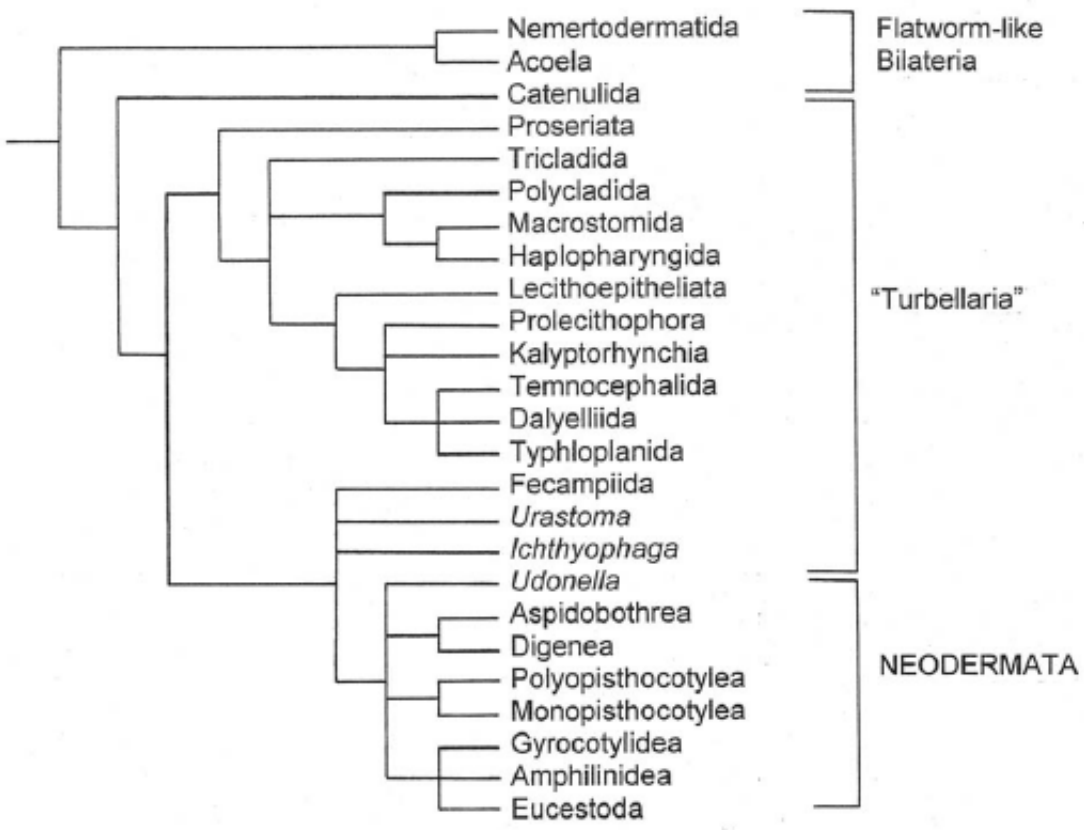


Figure 13.3 **A consensus tree obtained by Littlewood et al.[20] using both molecular and morphological characters.**
Free-living members of the phylum appear mostly at the base of the tree. A sister-group relationship between Digenea (Trematoda) and Aspidobothrea is supported, as is the basal position of catenulids and monophyly of the Neodermata.

Modified from D. T. J. Littlewood, K. Rohde and K. A. Clough, "The interrelationships of all major groups of Platyhelminthes: Phylogenetic evidence from morphology and molecules," in *Biol. J. Linnean Soc.* 66:75–114.

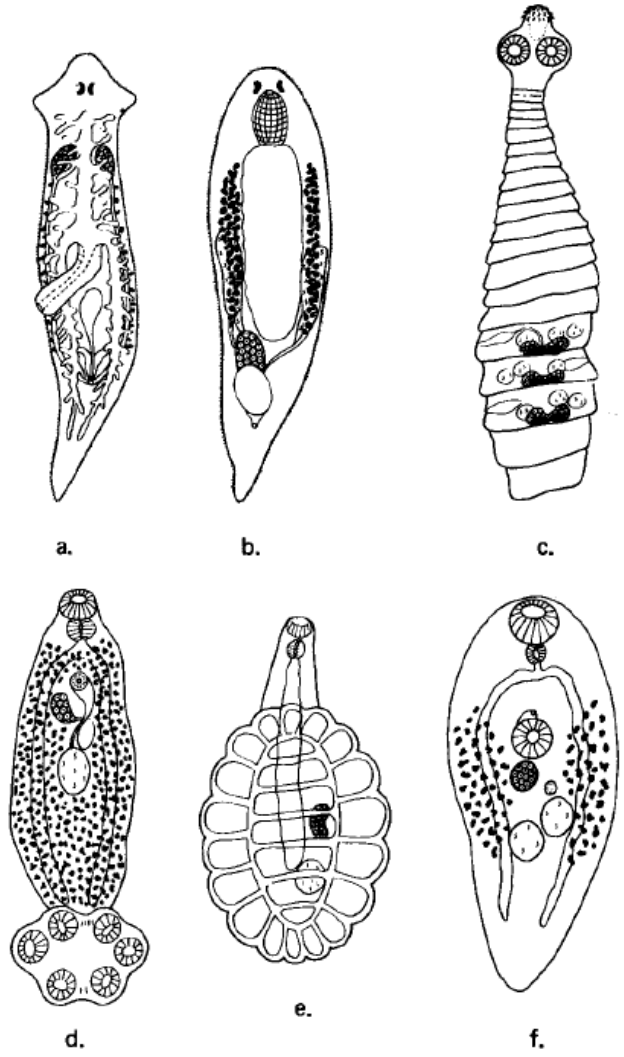
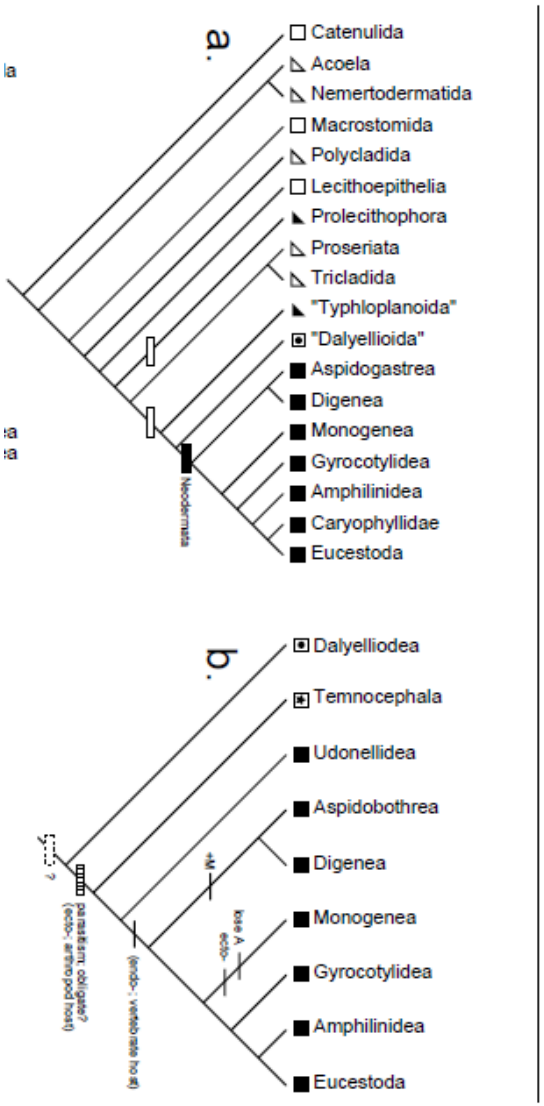
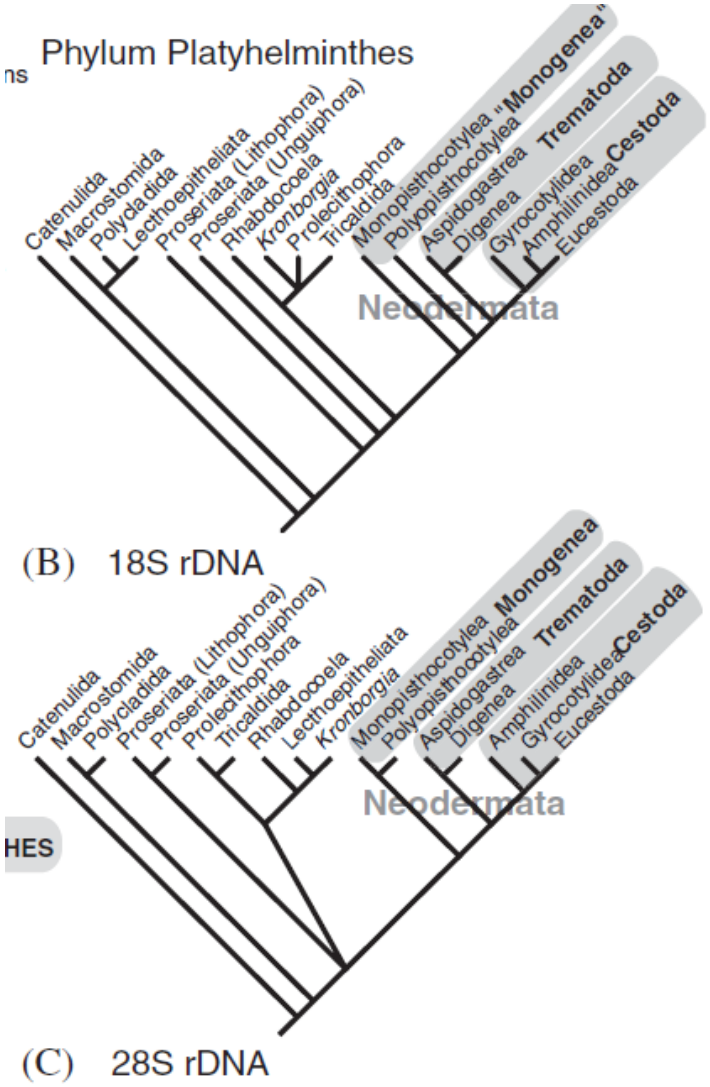


Fig. 1. Representatives of Classes in Phylum Platyhelminthes: a. and b. Turbellaria (a. Tricladida, b. Rhabdocoela); c. Cestoidea (Cestoda); d., e. and f. Trematoda (d. Monogenea, e. Aspidogastrea. f. Digenea)





interrelationships of the phylum

- **Definition** of **digenetic**. :of or relating to a subclass (Digenea) of trematode worms in which sexual reproduction as an internal parasite of a vertebrate alternates with asexual reproduction in a mollusk.
- Monogenetic: (of certain trematode worms) having only one generation in the life cycle, without an intermediate asexual generation.

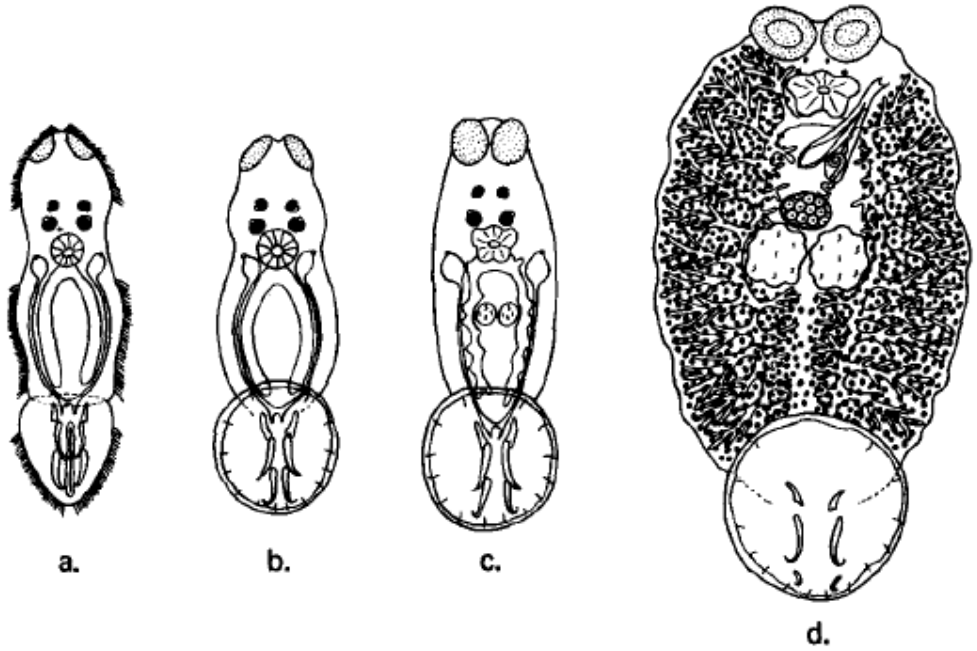


Fig. 2. Example of life cycle of a monogenetic trematode (a. onchomiracidium; b. and c. developmental stages; d. adult of *Neobenedenia melleni*) (Redrawn from Jahn & Kuhn, 1932)

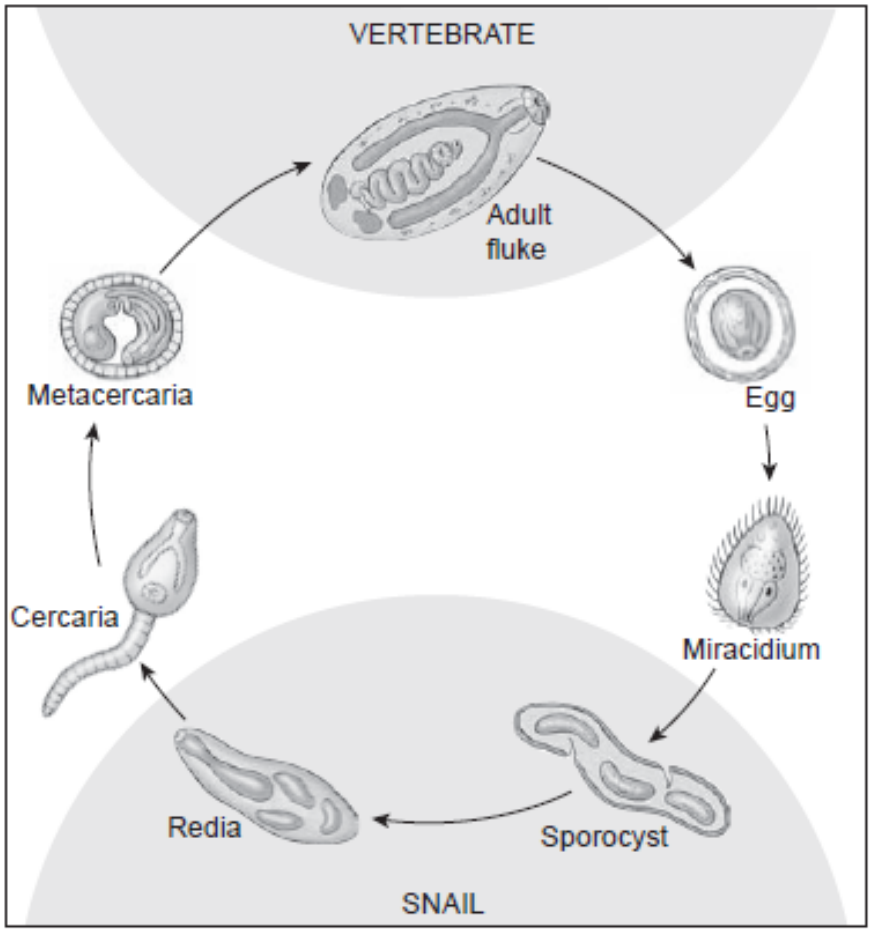


Figure 15.1 Typical trematode life cycle.
Many variations occur.

