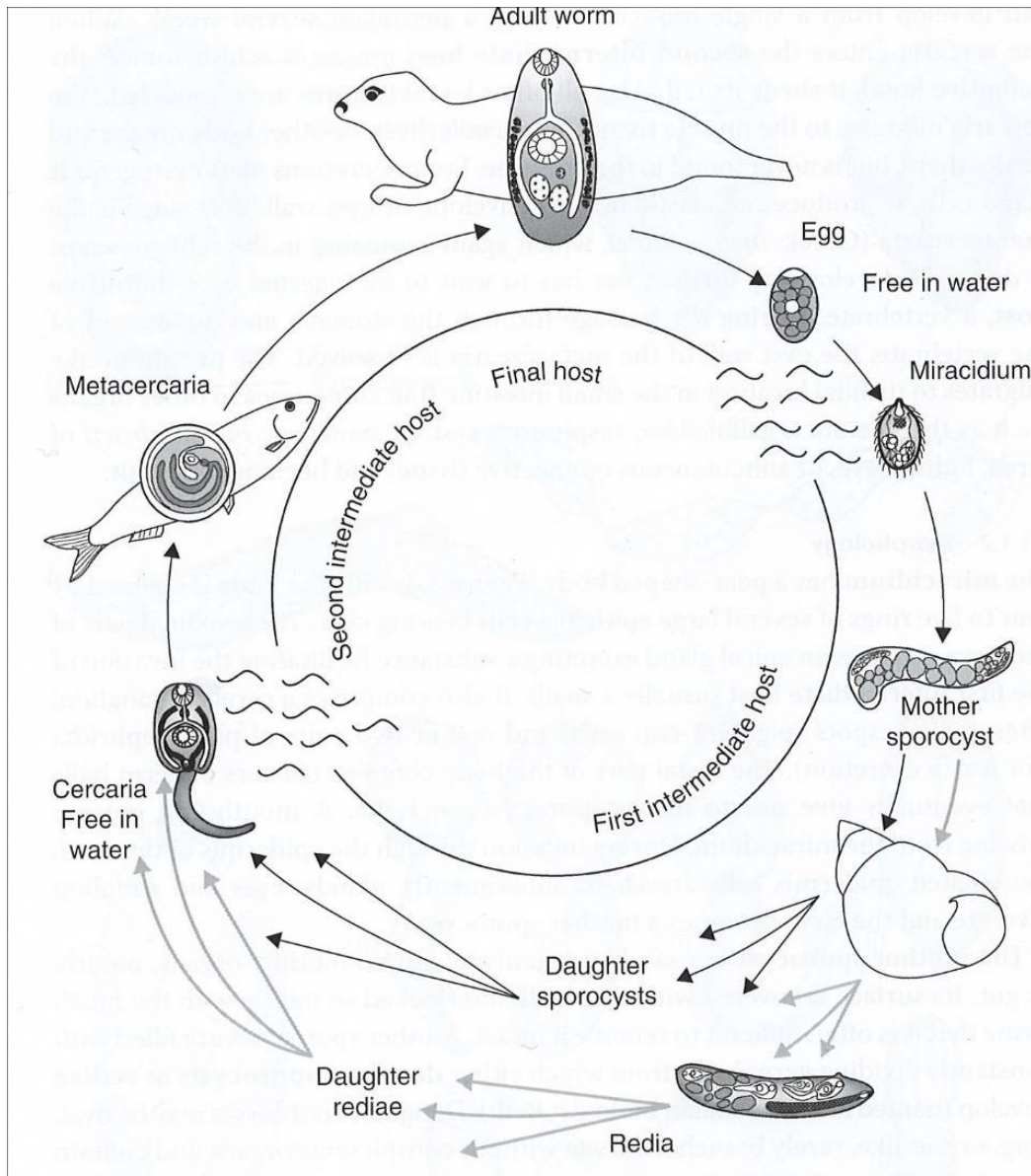


# MOTOLICE II

## Vývoj a životní cykly motolic

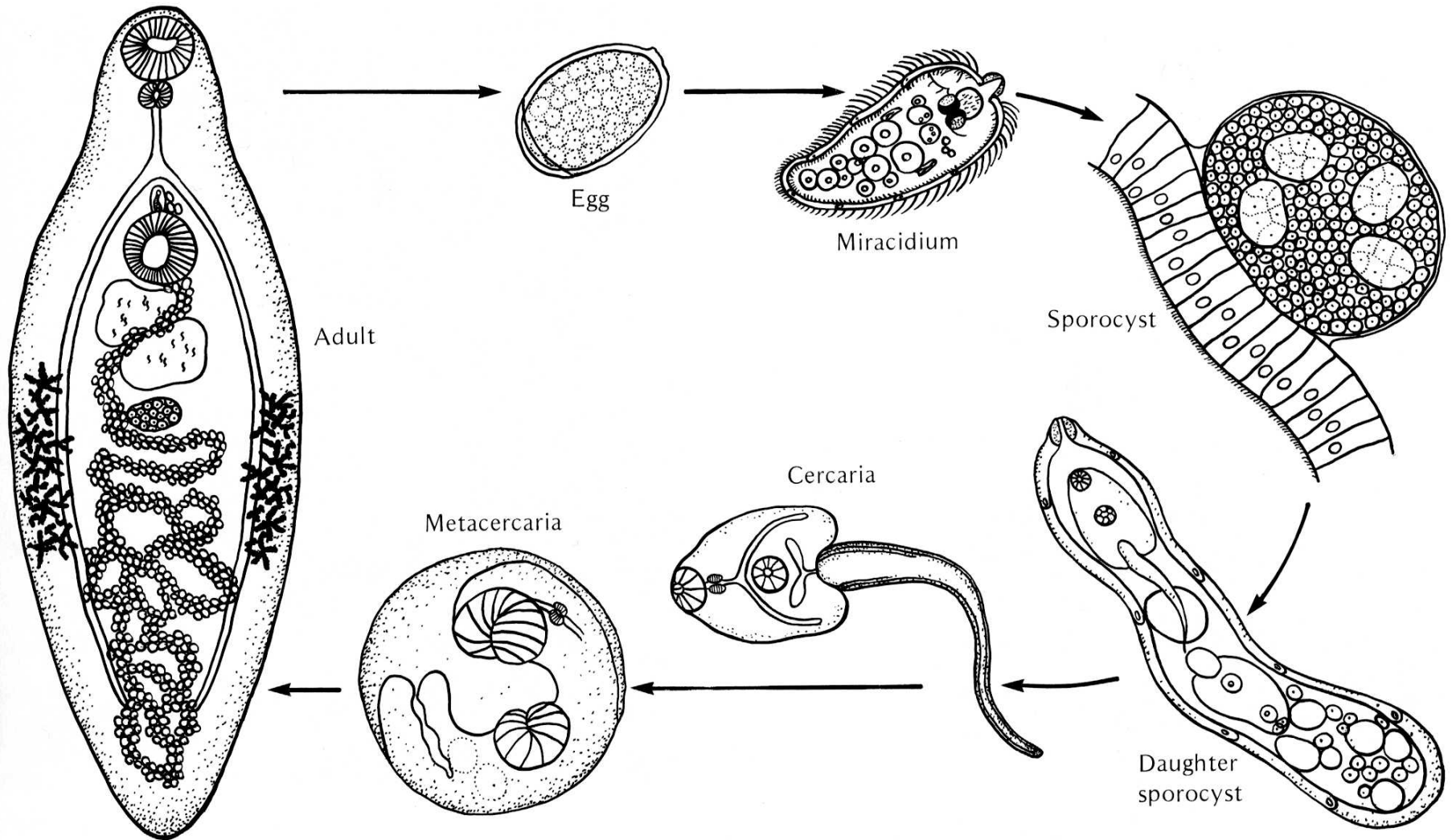
# Typický životní cyklus motolice



# Vývoj a životní cykly motolic

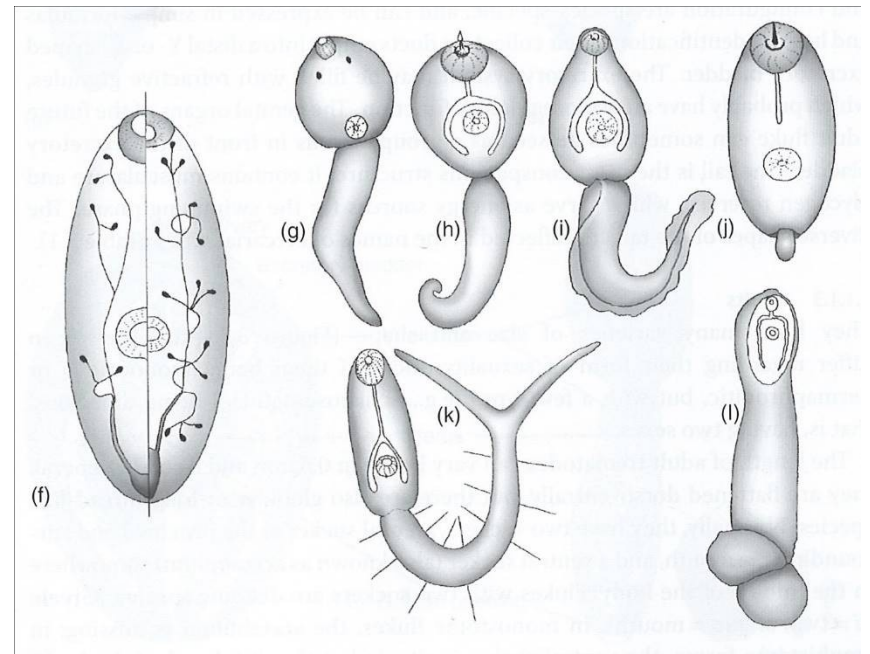
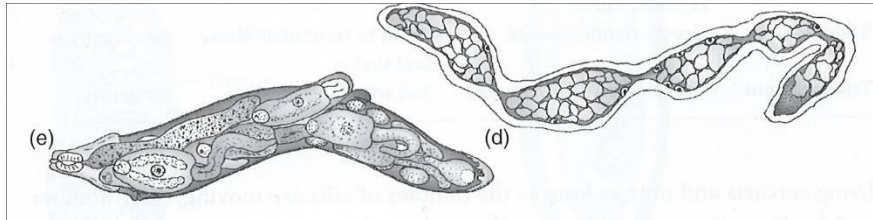
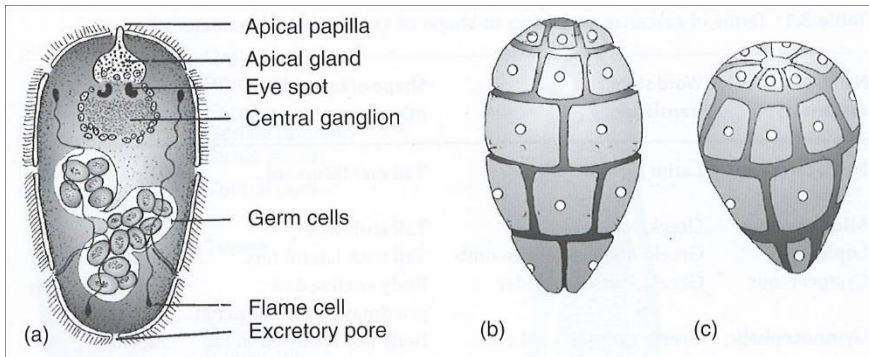
- **Vajíčko** – oválná, silnostěnná, operculum
- **Miracidium** – první larvální stádium
- **Sporocysta** – v prvním meziphostiteli asexuální množení – mateřská a dceřinná
- **Redie** – může následovat po sporocystě, více pohyblivé a migruje do hepatopankreatu plže – mateřská a dceřinná
- **Cerkárie** – základní funkcí je diseminace parazita v prostředí, morfotypy cercarií
- **Metacerkárie** – klidové stádium, encystace
- **Mesocerkárie** – přechodných typ mezi cercarií a metacercarií
- **Adultní motolice**

# Vývojový cyklus motolic



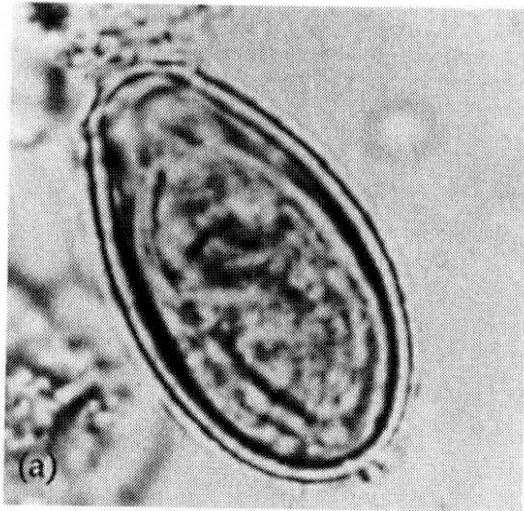


# Vývojová stádia motolic

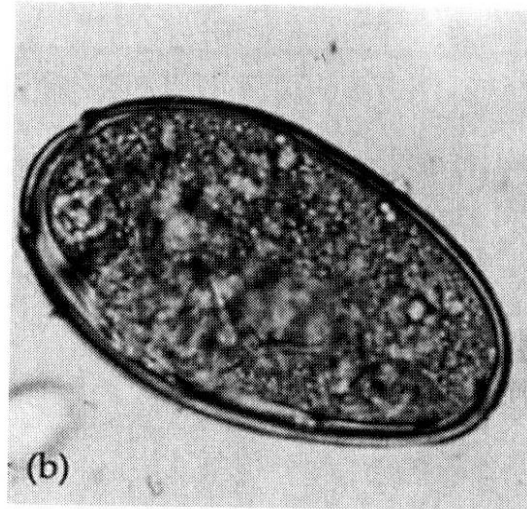


# Vajíčka motolic parazitujících u člověka

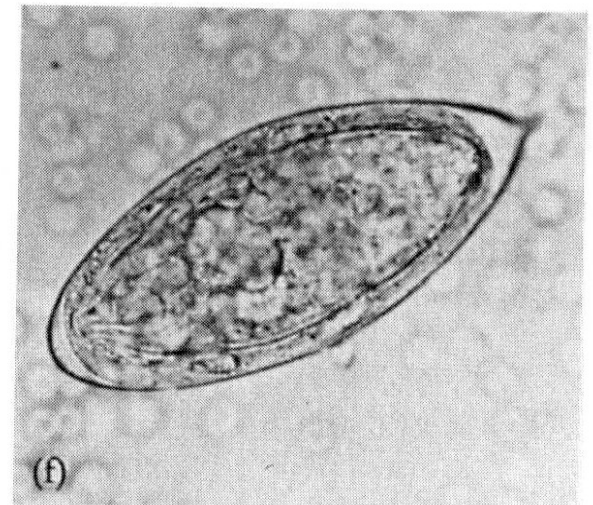
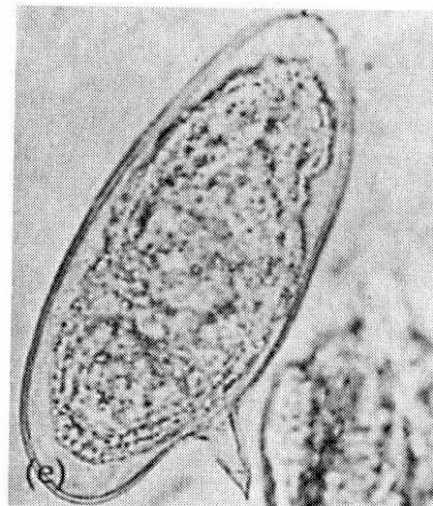
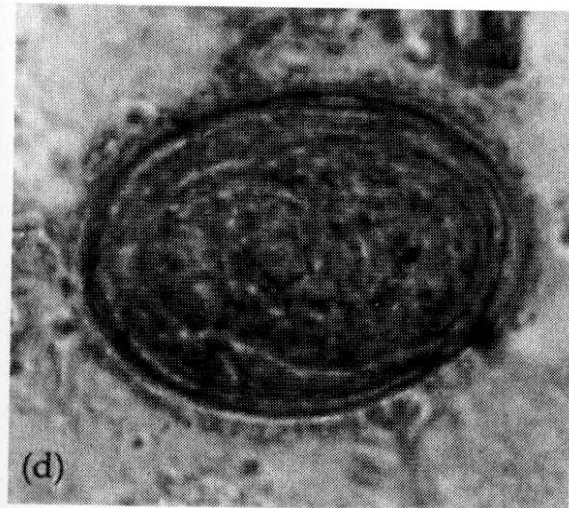
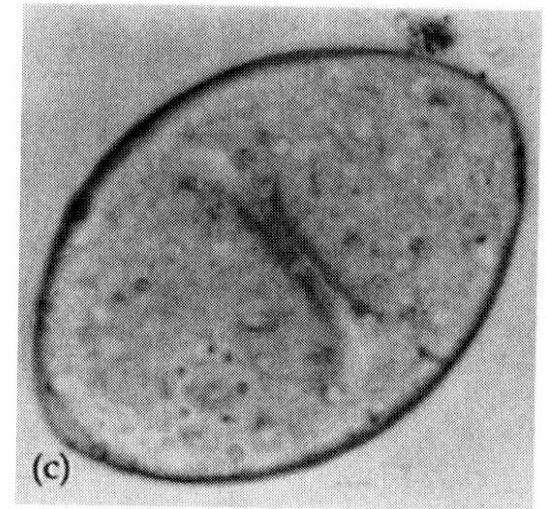
Clonorchis