Drawing by William Ober and Claire Garrison.

s it can be found
or end, beside the

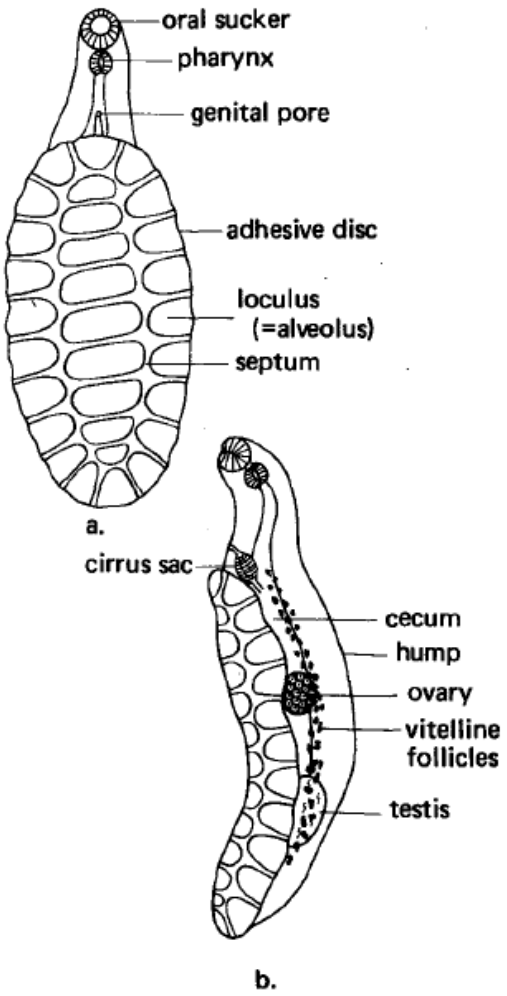


Fig. 5. Subclass Aspidogastrea (a. ventral view; b. lateral view).

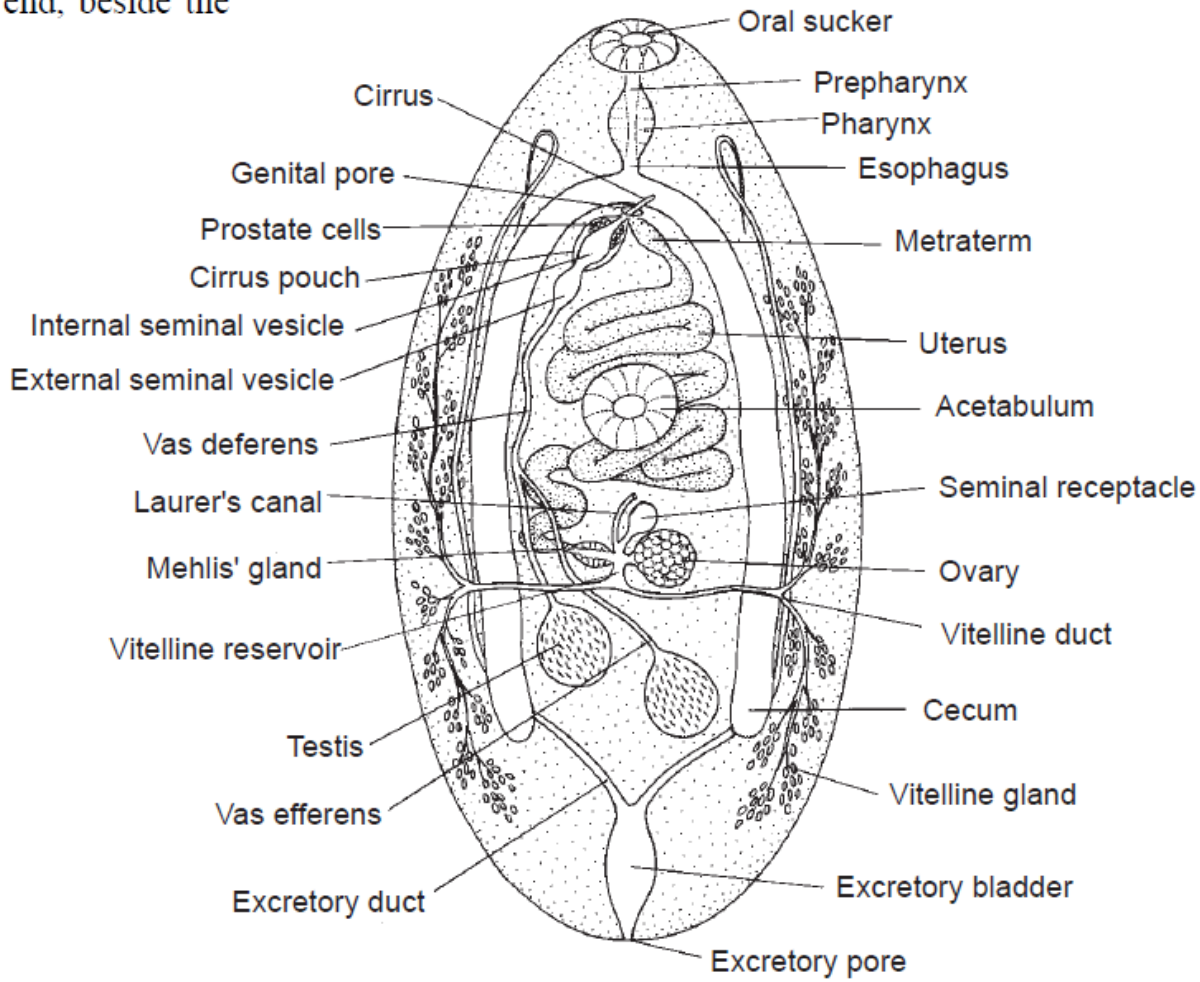
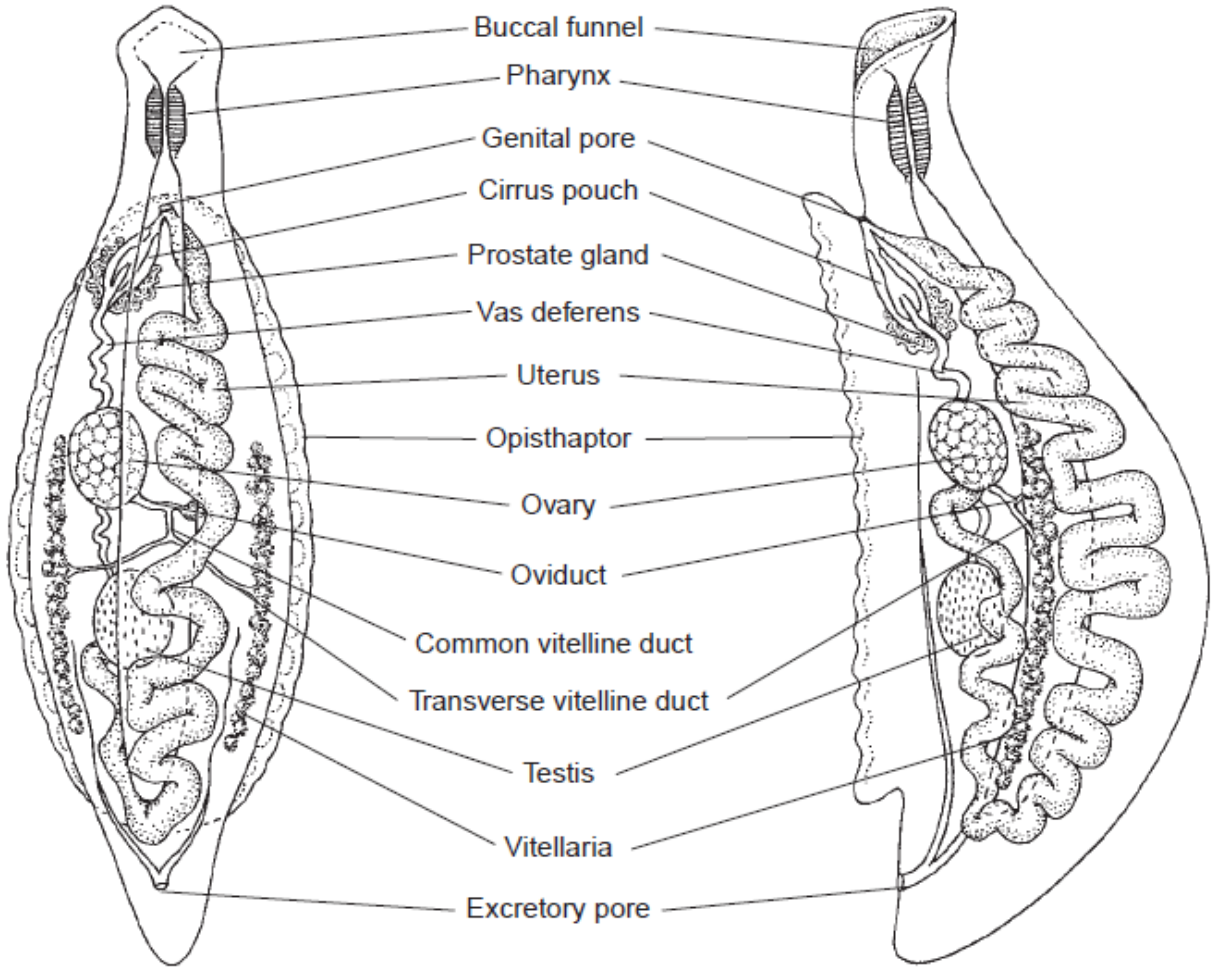
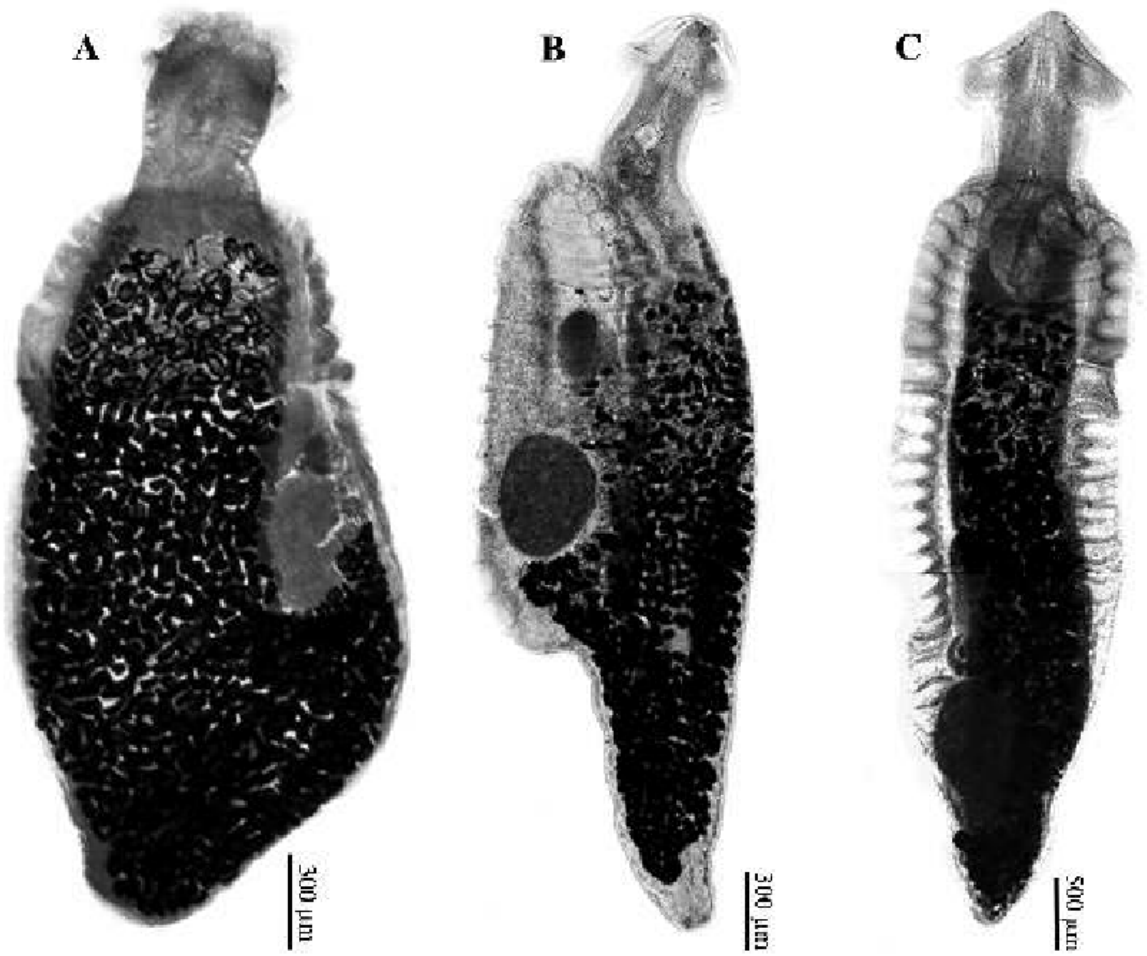


Figure 14.6 ***Aspidogaster conchicola*, a common parasite of freshwater clams.**
(*a*) Dorsal view, showing general body form. (*b*) Lateral view.
Drawing by William Ober and Claire Garrison.