Paragonimus



Fasciolopsis



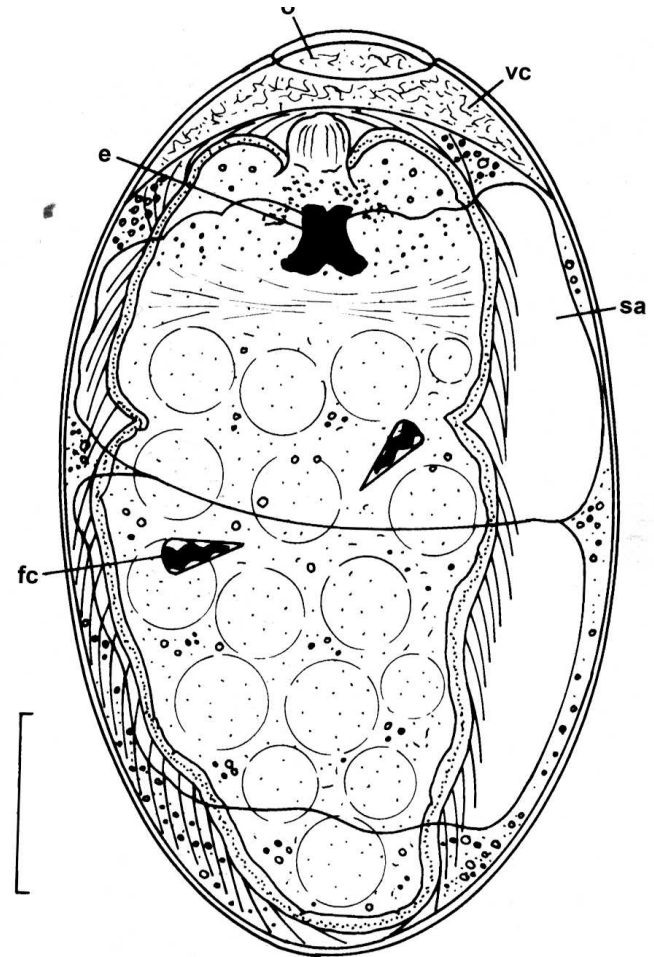
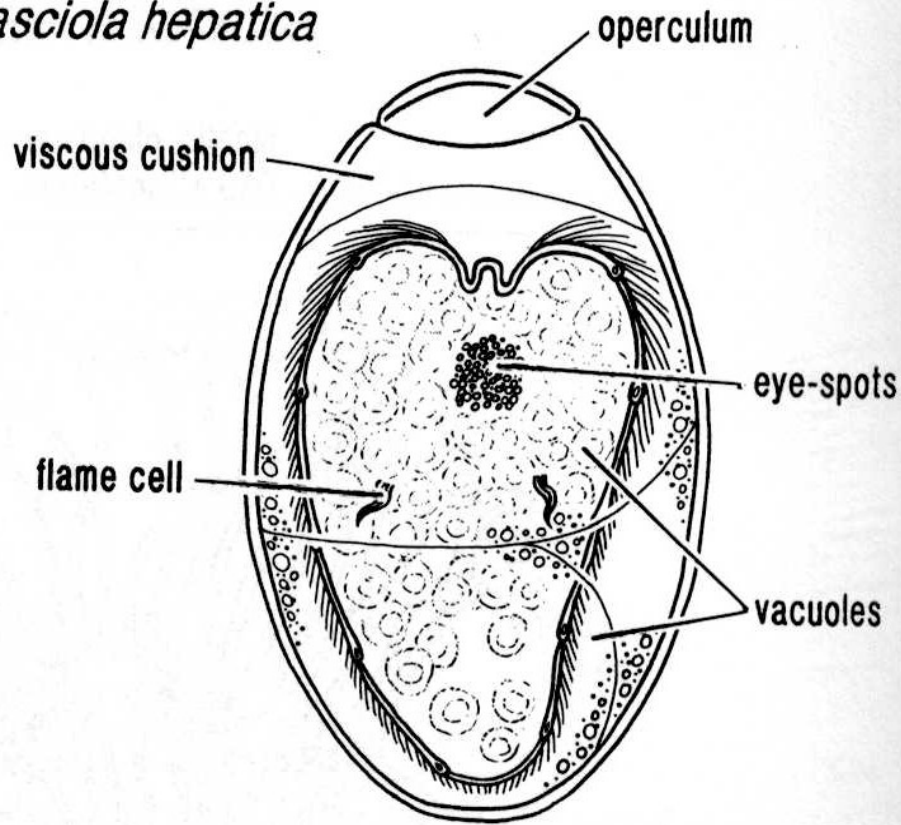
Schistosoma japonicum

S. mansoni

S. heamatobium

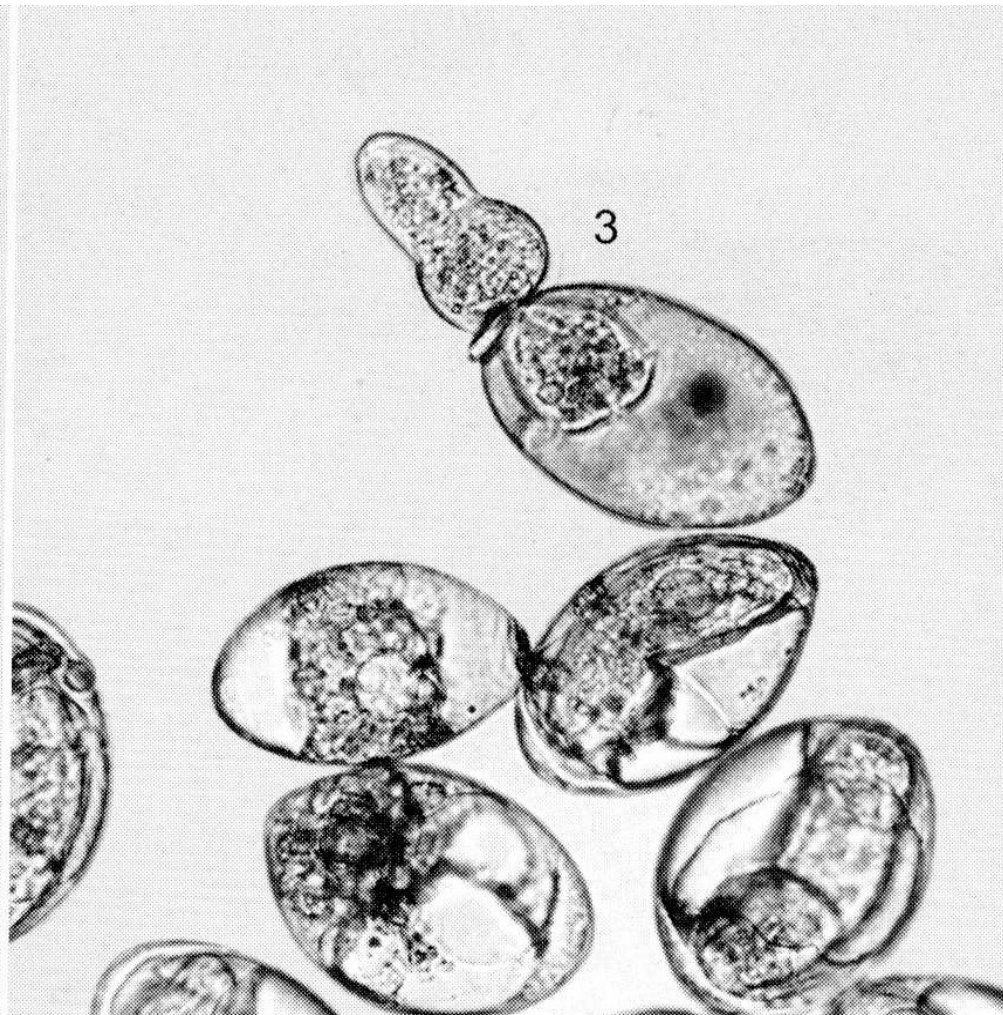
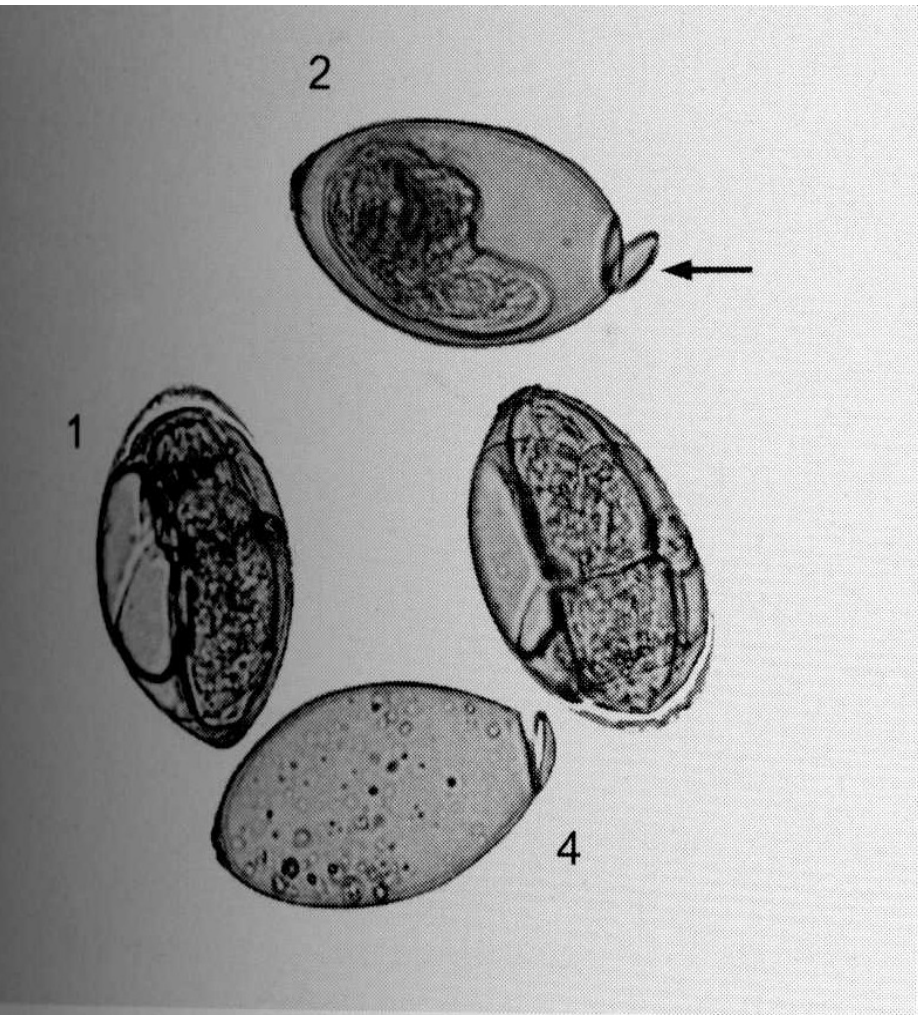
# Vývojová stádia - vajíčko

*Fasciola hepatica*

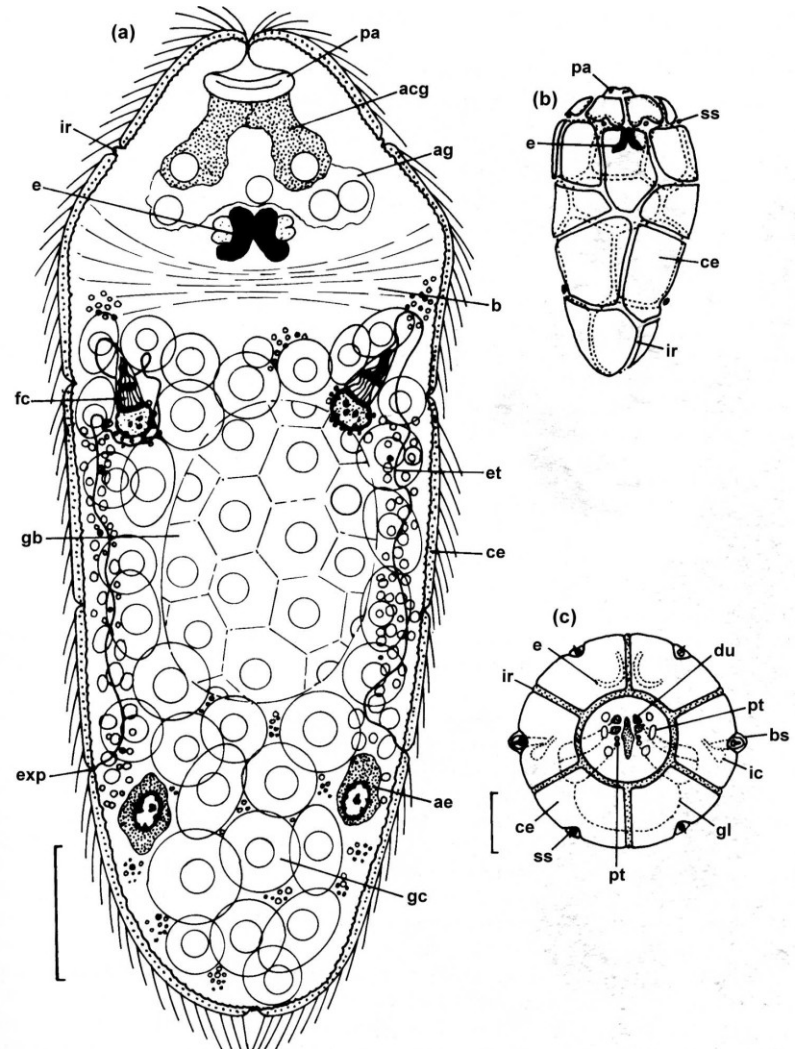
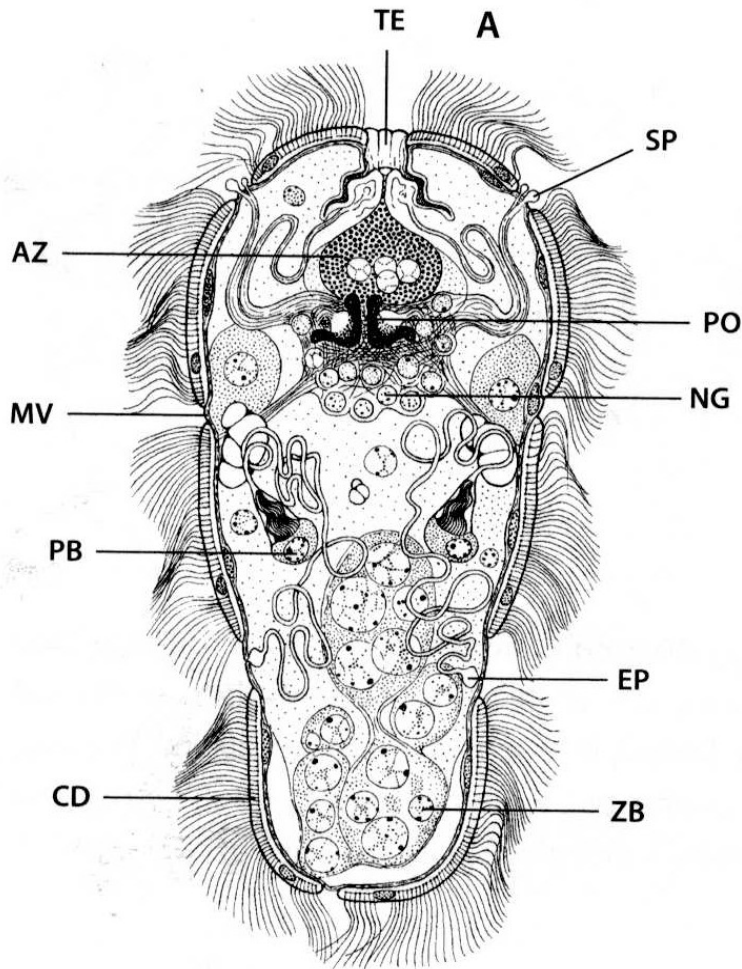