Lobatostoma albulae
L. Pacificum
L. manteri

Aspidogaster conchicola

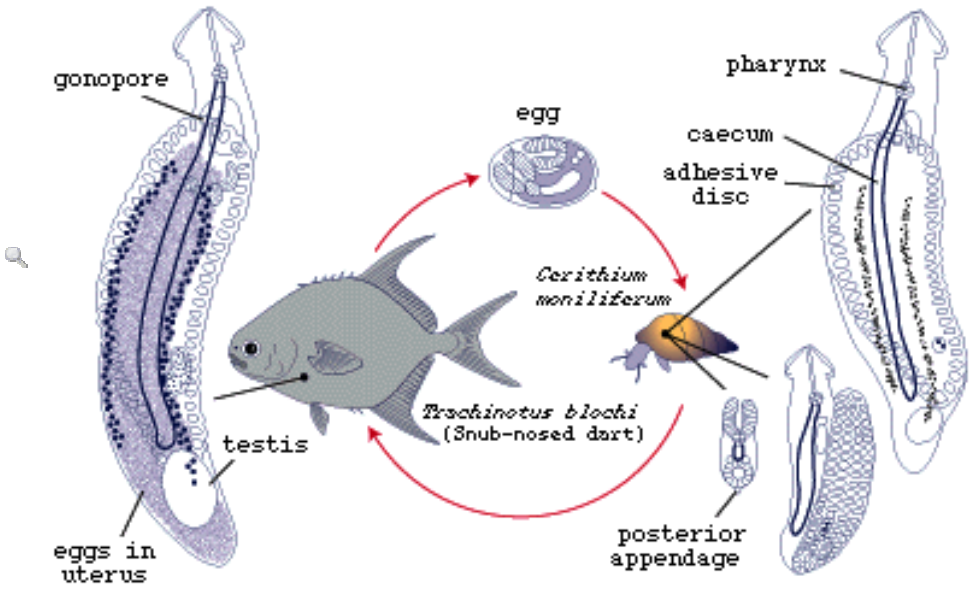
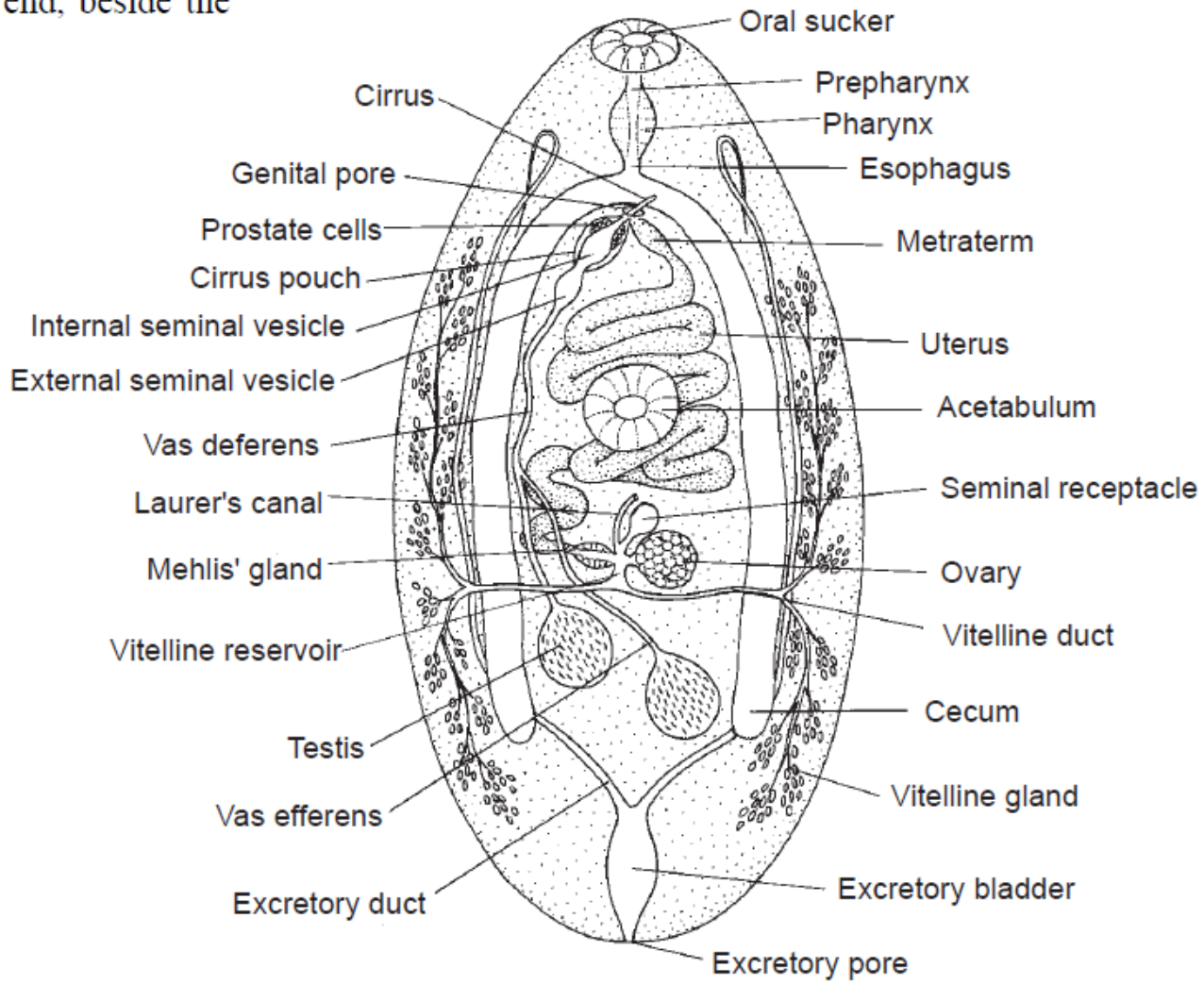
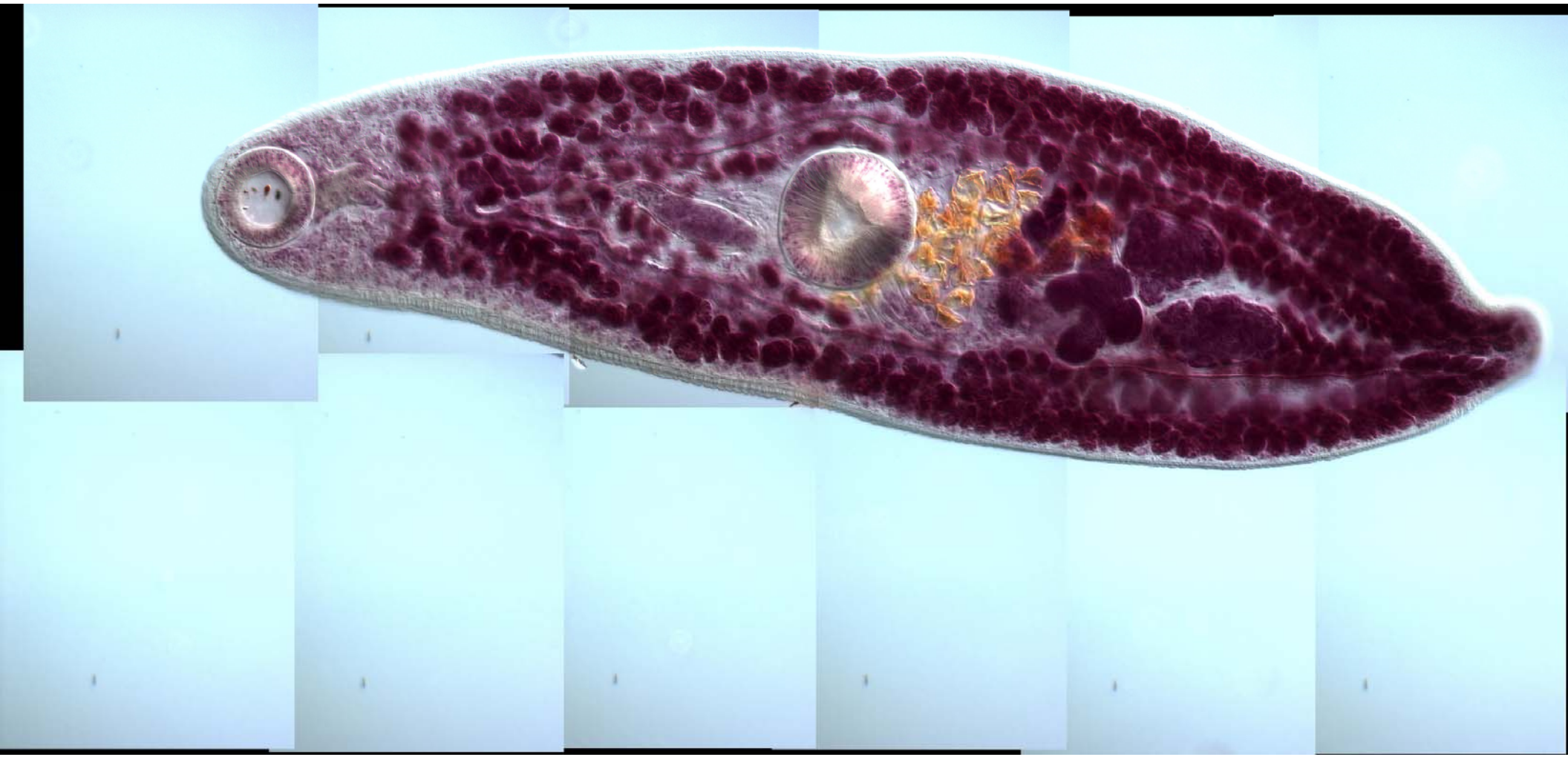


Figure 1. Life cycle of **Lobatostoma manteri**.
Lobatostoma manteri is an example of a species which has obligate vertebrate hosts (Fig. 1). Adult worms live in the small intestine of the snubnosed dart, **Trachinotus blochi** (Teleostei, Carangidae), on the Great Barrier Reef. They produce large numbers of eggs which are shed in the faeces. If eaten by various prosobranch snails, larvae

s it can be found
or end, beside the





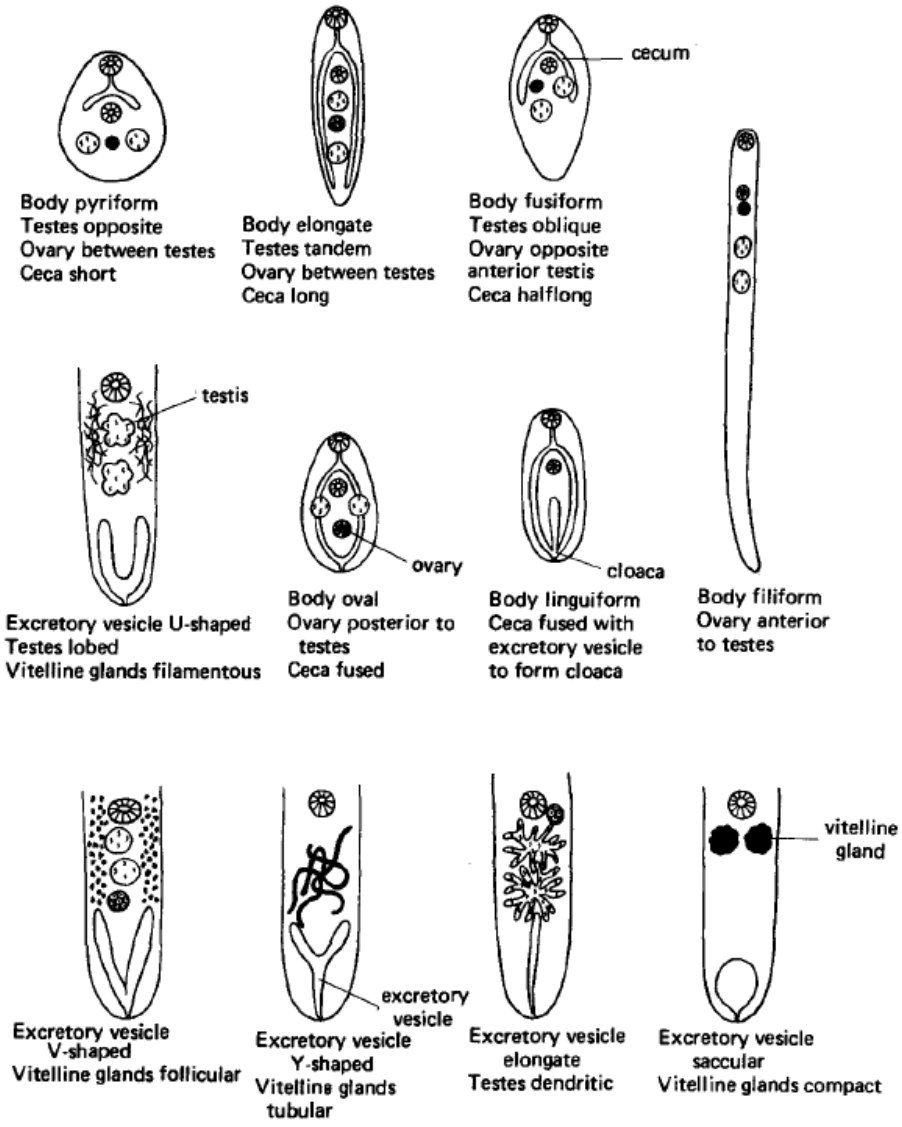


Fig. 6a. Important diagnostic features illustrated.