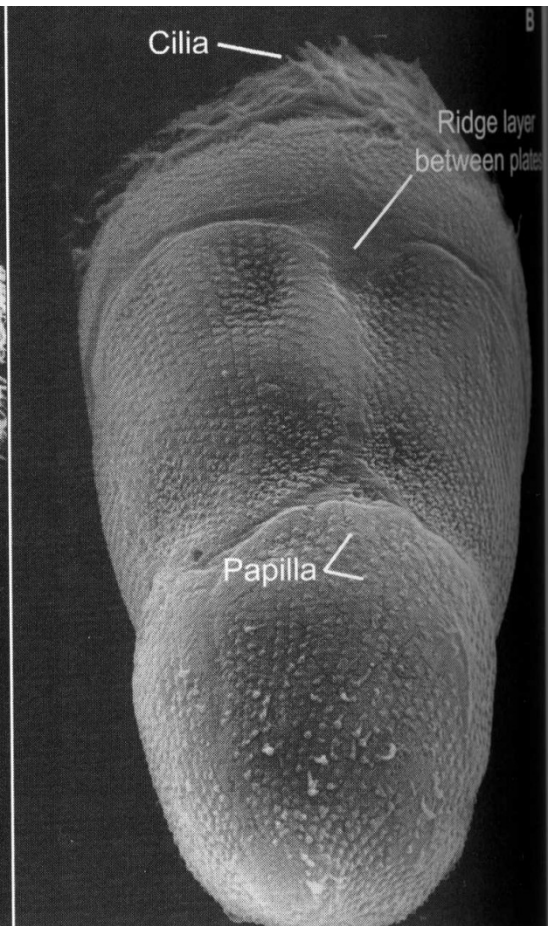
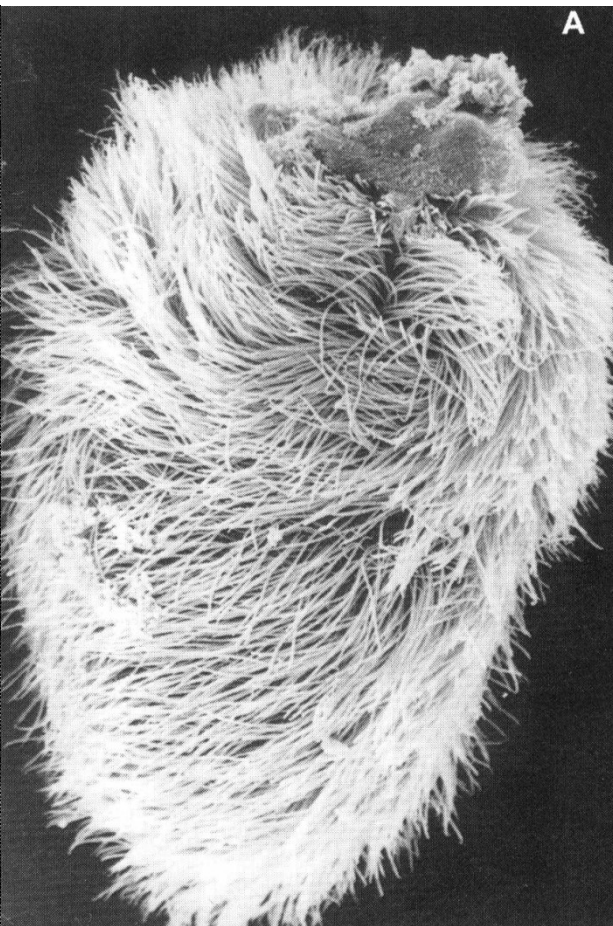
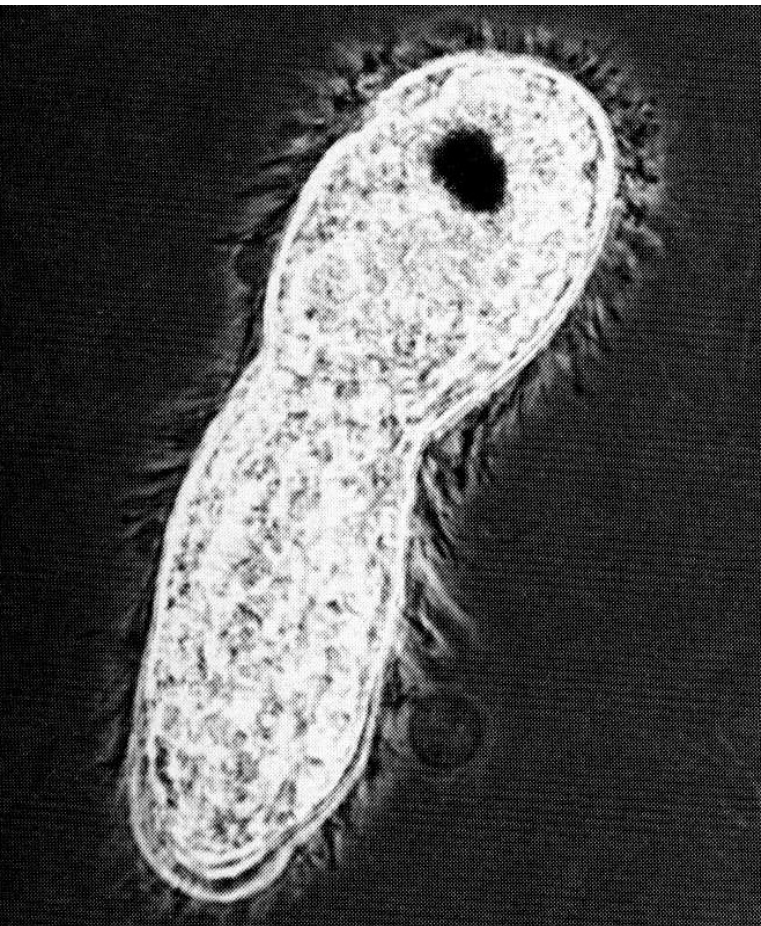
# Líhnutí vajíček motolic