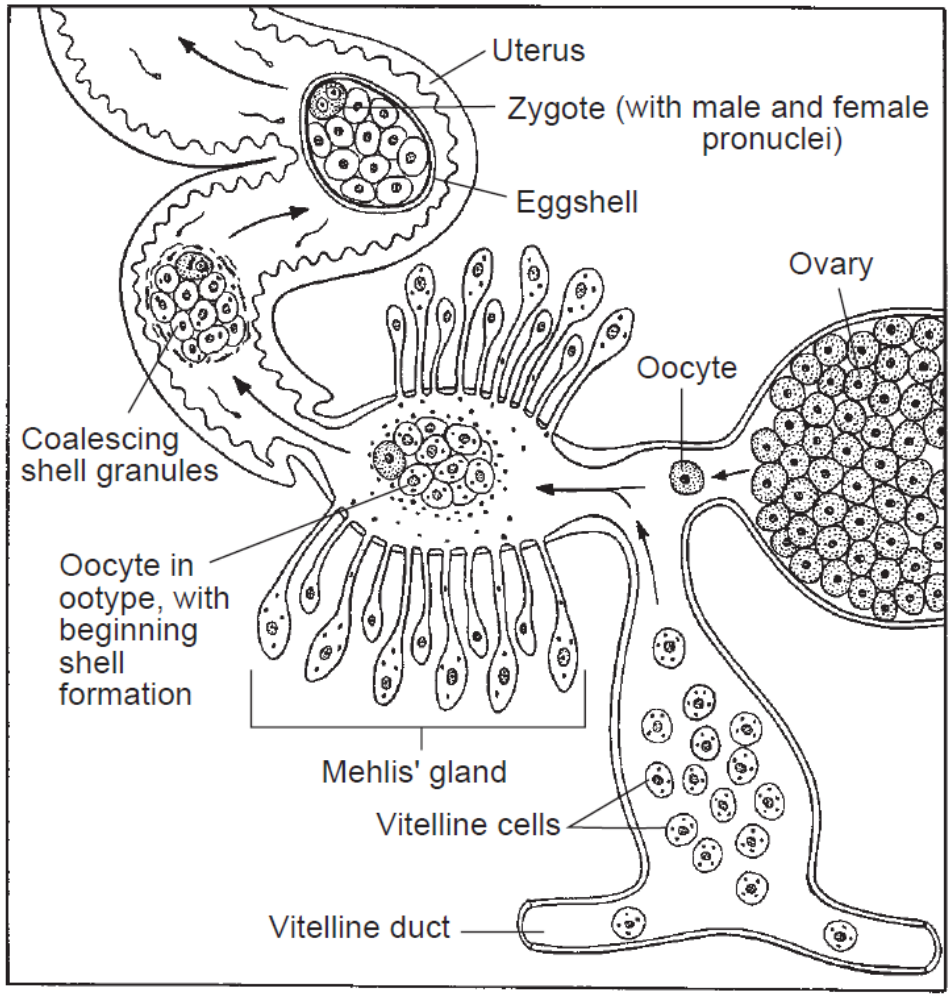


Figure 15.19 Schematic representation of the oogenotop of a digenetic trematode.

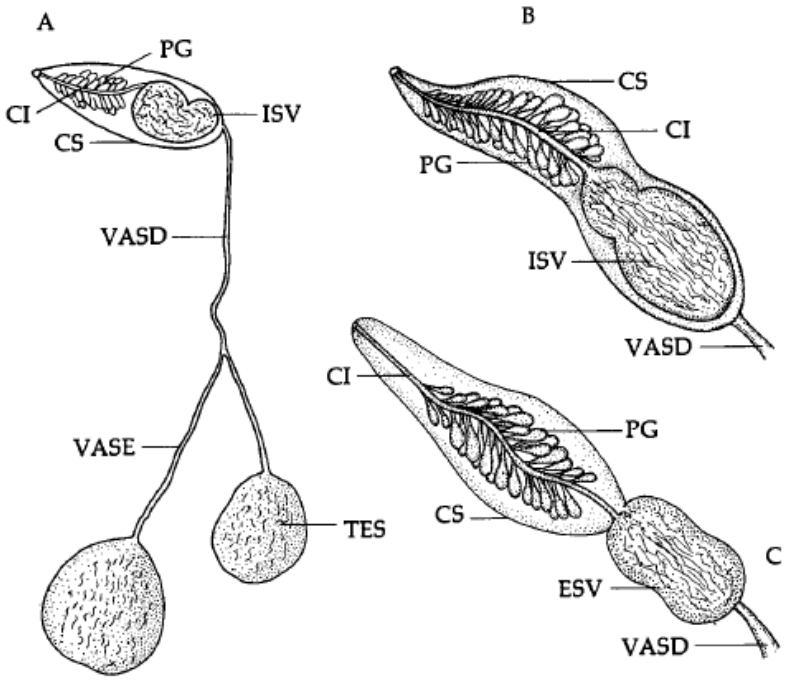
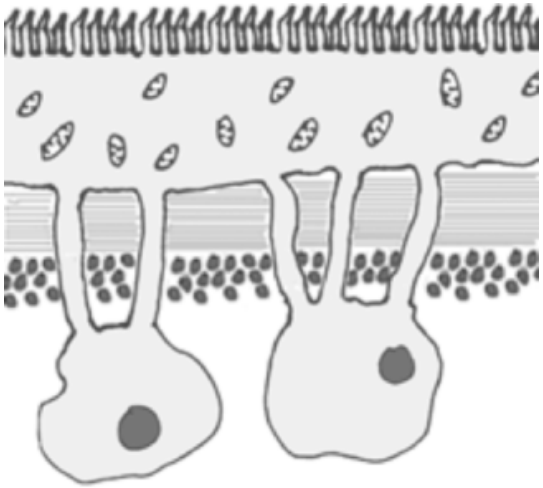
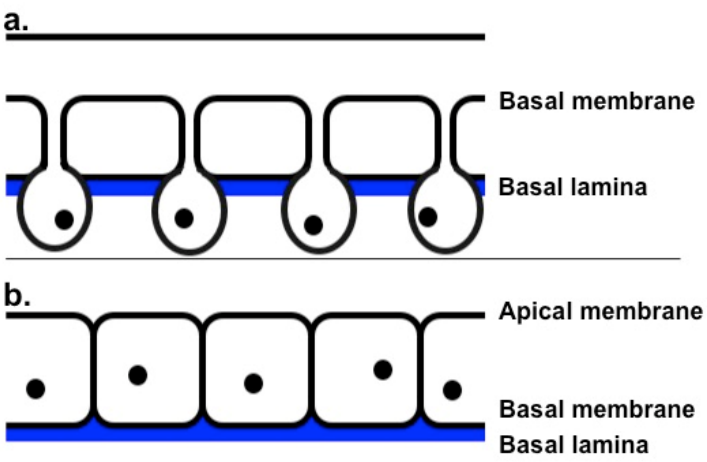
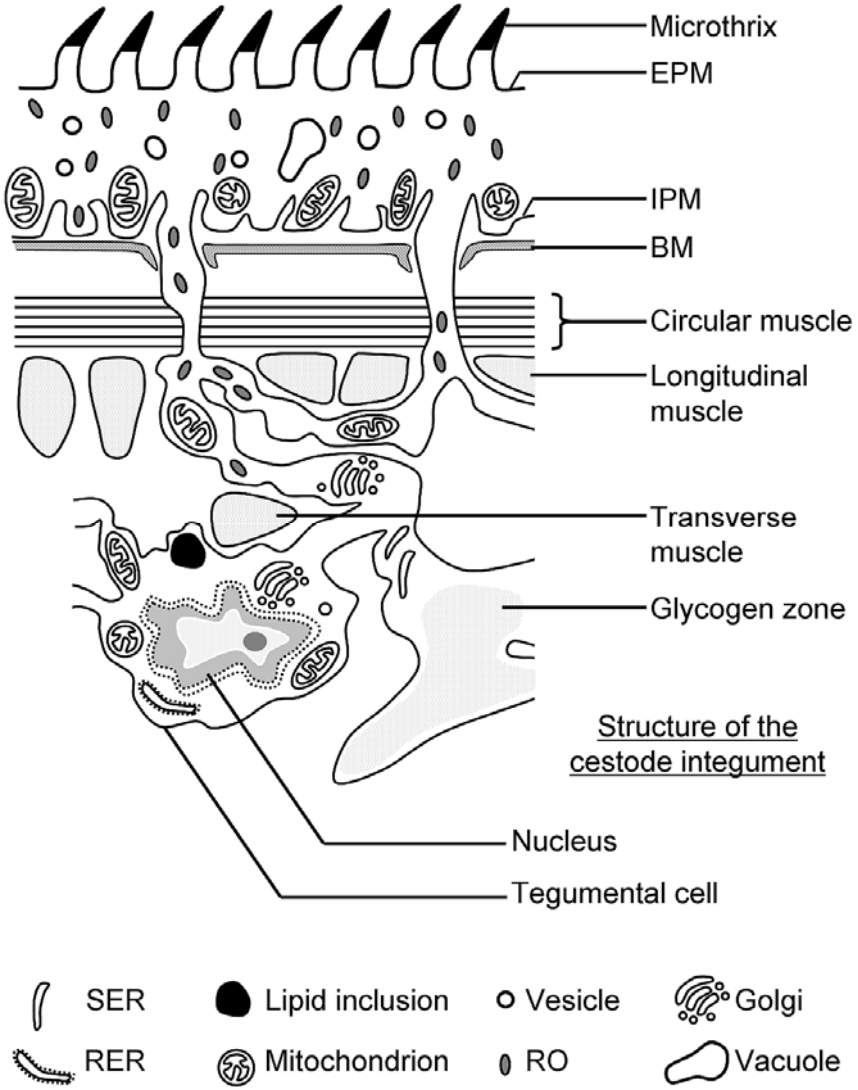


Fig. 10.6. Male reproductive system of digenetic trematode. A. Complete system showing constituent parts. **B.** Cirrus sac of species with internal seminal vesicle. **C.** Terminal portion of species with external seminal vesicle. CI, cirrus; CS, cirrus sac; ESV, external seminal vesicle; ISV, internal seminal vesicle; PG, prostate glands; TES, testis; VASD, vas deferens; VASE, vas efferens.