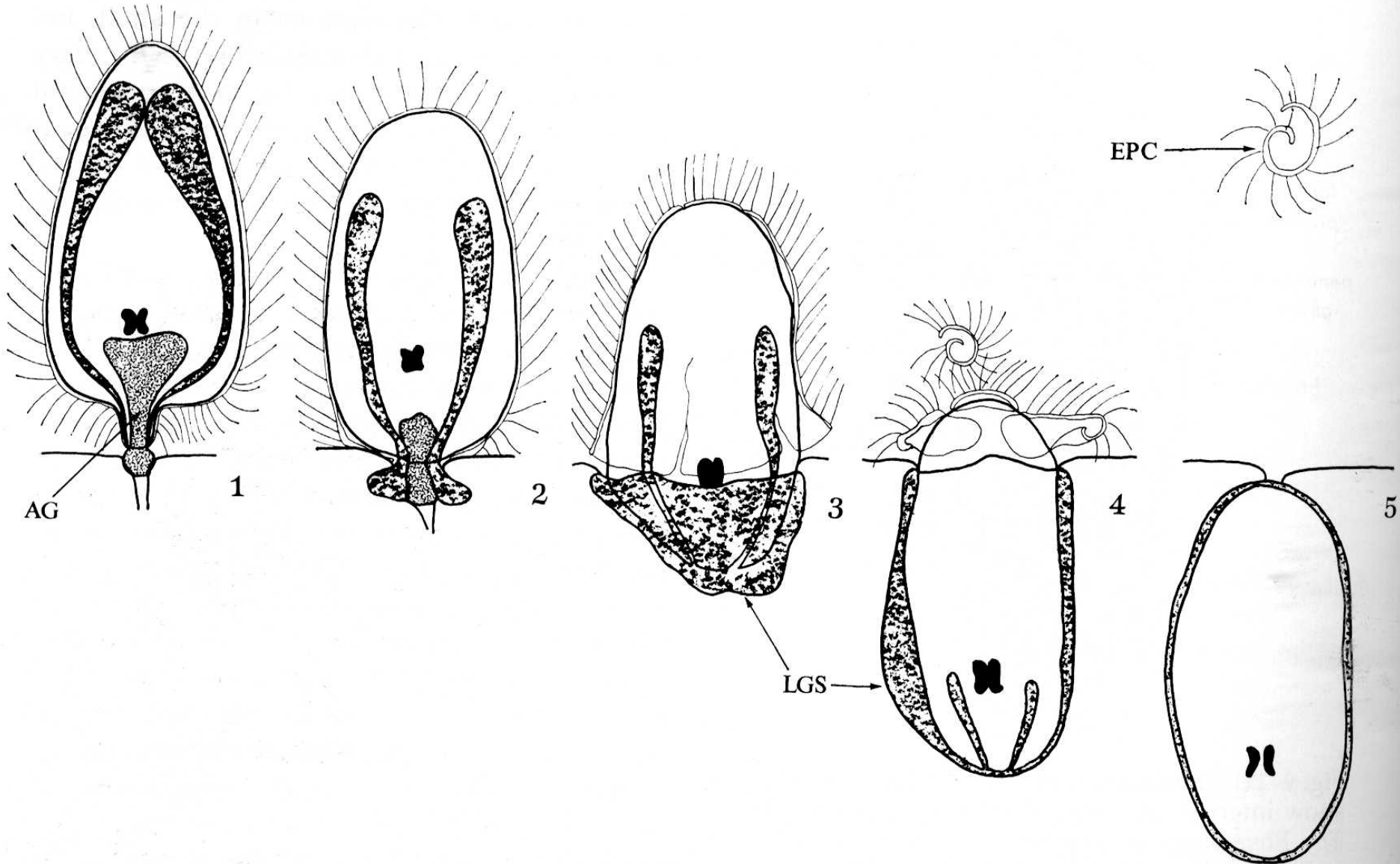
# Miracidium



# Miracidia motolic

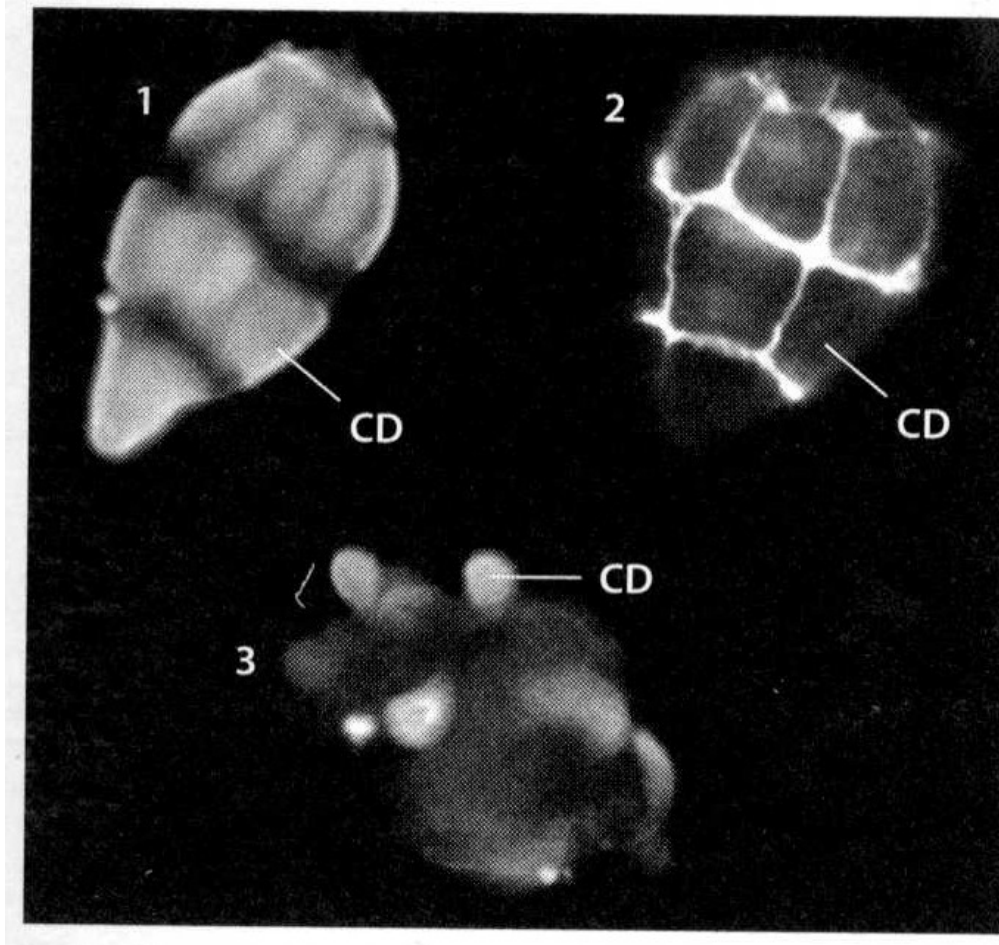


# Penetrace miracidia do prvého meziphostitele





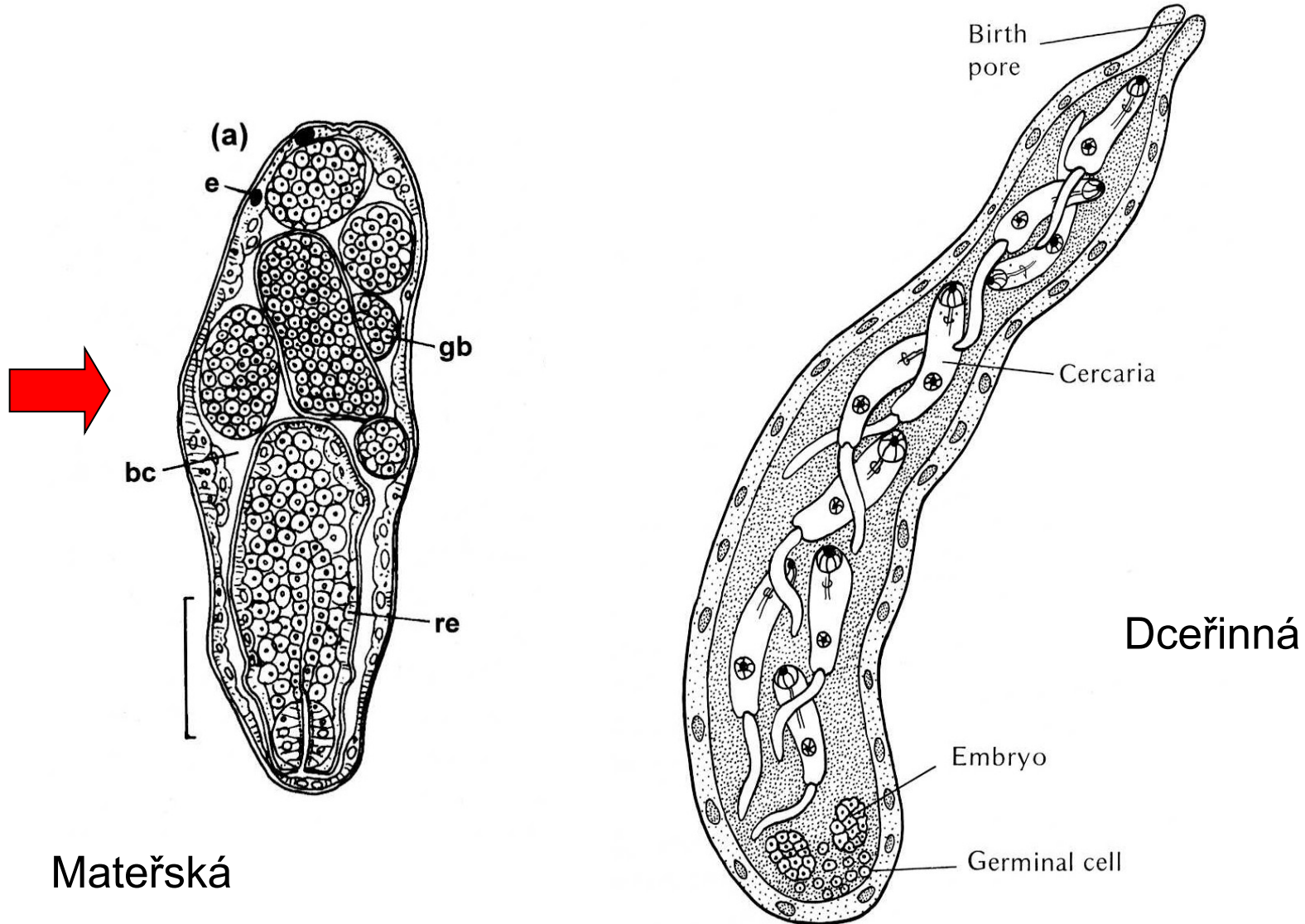
# Miracidium → mateřská sporocysta



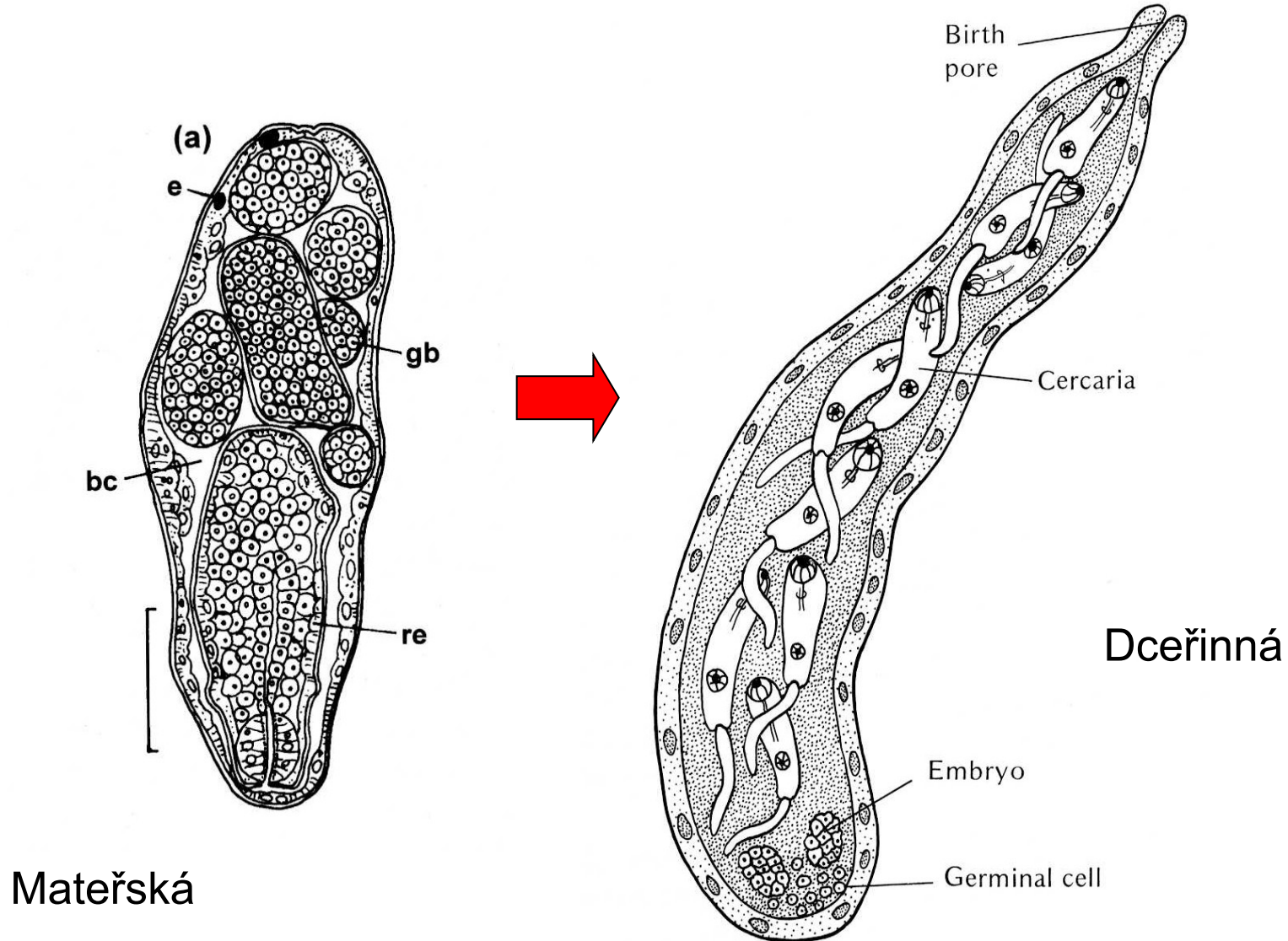
**Obr. 3–10 Digenea. Proces svlékání ciliárních destiček při přeměně miracidia na mateřskou sporocystu (vizualizováno značenými lektiny ve fluorescenčním mikroskopu). 1 – označené ciliární destičky na povrchu miracidia, 2 – označené mezibuněčné valy na povrchu miracidia, 3 – odvrhování označených ciliárních destiček při procesu vzniku dceřiných sporocysty. CD – ciliární destička (foto P. Horák a L. Mikeš).**



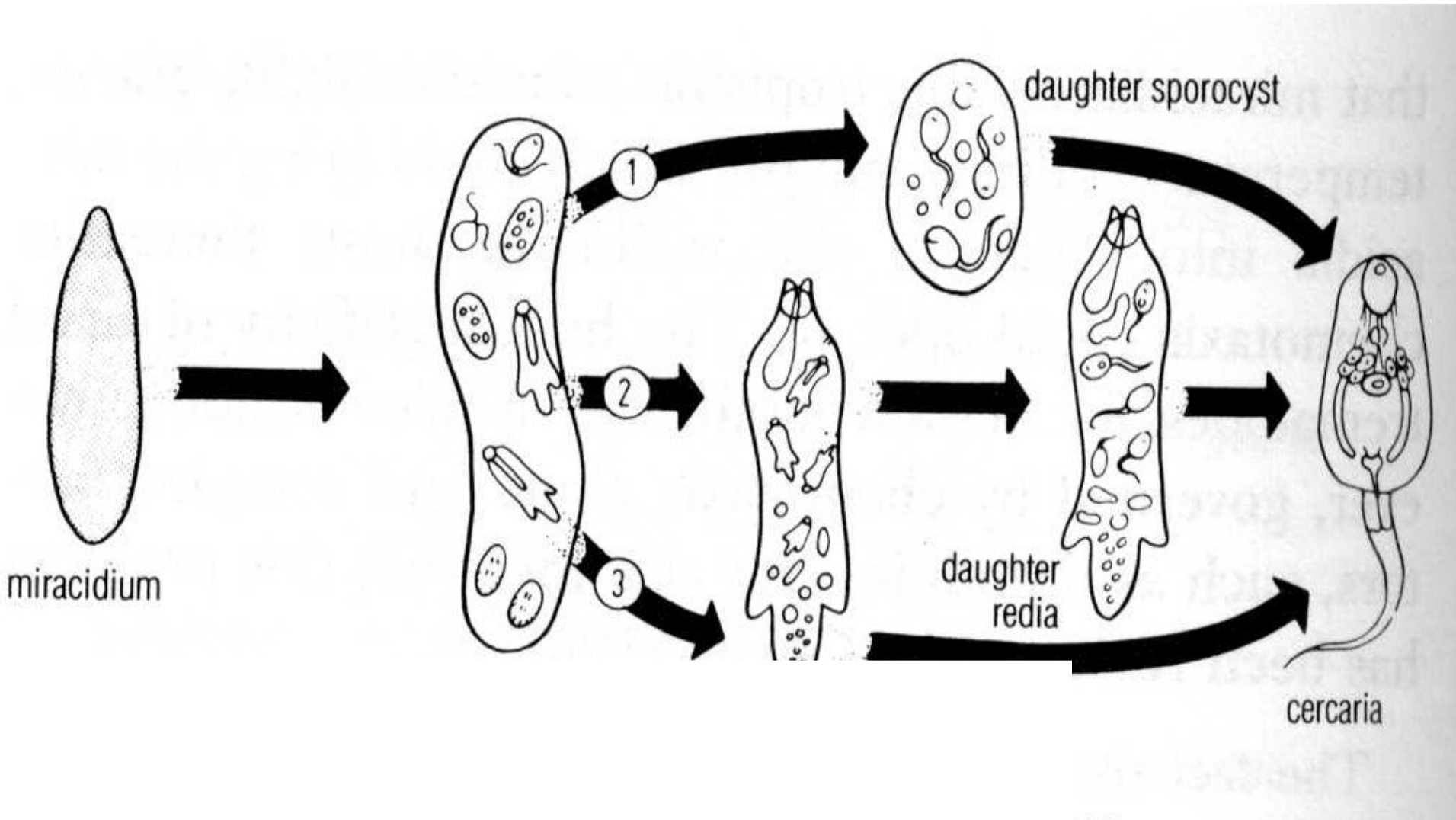
# Sporocysty



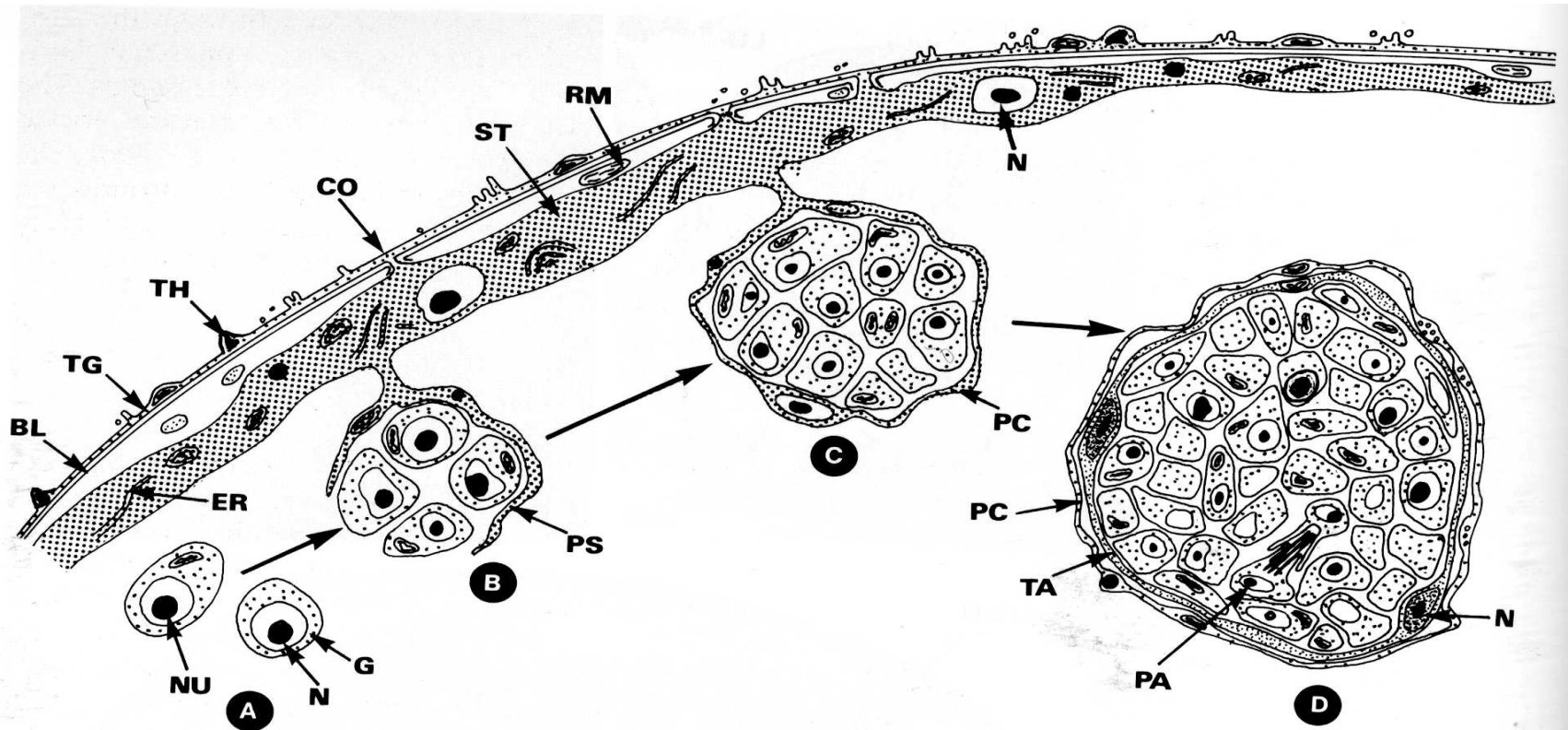
# Sporocysty



# Nepohlavní reprodukce larválních stádií



# Nepohlavní reprodukce larválních stádií

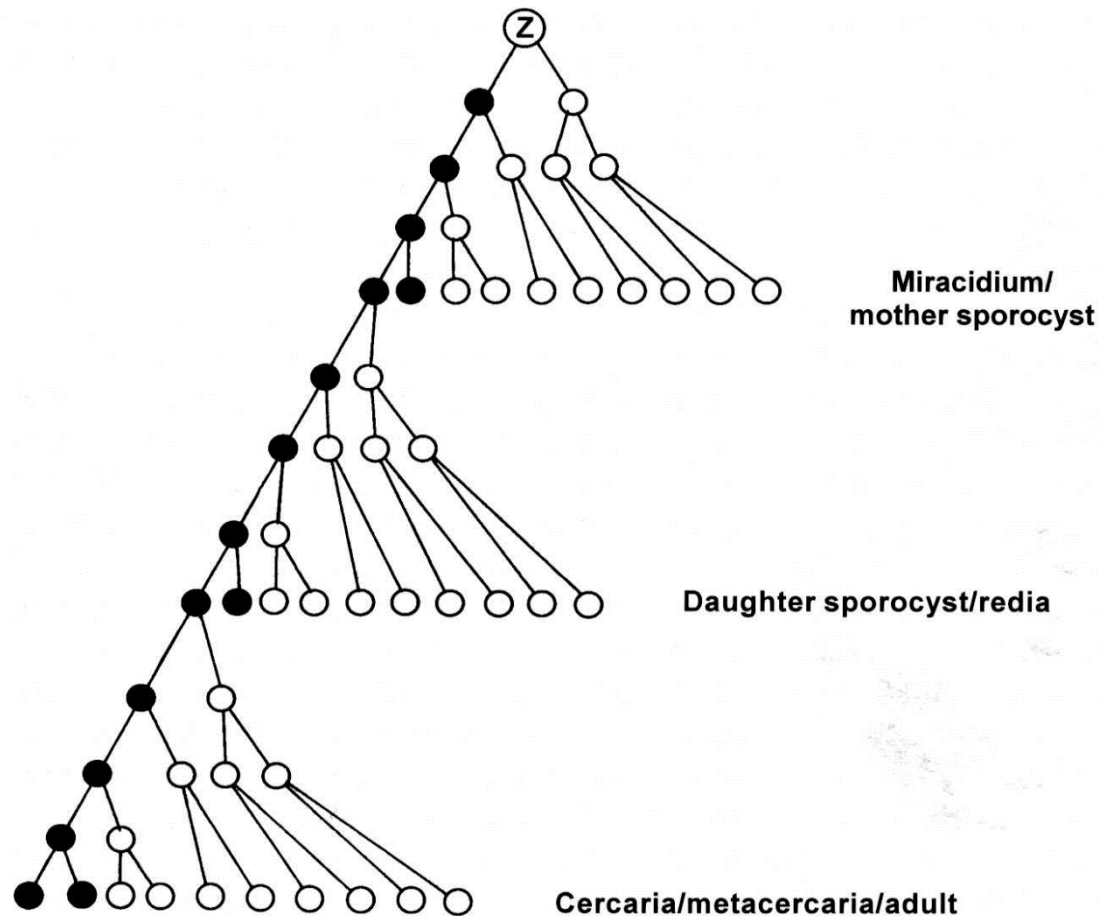


**Fig. 4.29 A-D.** Diagrammatic representation of the formation of daughter individuals in digenean trematodes. **A** Germinal (undifferentiated) cells are found singly inside the lumen of the mother individual (mother sporocysts, daughter sporocysts, rediae). **B** Protruding parts of the syncytial subtegumental layer surround the dividing germinal cells. **C** Now the subtegumental layer has completely surrounded the dividing cells. **D** The growing daughter organism increases in size. It is covered by a smooth primary layer, under which a new syncytial tegument is formed by fusion of undifferen-

tiated cells. Stages in **C** and **D** are also described as “germ balls”. *BL*, Basal lamina; *CO*, connection between tegument and subtegumental layer; *ER*, endoplasmic reticulum; *G*, germinal cell; *N*, nucleus; *NU*, nucleolus; *PA*, proto-nephridial anlage; *PC*, primary cover (formed by *ST*); *PS*, protruding part of subtegument; *RM*, remnant of muscle; *ST*, subtegumental layer; *TA*, tegument anlage; *TG*, tegument (differs in the different developmental stages); *TH*, thorn (hook)

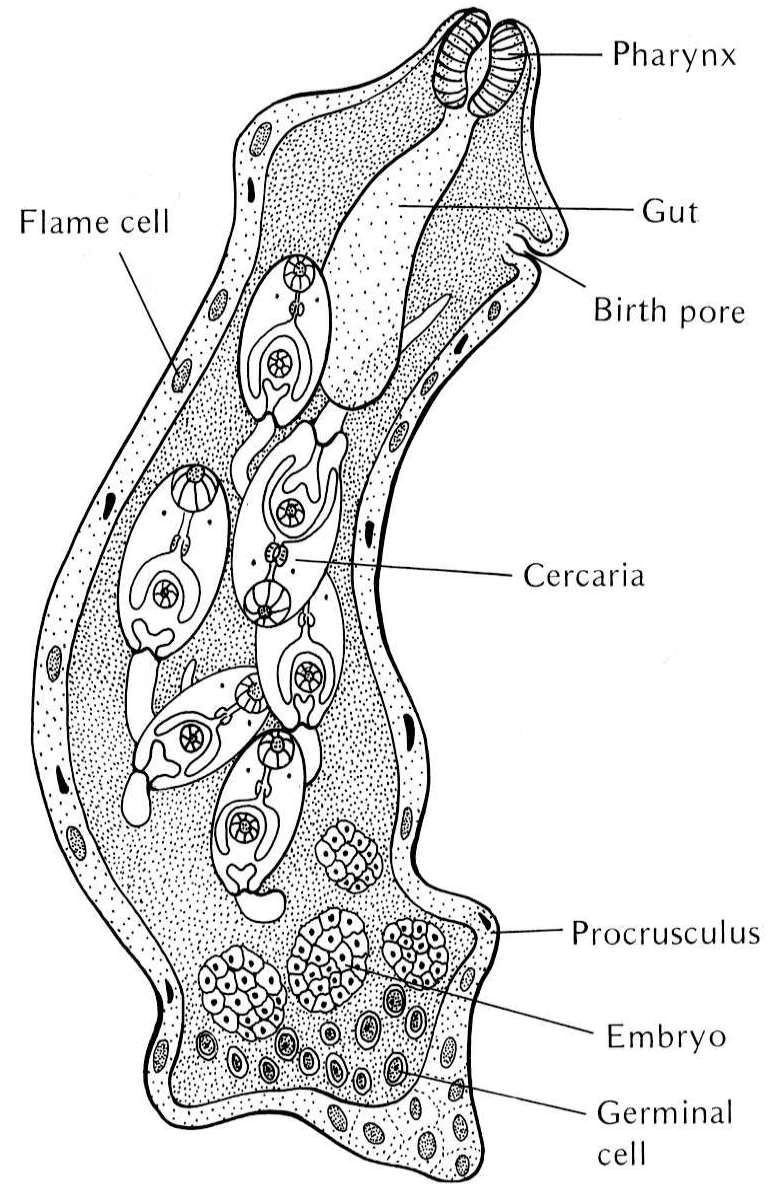
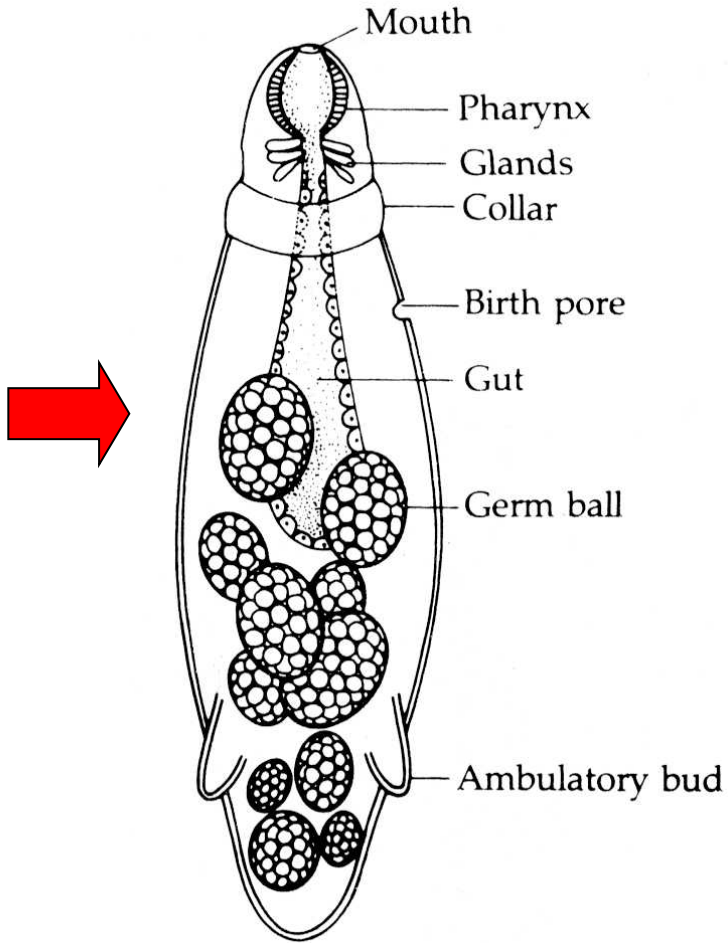


# Multiplikace germinativních buněk larválních stádií motolic - sporocysty

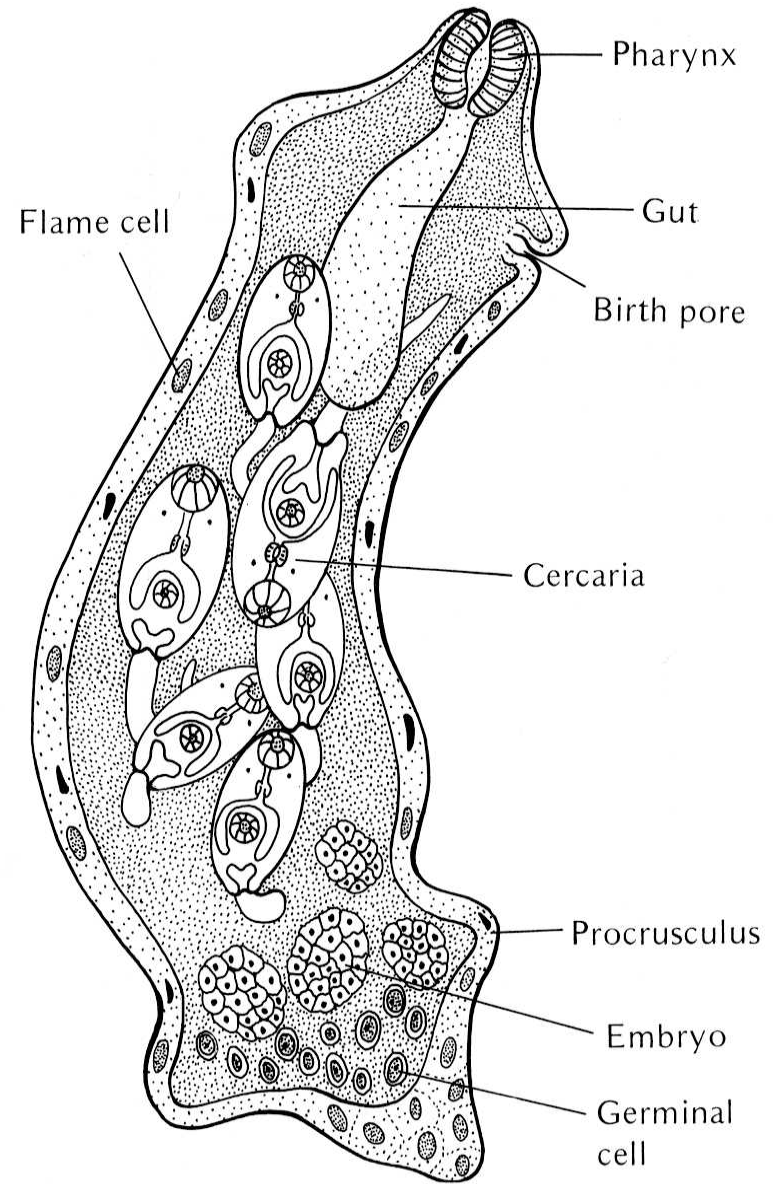
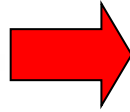
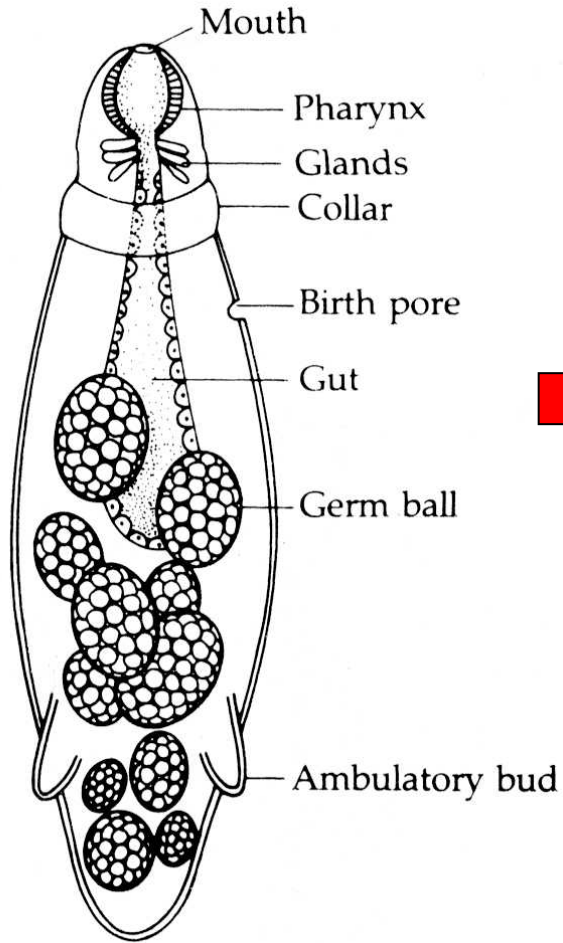


**Figure 14.3** Generalized scheme of germinal lineage in the Digenea. Multiplication of germinal cells in the cercaria–metacercaria–adult generation gives rise to the germarium and testes. See text for further explanation. Z=zygote; filled circle=germlinal cell; empty circle=somatic cell. Source: redrawn from Whitfield and Evans, 1983.