Tegumen: Syncytial epidermis







Structure of the cestode integument

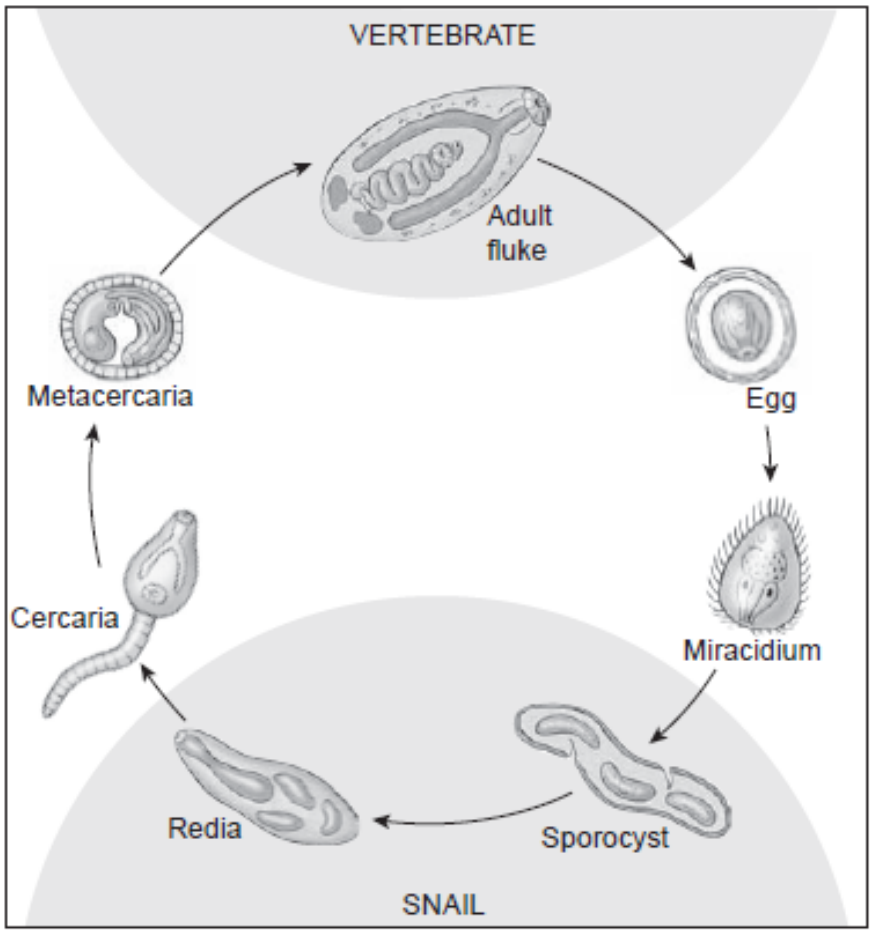
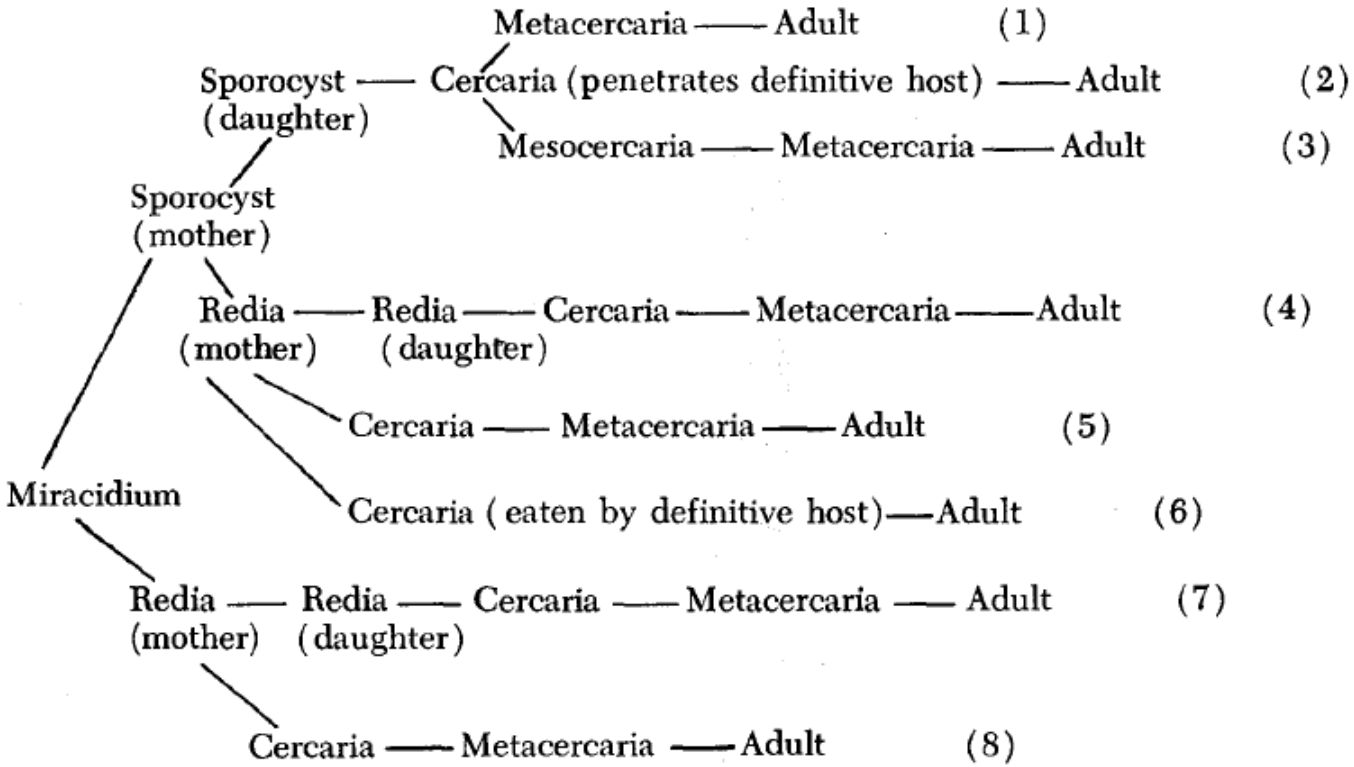


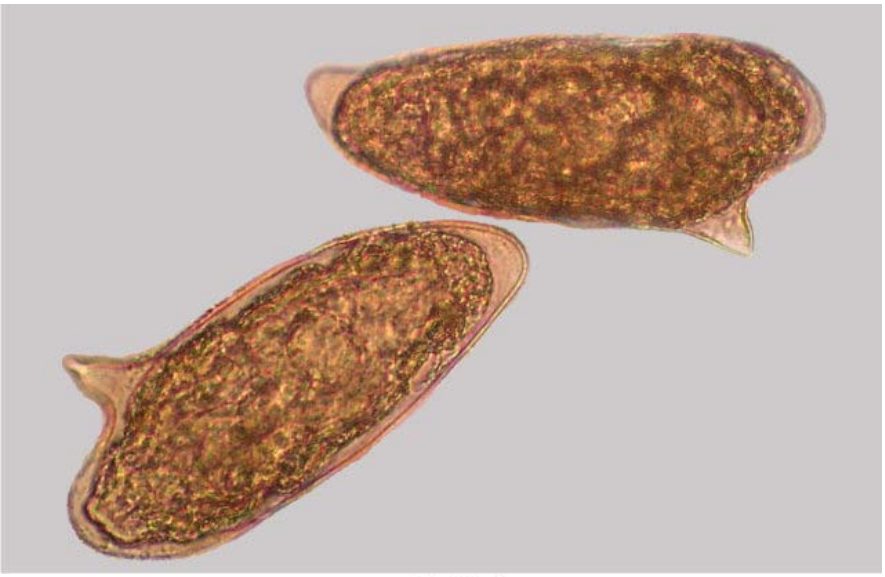
Figure 15.1 **Typical trematode life cycle.**
Many variations occur.

Drawing by William Ober and Claire Garrison.

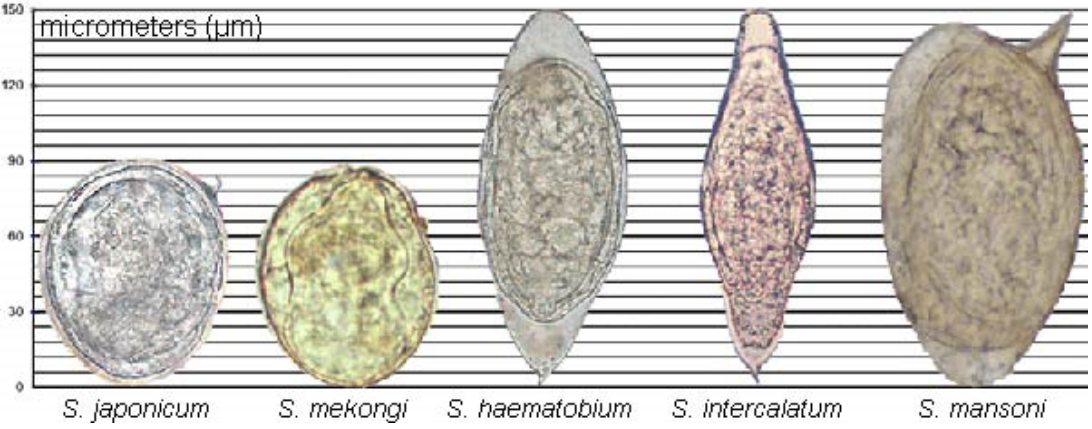
POSSIBLE LIFE CYCLES OF DIGENETIC TREMATODES



(1) *Diplostomum flexicaudum* (Cort and Brooks, 1928)
(2) *Trichobilharzia physellae* (Talbot, 1936)
(3) *Alaria mustelae* Bosma, 1931
(4) *Fasciola hepatica* Linnaeus, 1758
(5) *Metorchis conjunctus* (Cobbold, 1860)
(6) *Proterometra dickermani* Anderson, 1962
(7) *Stichorchis subtriquetrus* (Rudolphi, 1814)
(8) *Caecincola parvulus* Marshall and Gilbert, 1905



***Schistosoma* eggs**



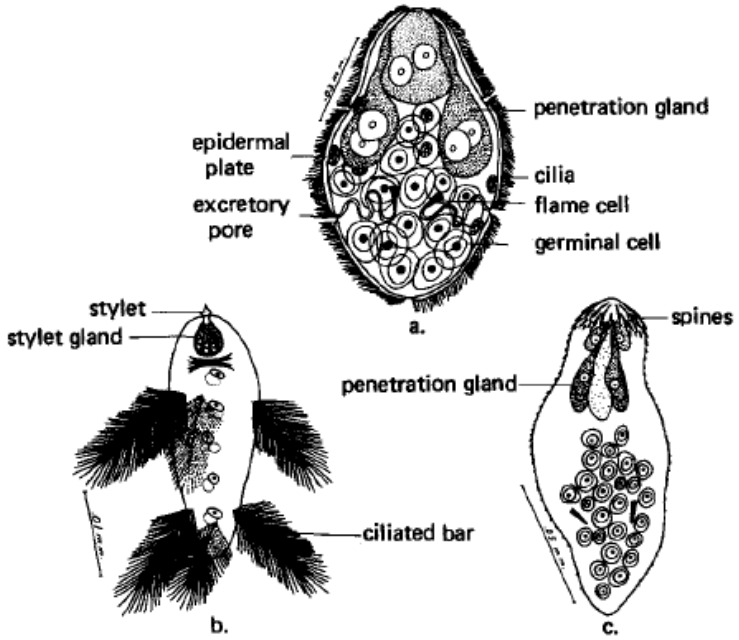
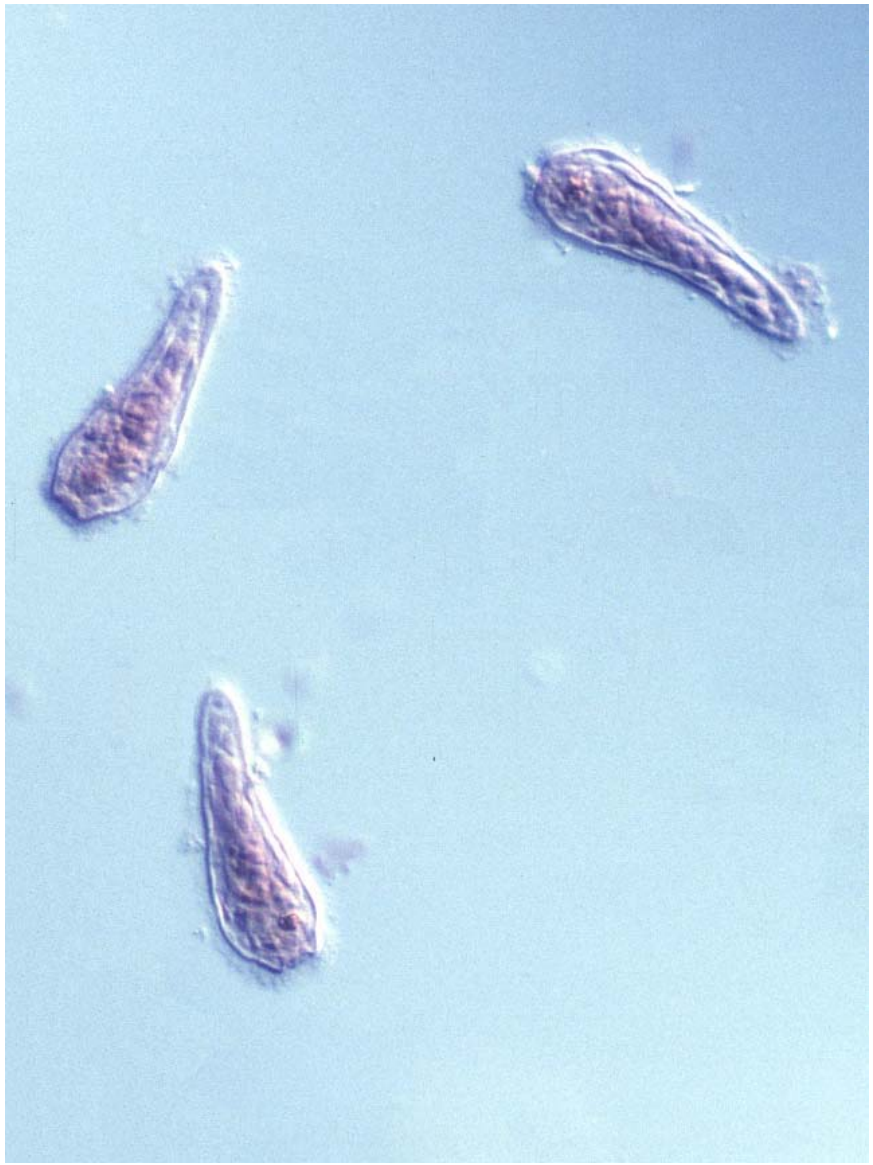


Fig. 8. Miracidia (a. *Phyllodistomum* sp.; b. *Leucochloridiomorpha constantiae*; c. *Halipegus* sp.). (Redrawn from Allison, 1943).