# Rédie

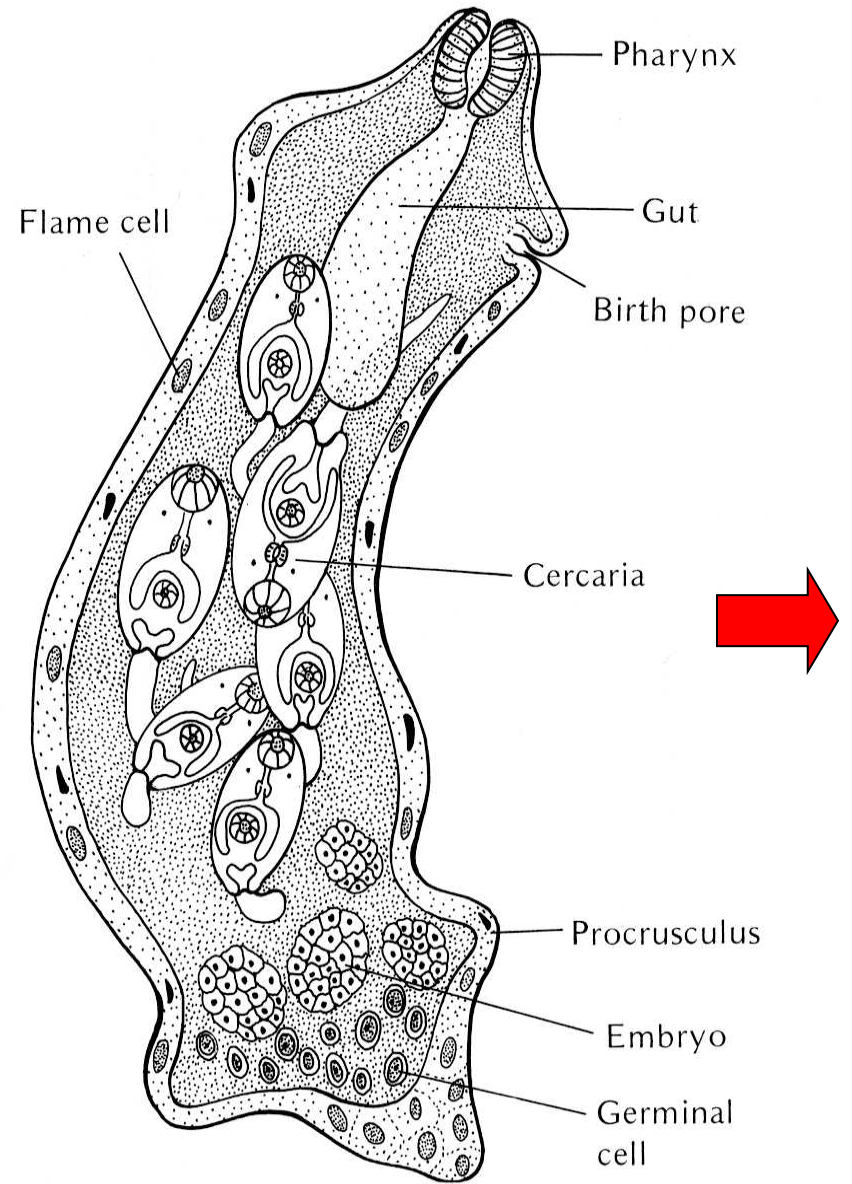
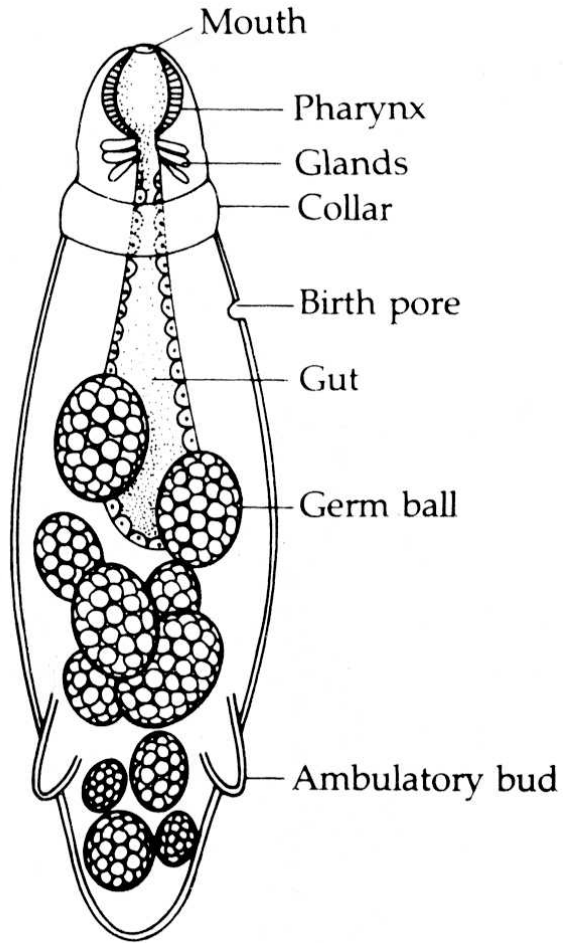


# Rédie



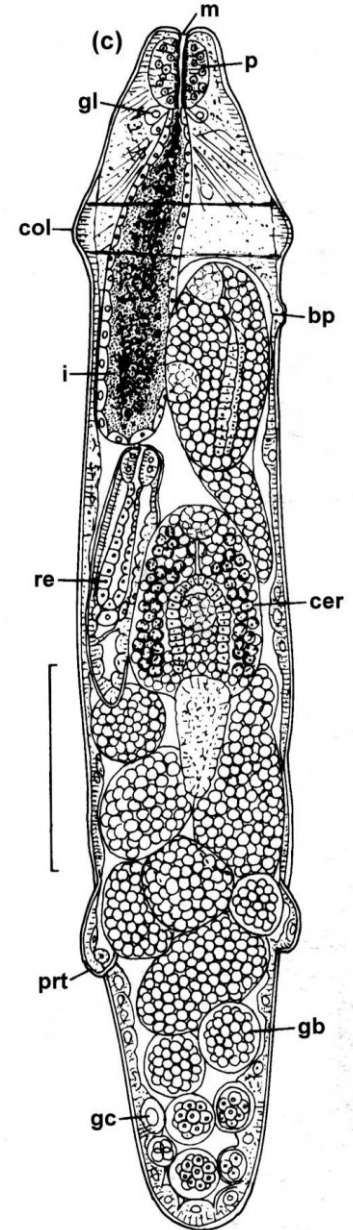
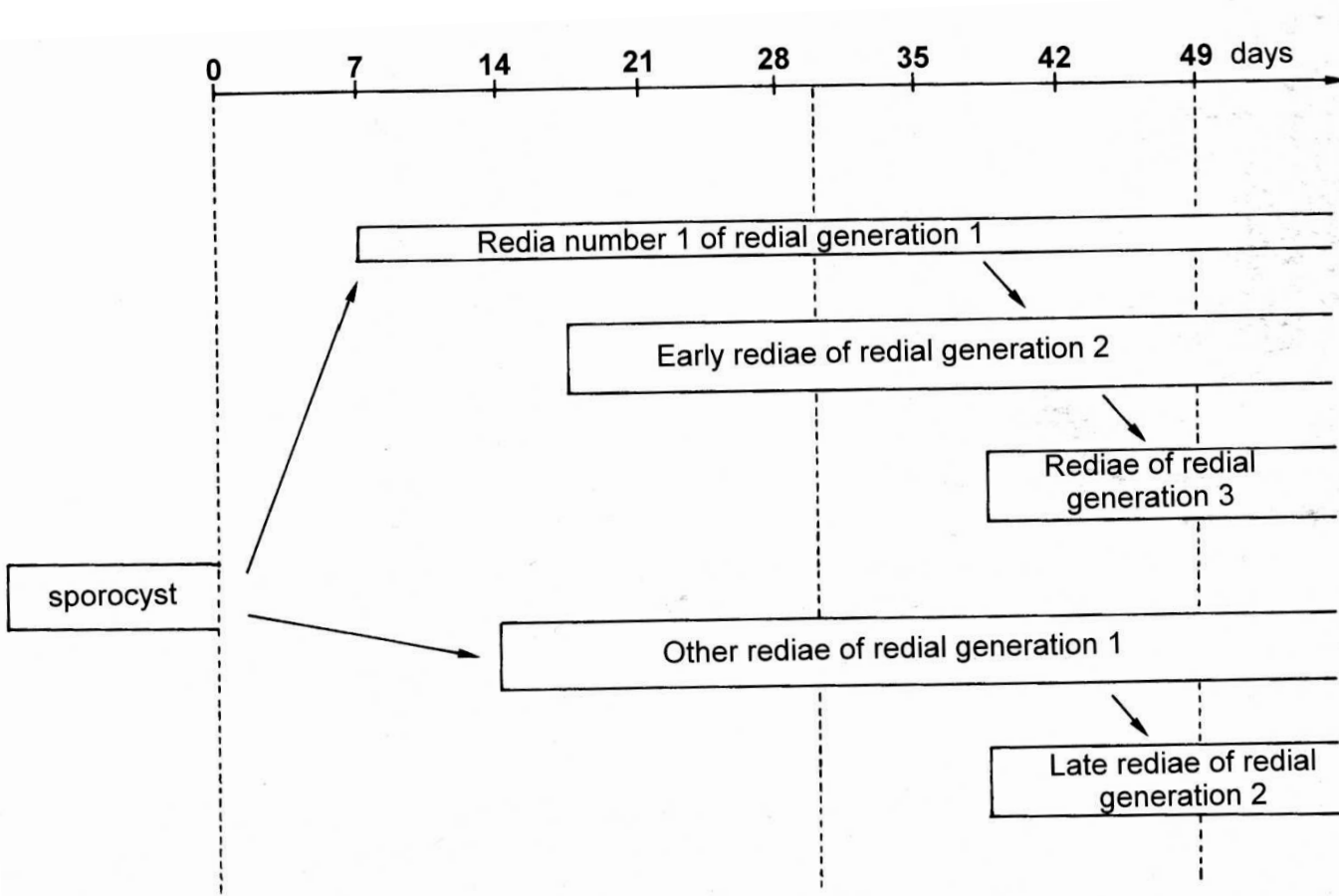


# Rédie



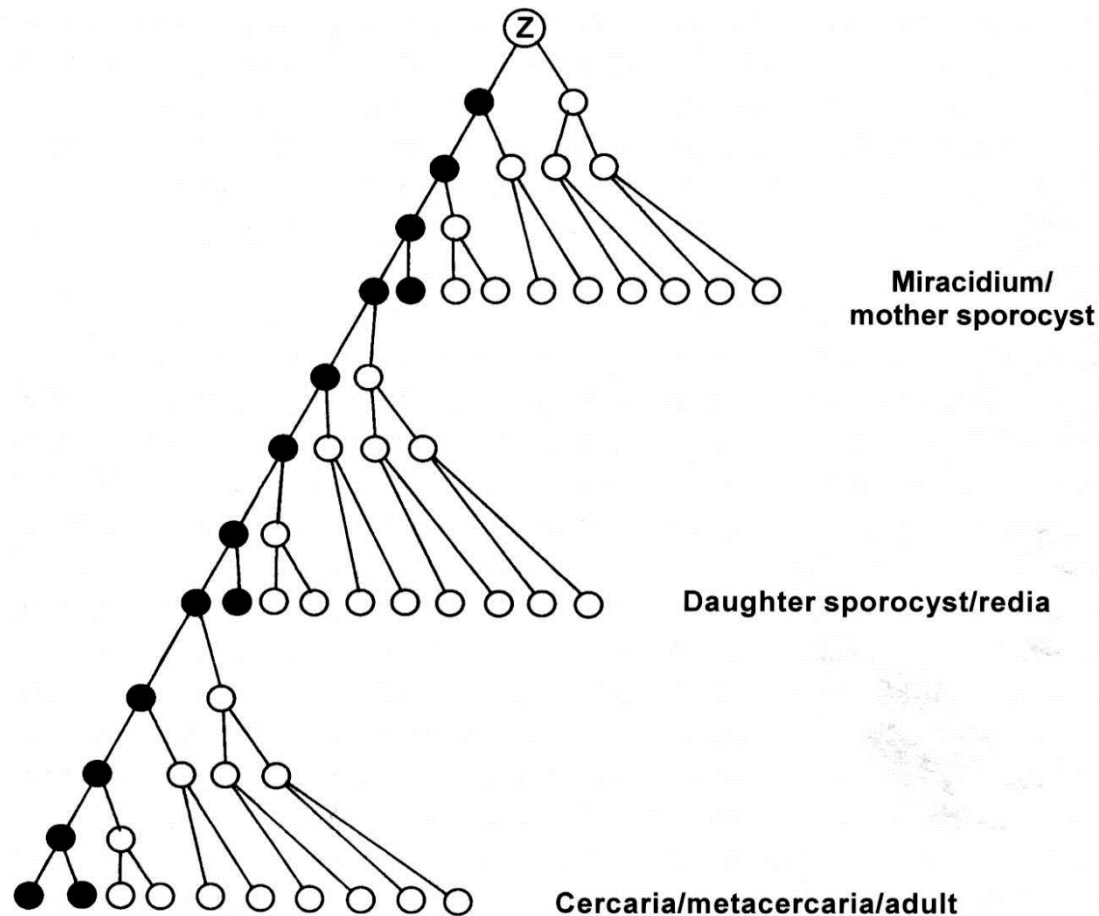


# Sekvence vývoje redií



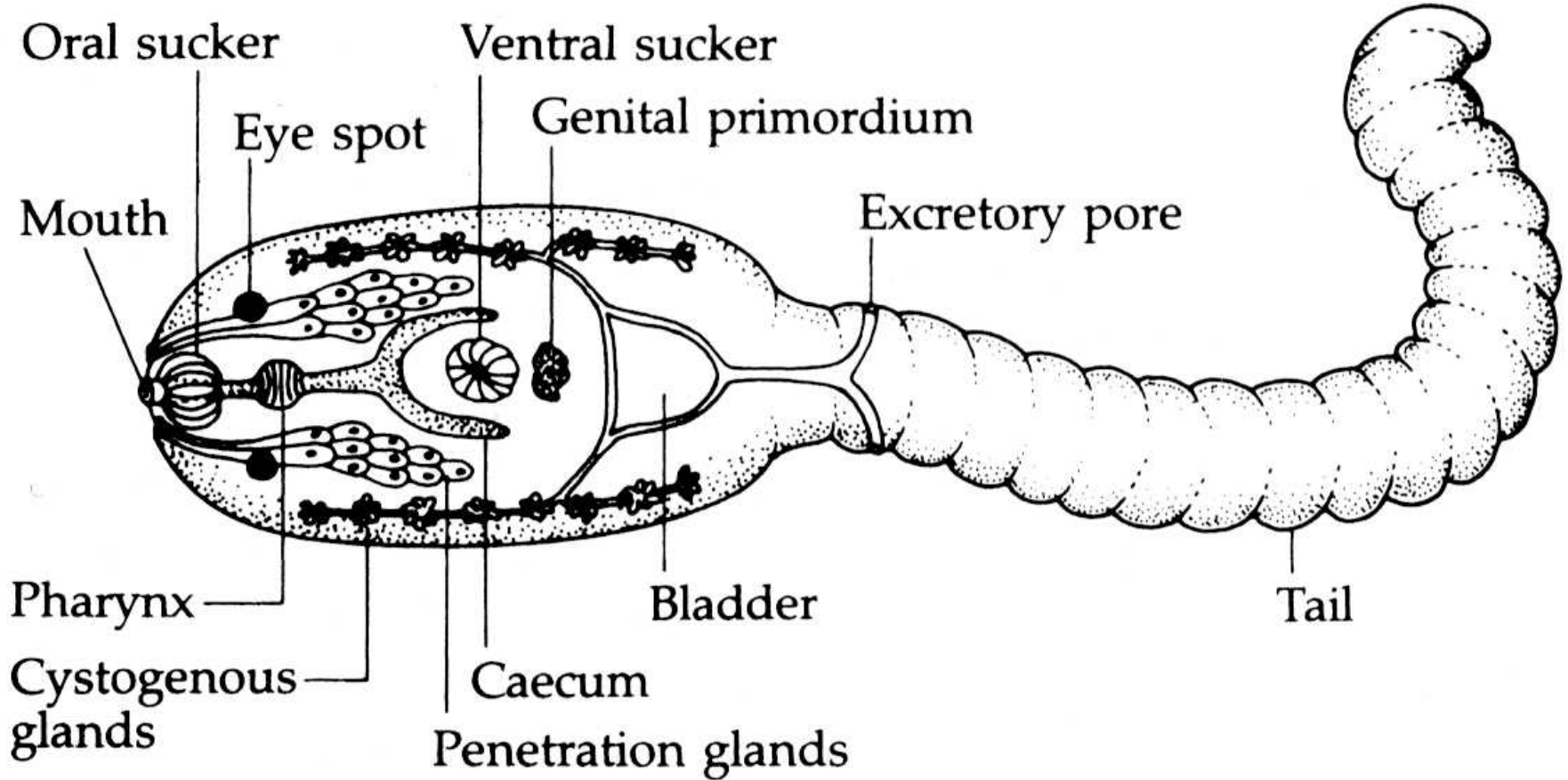
**Figure 13.11** Sequence of development of rediae from a single sporocyst of *Fasciola hepatica*. The left-hand edge of each box indicates the date when the first rediae of the generation in question became independent. Source: redrawn from Rondelaud and Barthe, 1982.