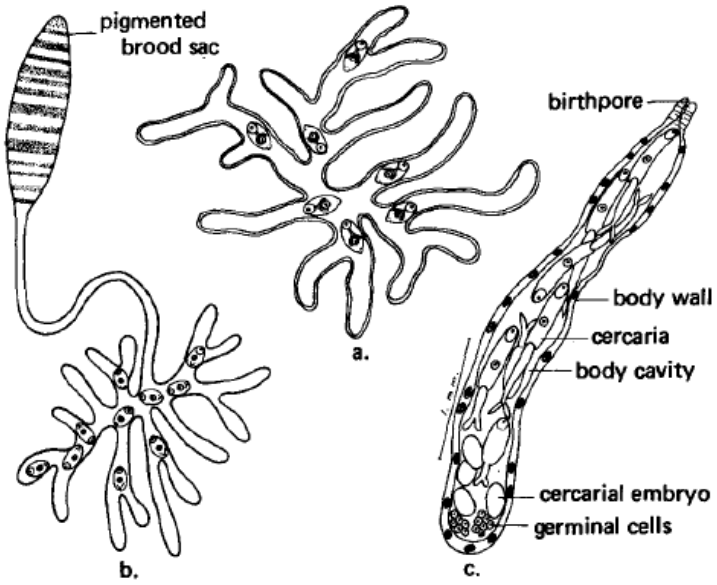
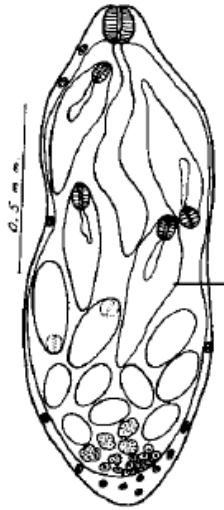
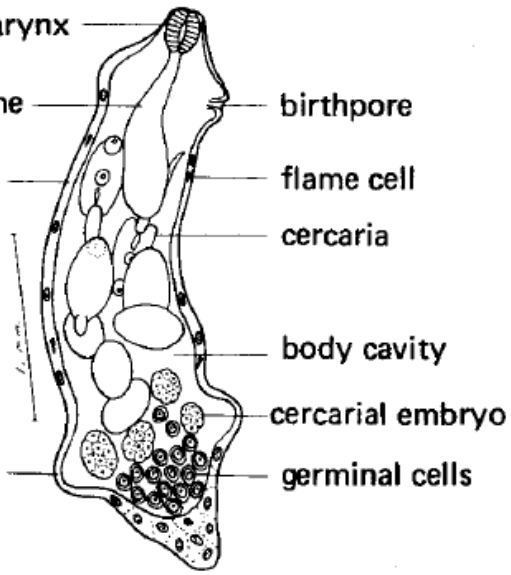


Fig. 9. Sporocysts (a. branched sporocyst of *Postharmostomum* sp.; b. branched with pigmented brood sac, *Leucochloridium* sp.; c. unbranched sporocyst of *Strigea* sp.



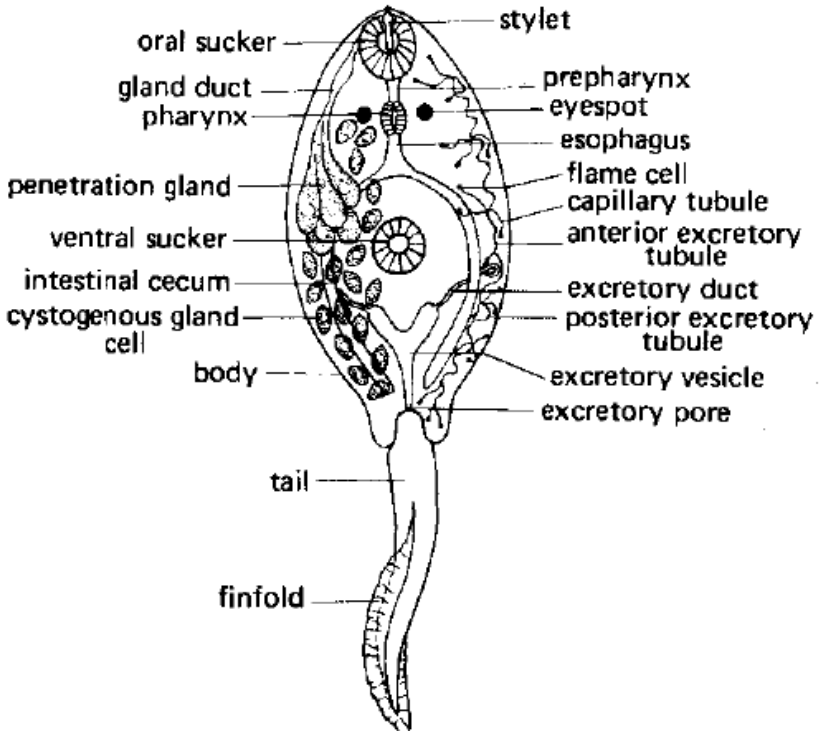
a.

Fig. 10. Mother redia.



b.

Fig. 11. Daughter redia.


stylet
oral sucker
prepharynx
gland duct
eyespot
pharynx
esophagus
flame cell
penetration gland
capillary tubule
anterior excretory tubule
ventral sucker
intestinal cecum
excretory duct
posterior excretory tubule
cystogenous gland cell
excretory vesicle
body
excretory pore
tail
finfold

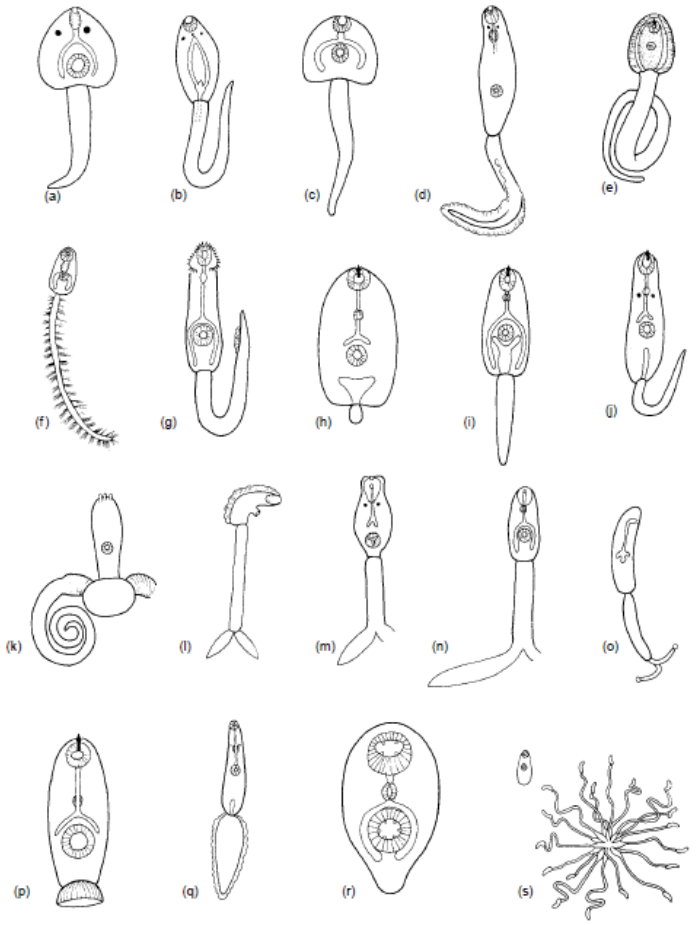


Figure 15.24 **A few of the many types of cercariae.**
(*a*) Amphistome cercaria; (*b*) monostome cercaria; (*c*) gymnocephalous cercaria; (*d*) gymnocephalous cercaria of pleurolophocercous type; (*e*) cystophorous cercaria; (*f*) trichocercous cercaria; (*g*) echinostome cercaria; (*h*) microcercous cercaria; (*i*) xiphidiocercaria; (*j*) ophthalmoxiphidiocercaria; (*k–o*) furcocercous types of cercariae: (*k*) gasterostome cercaria; (*l*) lophocercous cercaria; (*m*) apharyngeate furcocercous cercaria; (*n*) pharyngeate furcocercous cercaria; (*o*) apharyngeate monostome furcocercous cercaria without oral sucker; (*p*) cotylocercous cercaria; (*q*) rhopalocercous cercaria; (*r*) cercariae; (*s*) rattenkönig, or rat-king, cercariae.

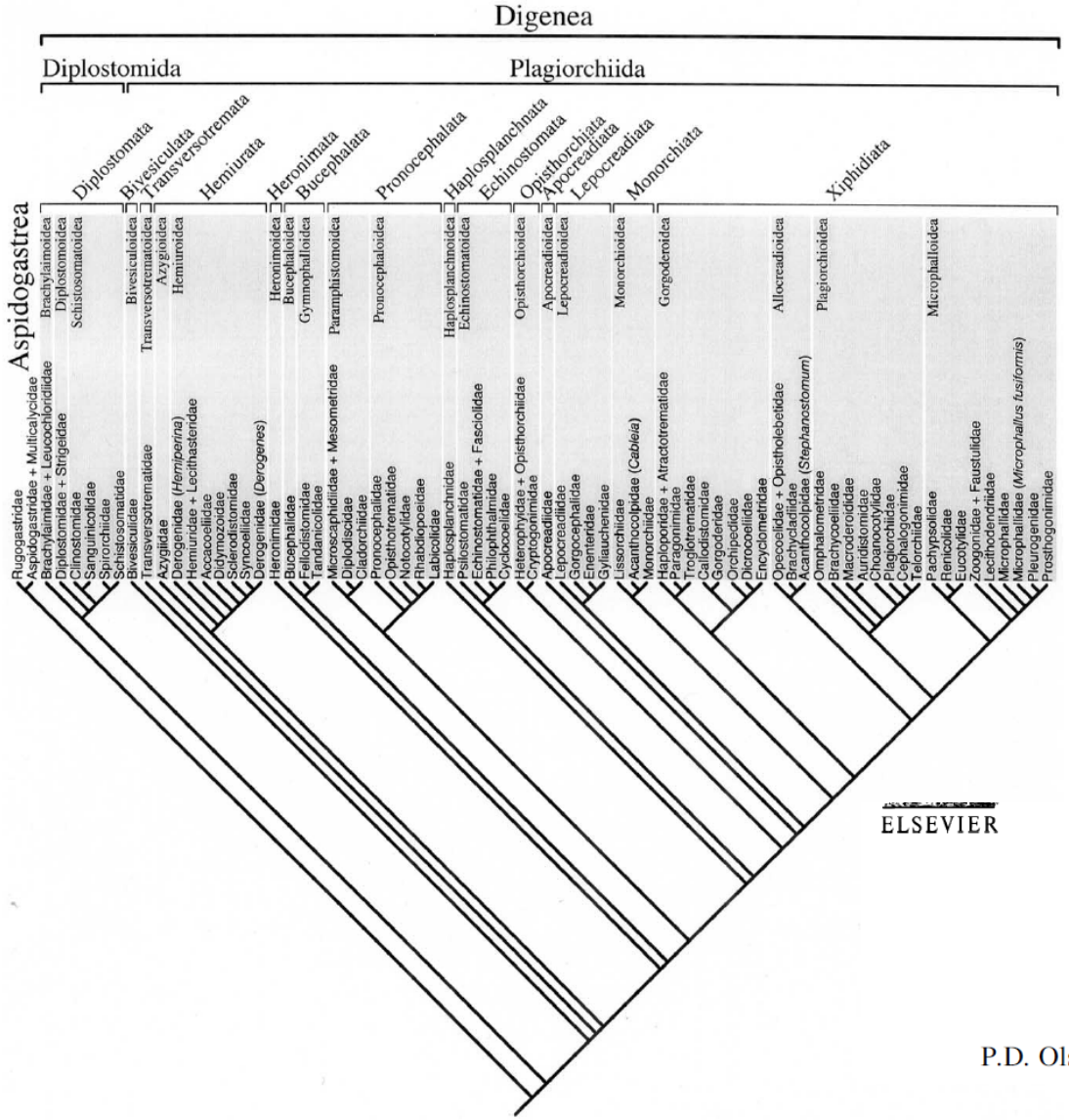


Fig. 6. Revised classification of the Digenea based on the results of Bayesian inference of lsrDNA and ssrDNA combined (see Fig. 3).

Phylum: Platyhelminthes
Class: Trematoda
Subclass:Digenea
Order: ….a
Families: ….ae

International Journal for Parasitology 33 (2003) 733–755

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Phylogeny and classification of the Digenea (Platyhelminthes: Trematoda)[1]

P.D. Olson[a], T.H. Cribb[b,c], V.V. Tkach[d,e,2], R.A. Bray[a], D.T.J. Littlewood[a,*]

O. Paramphistomiformes→ cercaria with eyespots, encyst in the open, body elongated, ventral sucker large, hind part of the body

O. Echinostomatiformes→ cercaria encyst in open, spines on body or spiny collar (mostly but not always) includes Fasciolidae