# Multiplikace germinativních buněk larválních stádií motolic - redie

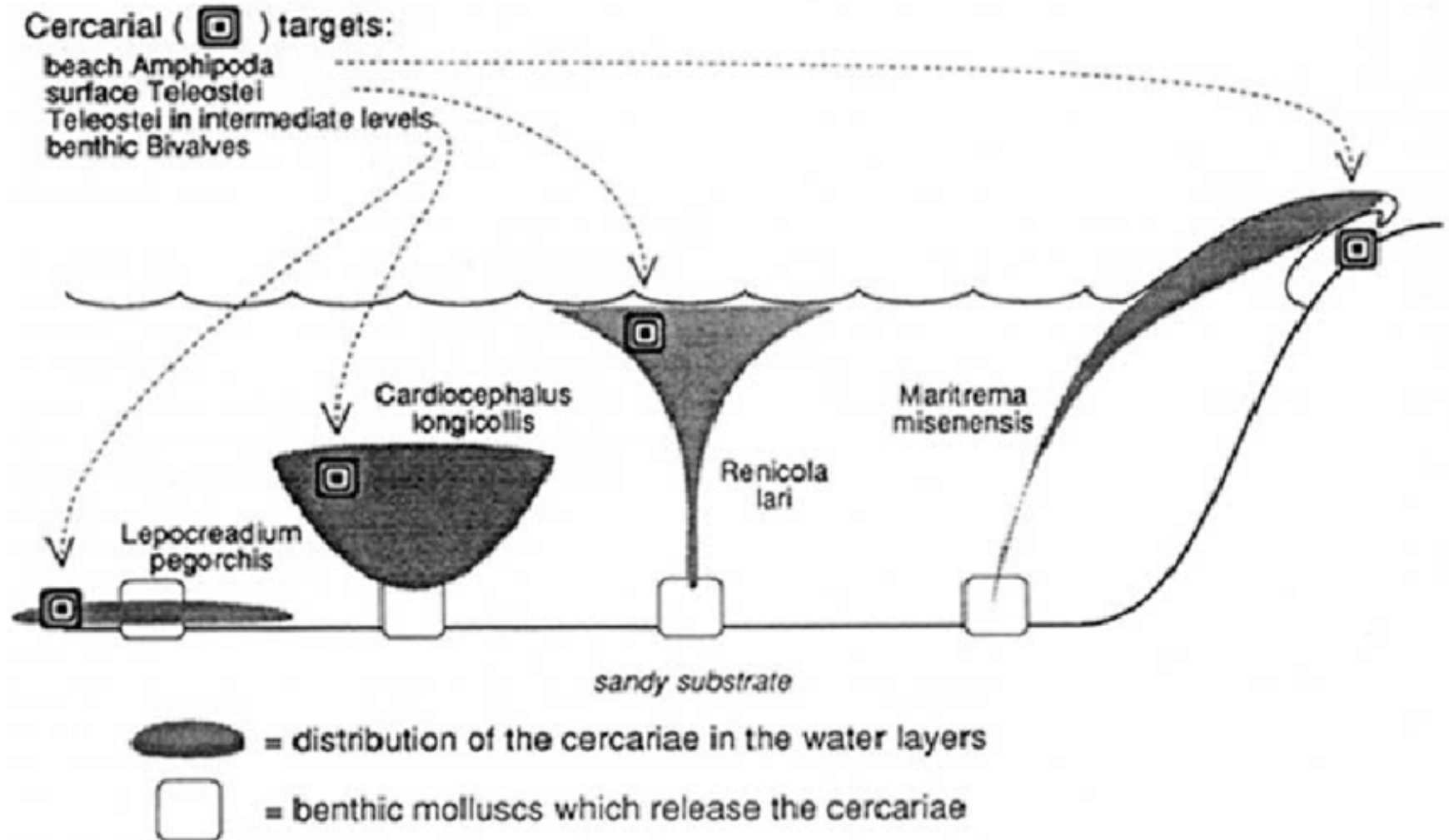


**Figure 14.3** Generalized scheme of germinal lineage in the Digenea. Multiplication of germinal cells in the cercaria–metacercaria–adult generation gives rise to the germarium and testes. See text for further explanation. Z=zygote; filled circle=germinal cell; empty circle=somatic cell. Source: redrawn from Whitfield and Evans, 1983.

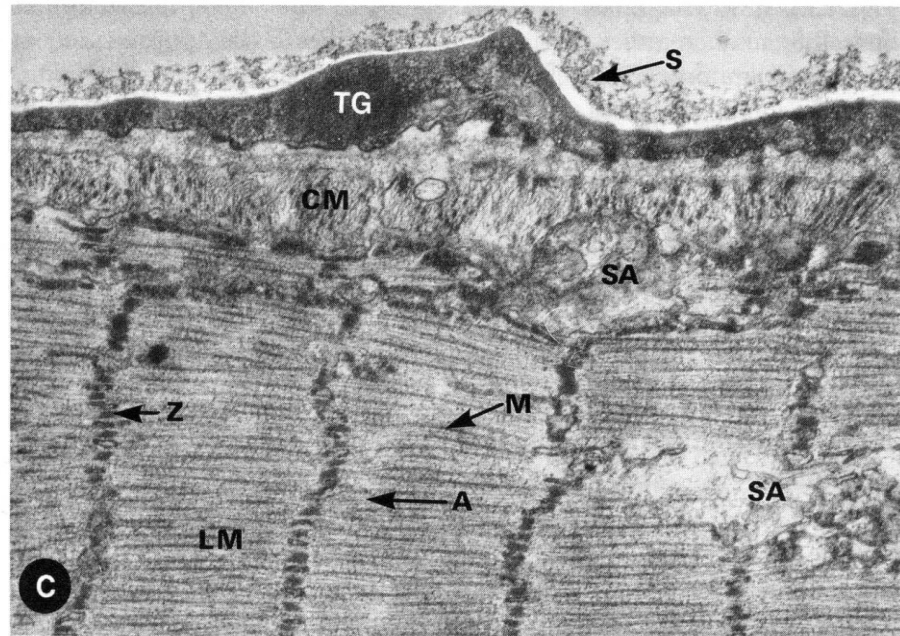
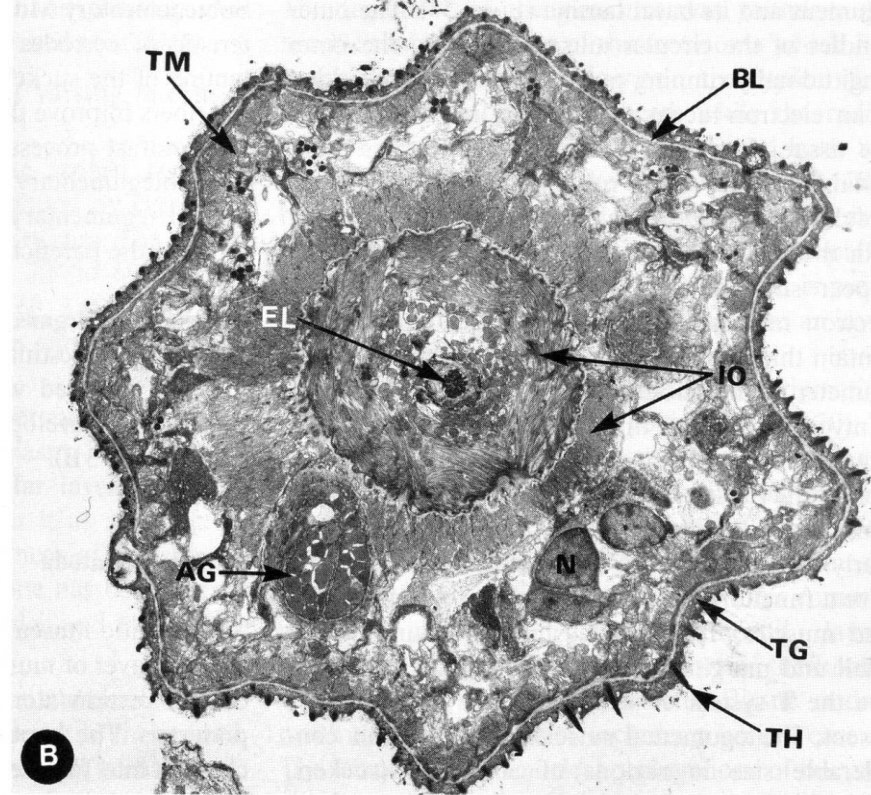
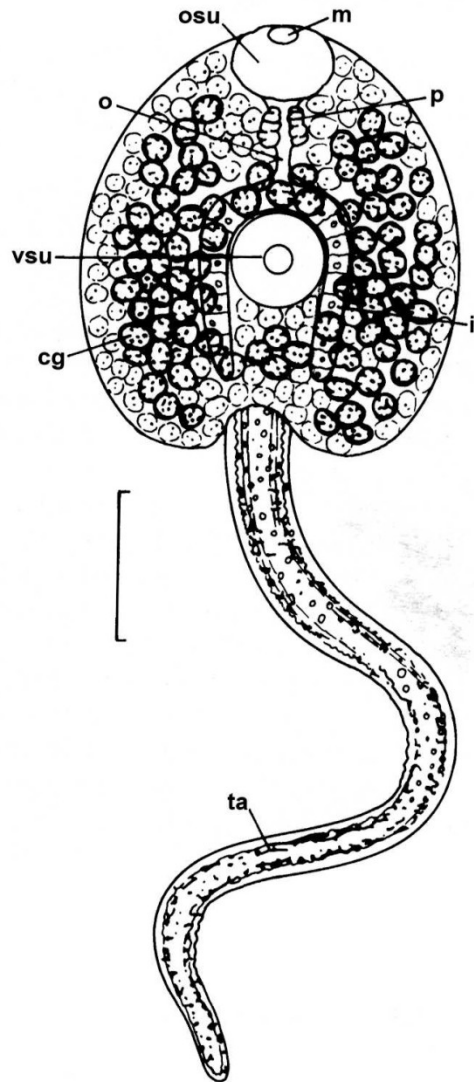
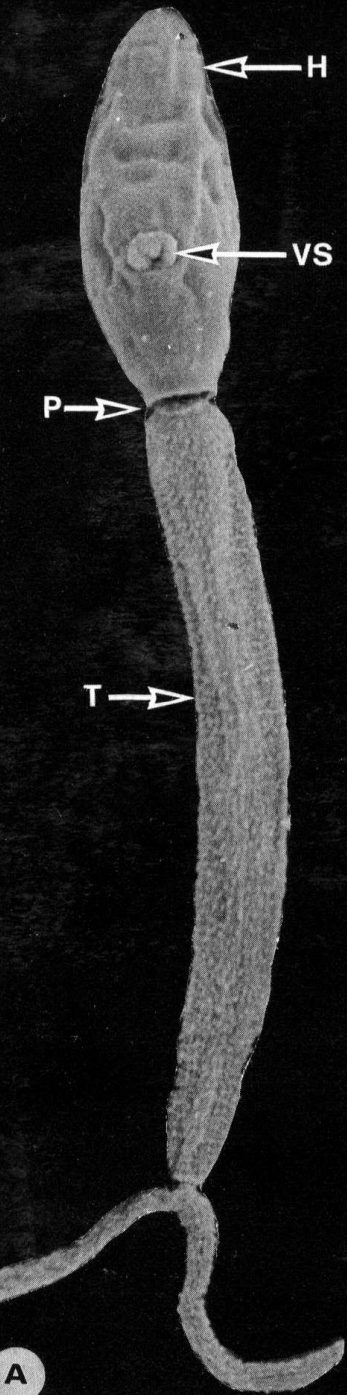
# cerkárie



# Migrace cerkarie Combes



# Cerkáriae

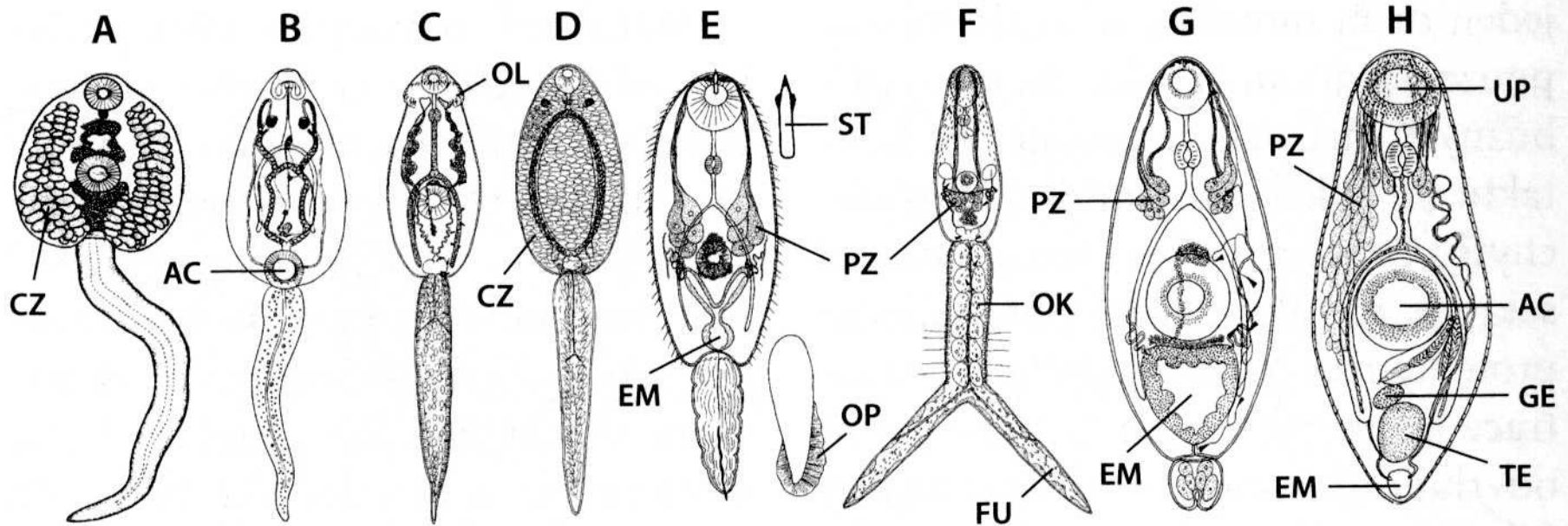


# Morfologické typy cerkarií

- Ahistomní
- Monostomní
- Gymnocephalní
- Pleurolophocerkárie
- Echinostomní
- Cystophorní
- Trichocerkárie
- Mikrocerkárie
- Furkocerkárie
  - Bucephalní
  - Strigeidní
  - Skupina vivax
  - Skupina ocellata
- Xiphidiocerkarie
- Ophthalmoxiphidiocerkarie
- Cercarieum