O. Hemiuriformes→ tadpole like tail hind body section (tail+ecsoma)

O. Strigeiformes→ cup shaped forebody (Diplostomidae: Alaria americana), some classifications include Schistosomatidae)

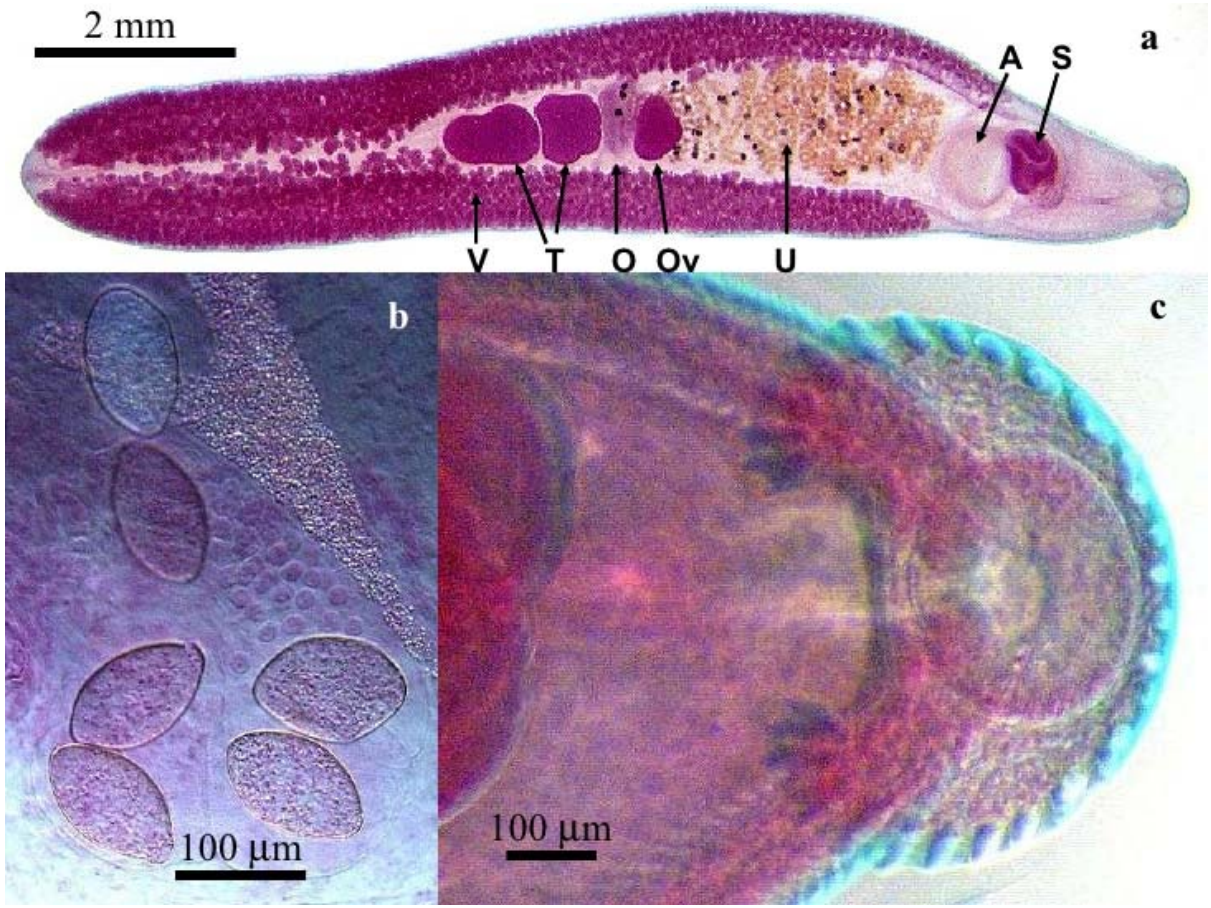
O. Opisthorchiformes→ general oval shape (small/weak suckers) no cirrus sac and cirrus adult body often with spines, Clonorchis sinensis

O. Plagiorchiformes→ general oval shape, large suckers, small spines on body (Paragonomius westermani

Paramphistomatidae

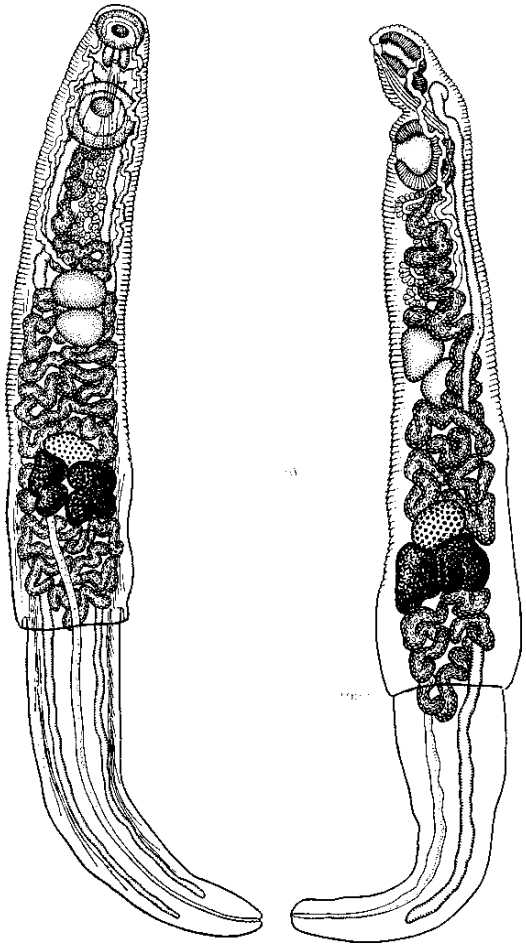
Megalodiscus temperatus
(rectum / bladder of frogs)
Heliosoma as intermediate host.

Echinostomatidae



Echinostoma ilocanum

Hemiuridae



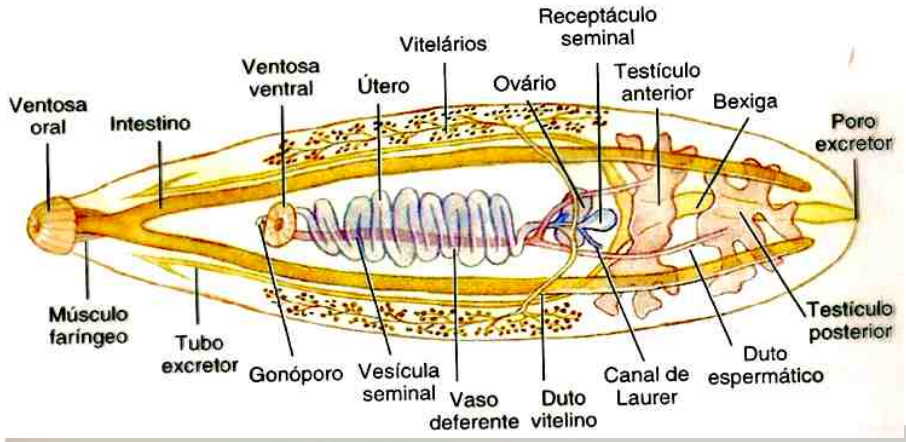
Hemiurus rugosus, Looss, 1907
(fish gut)

Strigeidae

Strigea elegans (snail, tadpole, garter snake/duck, owl)

Alaria canis (snail, tadpole/frog, (mouse), fox/dog)

Opisthorchiidae



Clonorhis sinensis

Plagiorchiidae

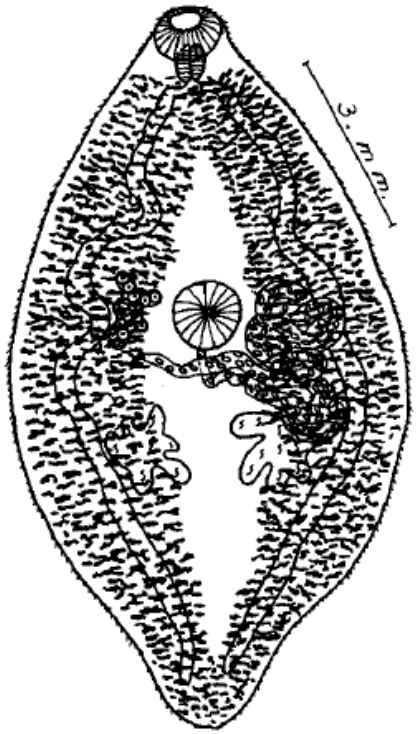
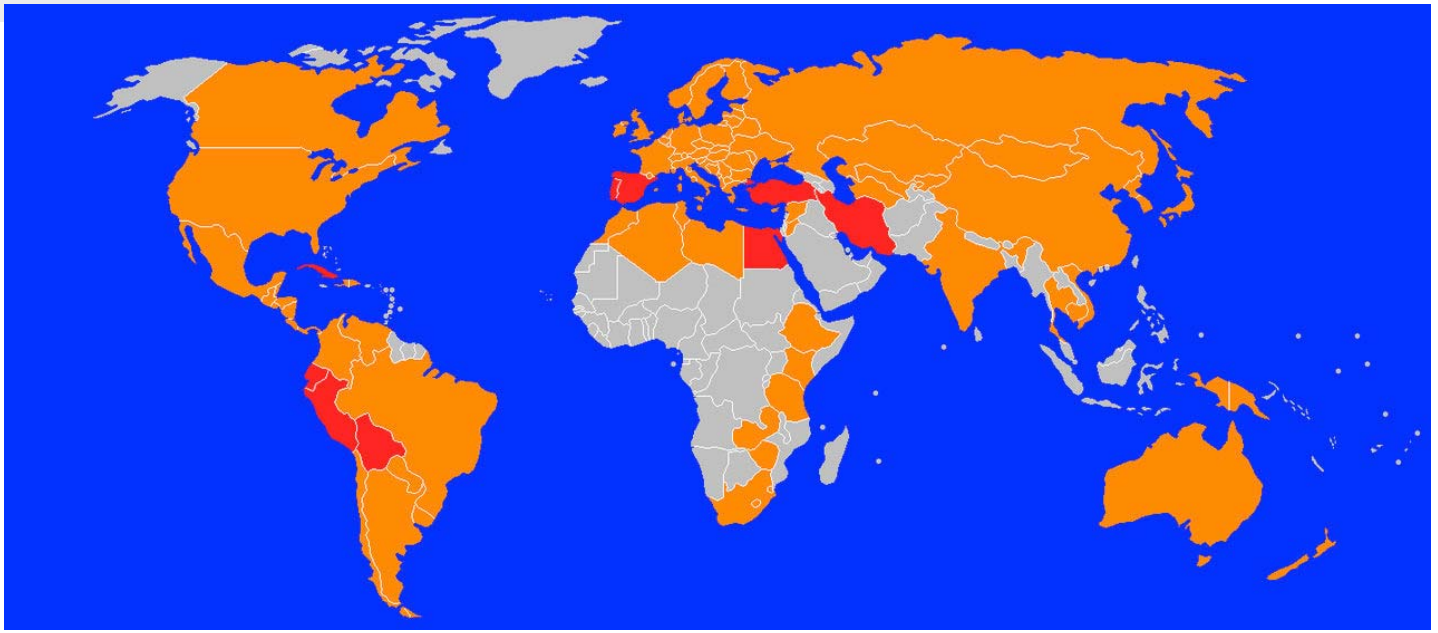


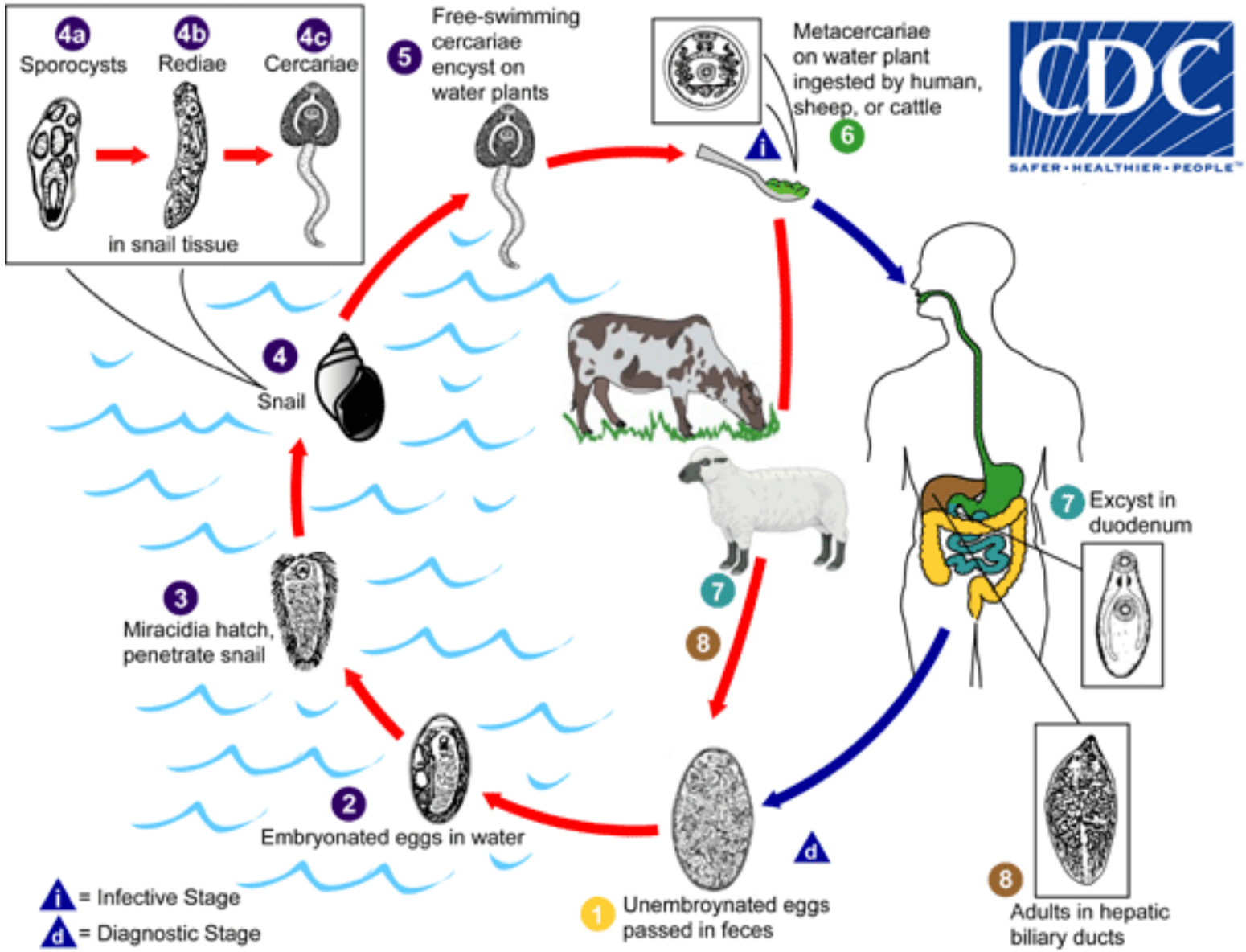
Fig. 580. *Paragonimus kellicotti.*

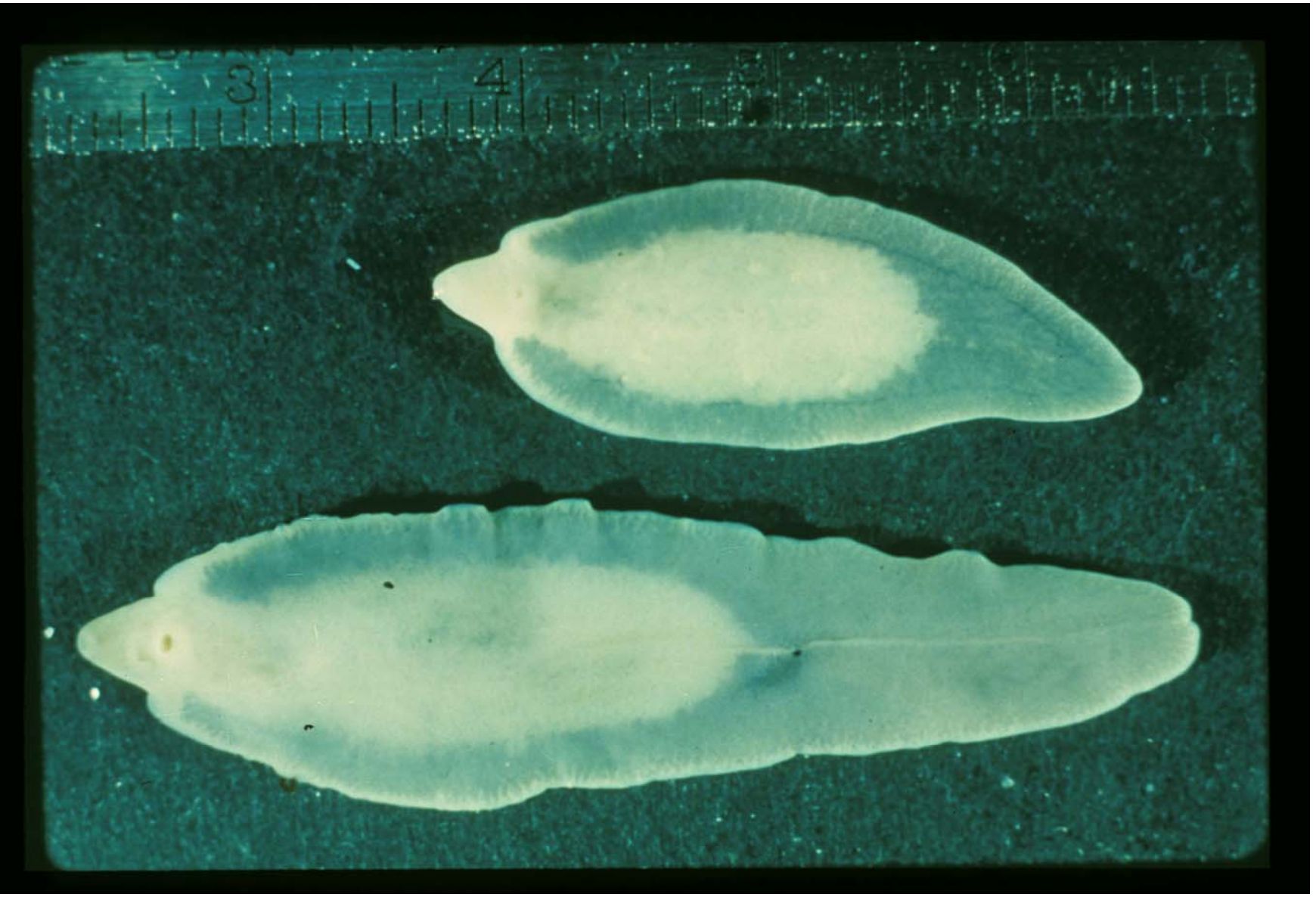
Paragonomius kellicotti
Lung worm of minks in North America (snail, crayfish)

Fasciolidae

Fasciola hepatica (snail, herbivor)



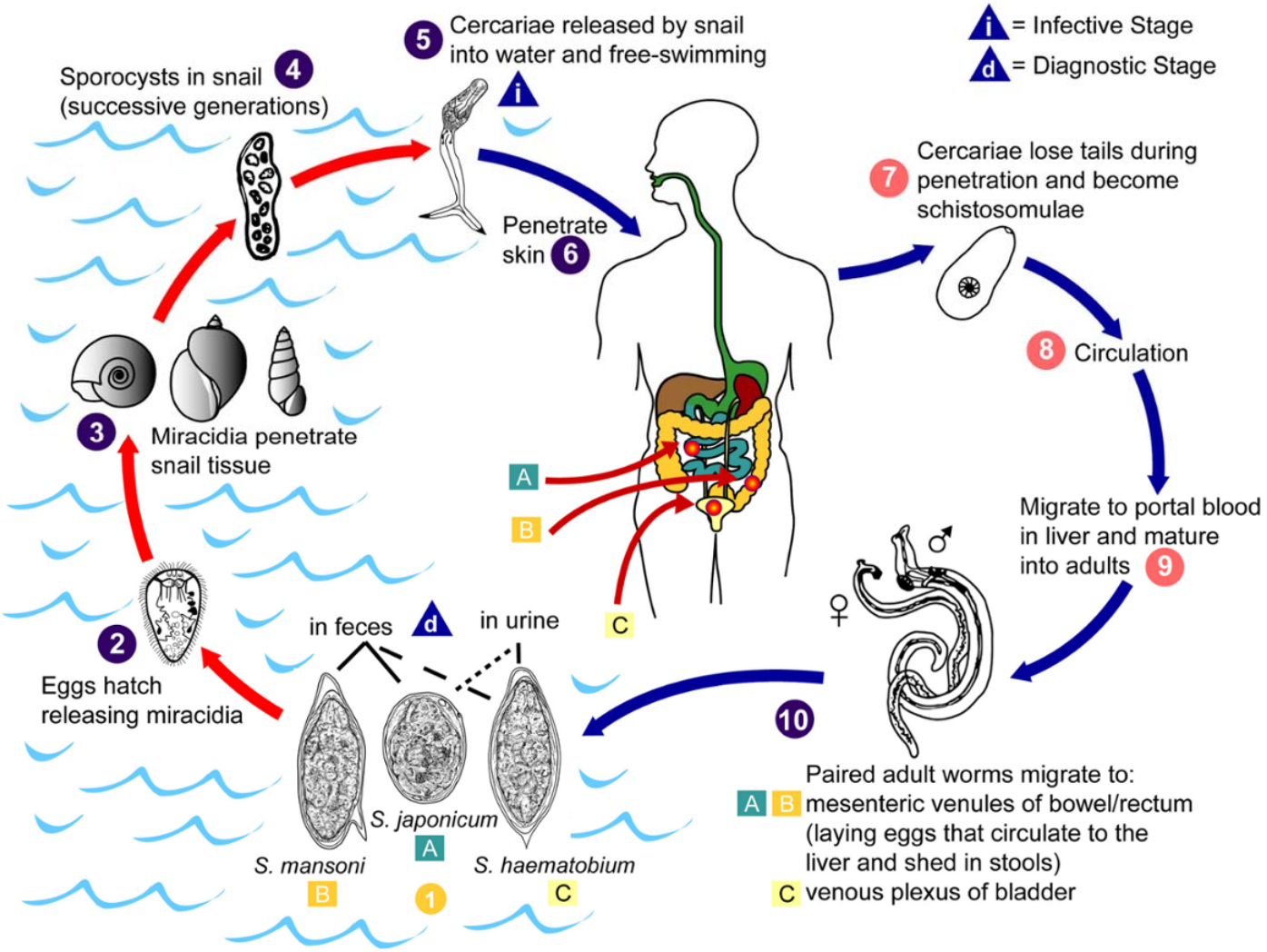

4a
Sporocysts
4b
Rediae
4c
Cercariae
in snail tissue
5
Free-swimming cercariae encyst on water plants
Metacercariae on water plant ingested by human, sheep, or cattle
6
i
CDC
SAFER • HEALTHIER • PEOPLE™
4
Snail
3
Miracidia hatch, penetrate snail
7
Excyst in duodenum
8
2
Embryonated eggs in water
d
1
Unembroynated eggs passed in feces
8
Adults in hepatic biliary ducts
i = Infective Stage
d = Diagnostic Stage



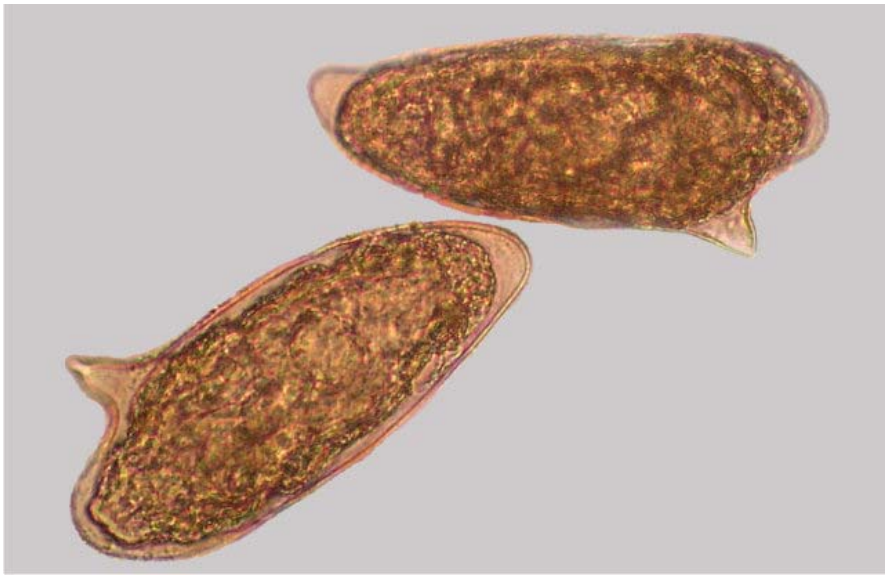
Fasciola hepatica and gigantica. Ventral view of formalin fixed, unstained specimens. Compare size and note the ventral suckers in both parasites.

Fasciolopsis buski

Schistosomiasis




100 µm




1
2
3
4
5
6
CENTIMETERS

Schistosoma japonicum, Liver and splenic enlargement. Nearly 800 worms were removed from this patient.

Plagiorchiformes

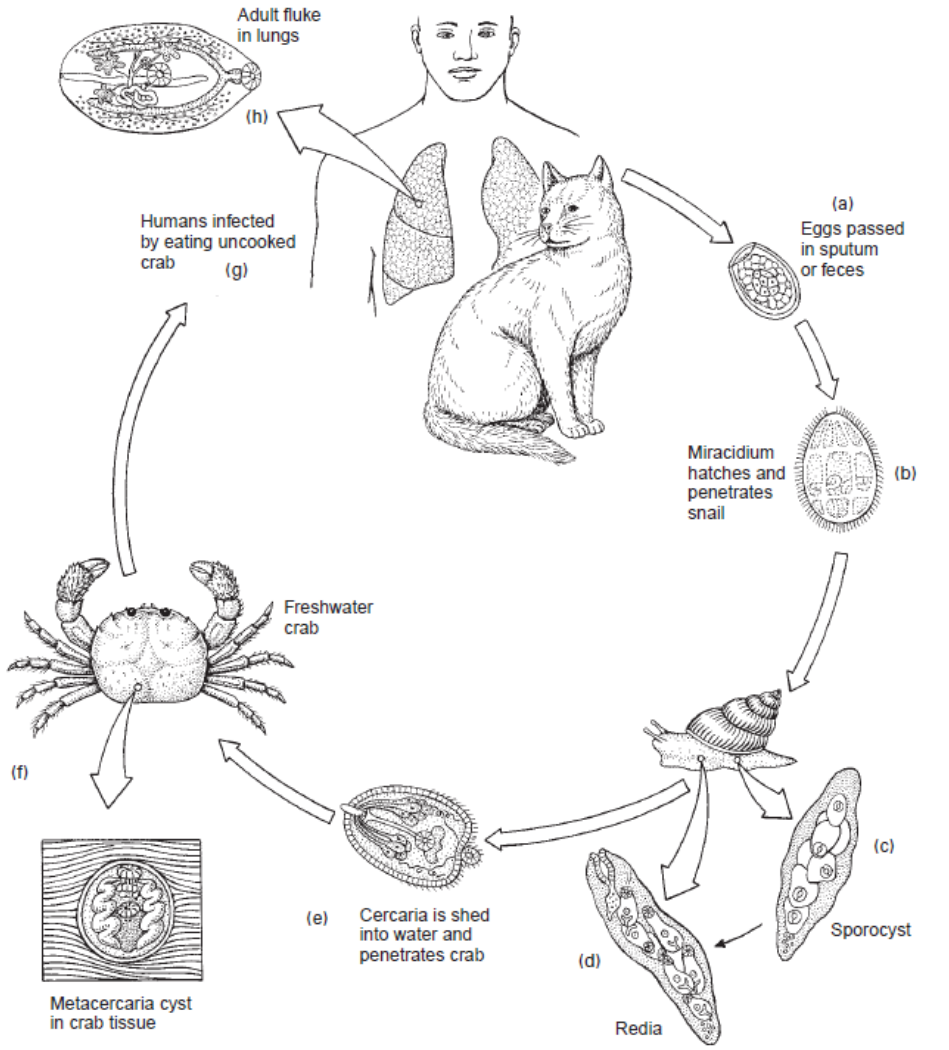


Figure 18.8 Life cycle of *Paragonimus westermani*.
(*a*) Shelled embryo passed in feces or sputum. (*b*) After development miracidium hatches spontaneously and penetrates snail. (*c*) Sporocyst. (*d*) Redia. (*e*) Cercaria is shed into water and penetrates crab. (*f*) Metacercarial cyst in tissue of freshwater crab. (*g*) Cats or humans infected by eating uncooked crab. (*h*) Adult fluke in lungs.
Drawing by William Ober and Claire Garrison.