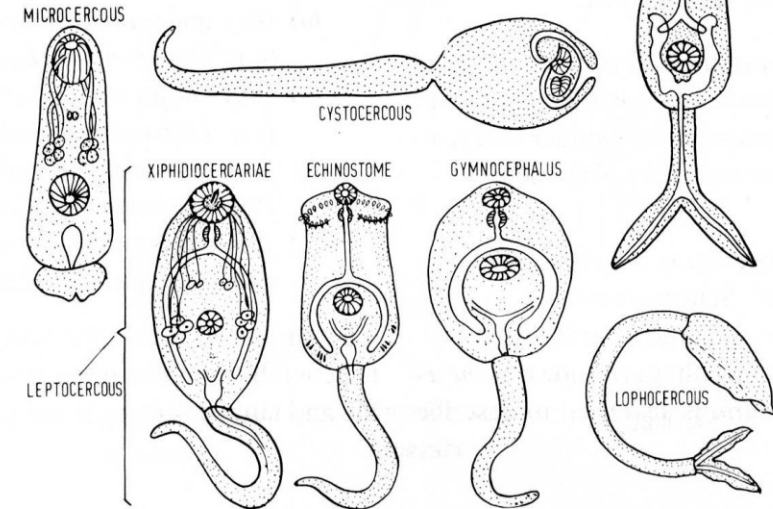
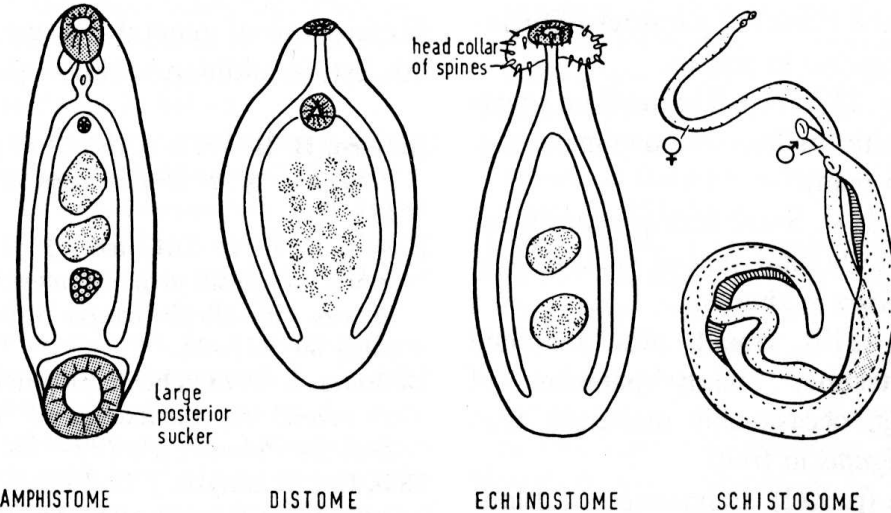
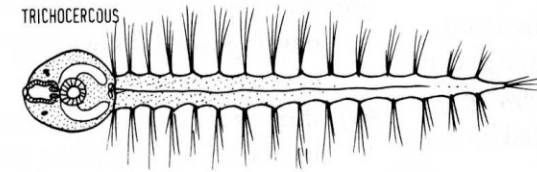
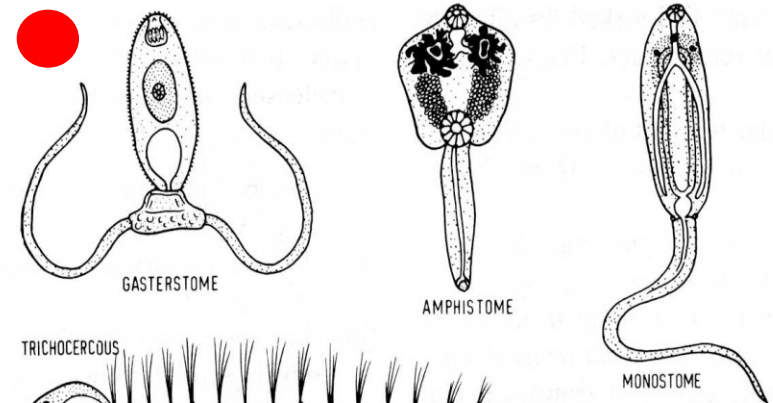
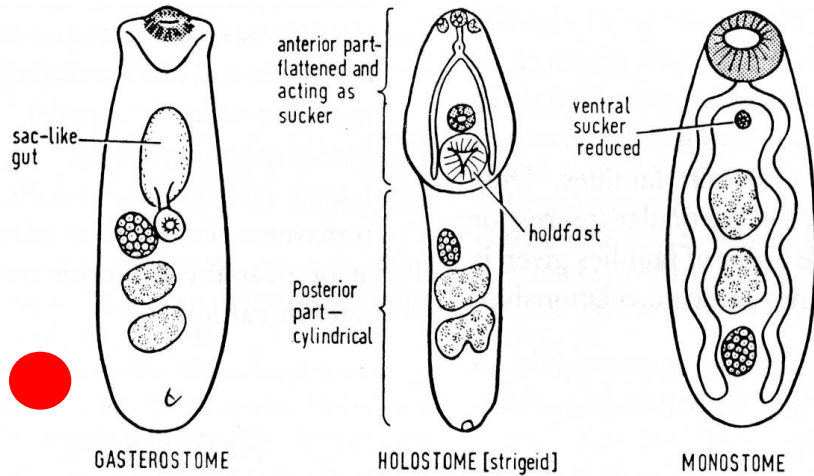


# Morfologické typy cercárií



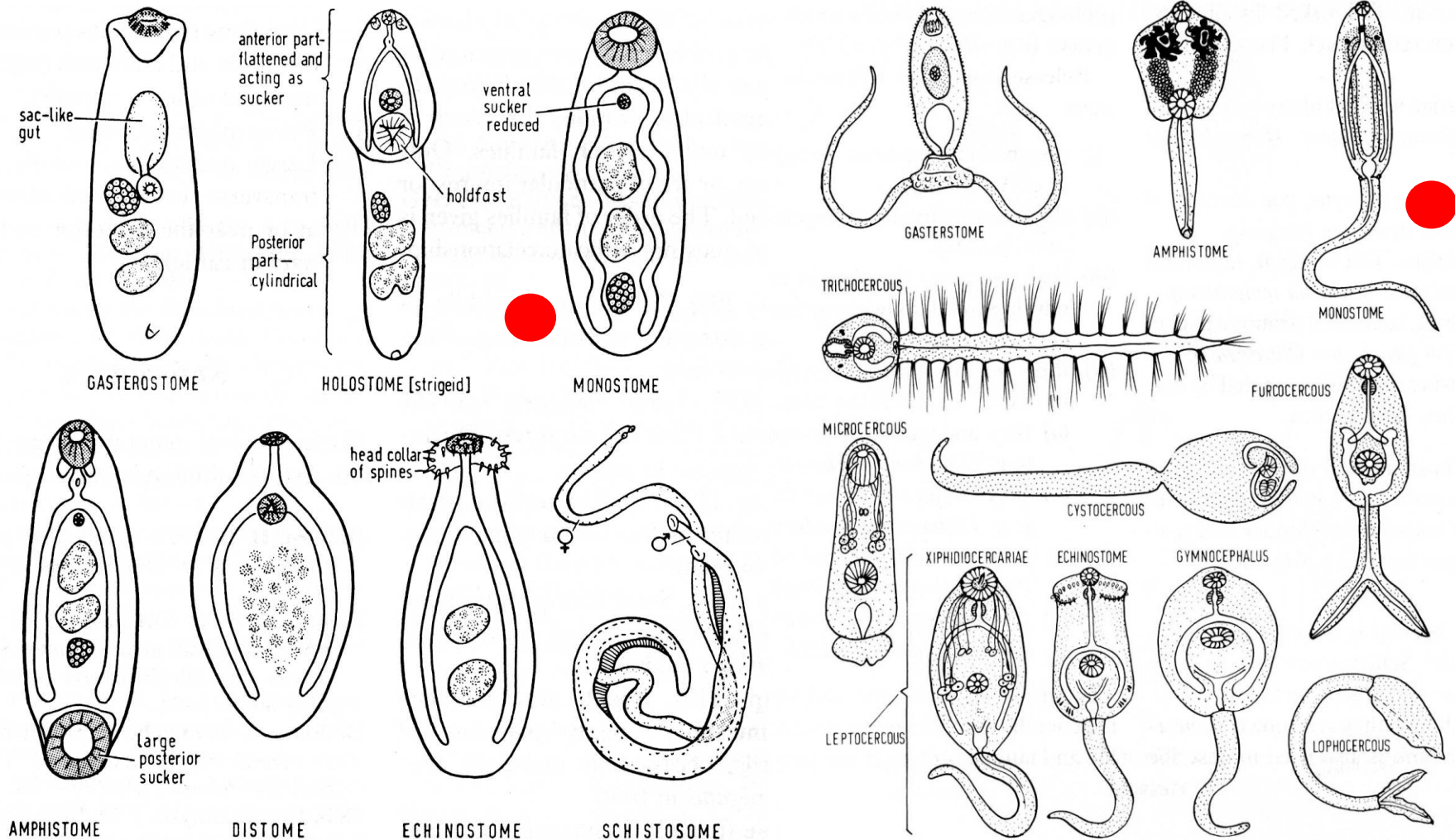
**Obr. 3–11 Digenea. Vybrané morfologické typy cercárií. A – gymnocefalní, B – amfistomní, C – echinostomní, D – monostomní, E – xifidiocerkárie, F – furkocerkárie, G – mikrocerkárie, H – cercarieum (progenetické stadium). CZ – cystogenní žlázy, AC – acetabulum, OL – otrněný límec, ST – stylet, PZ – penetrační žlázy, OP – ocasní ploutvička, OK – ocasní kmen, FU – furka, EM – exkreční měchýř, UP – ústní přísavka, GE – germarium, TE – testis (A dle Swales, 1935, upraveno; B–H dle Našincová, 1992, upraveno).**

# Morfologické typy motolic a cercárií

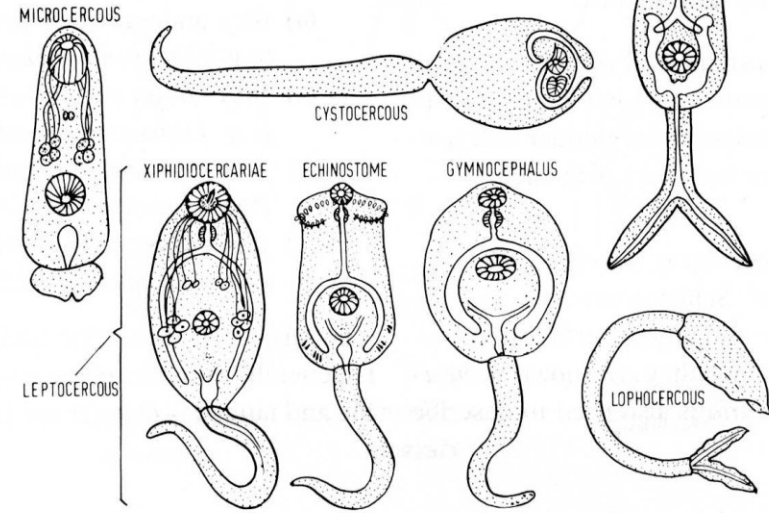
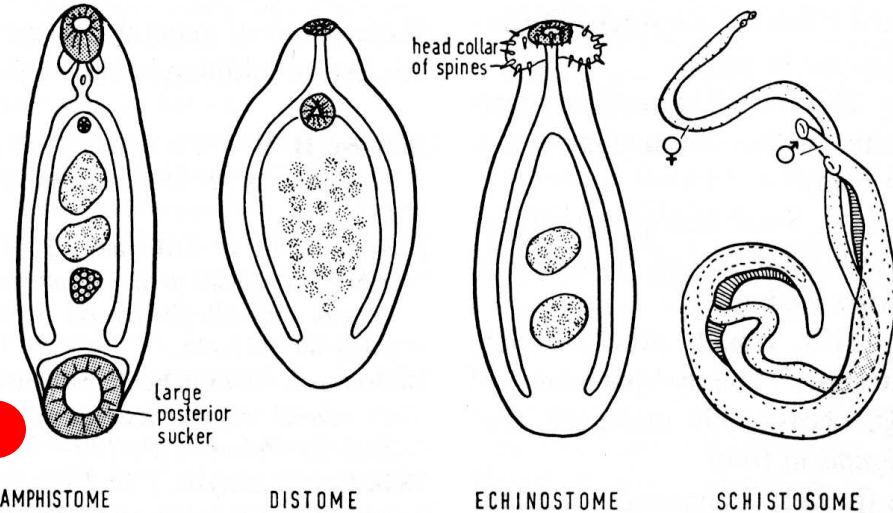
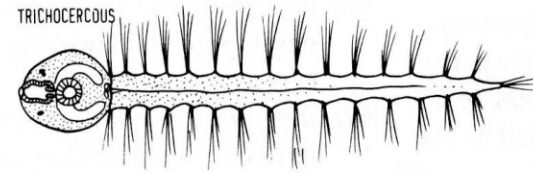
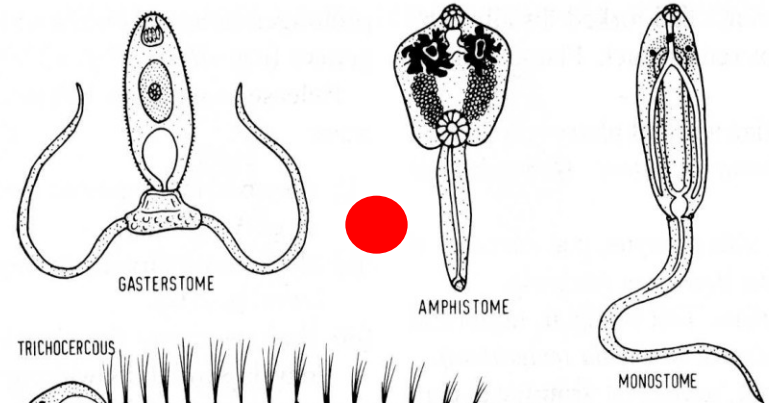
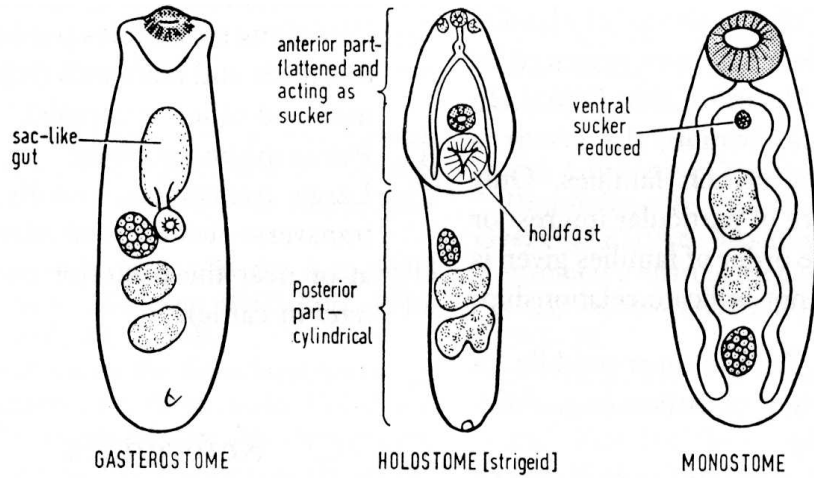




# Morfologické typy motolic a cercárií

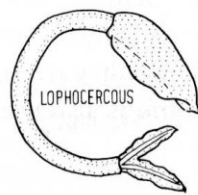
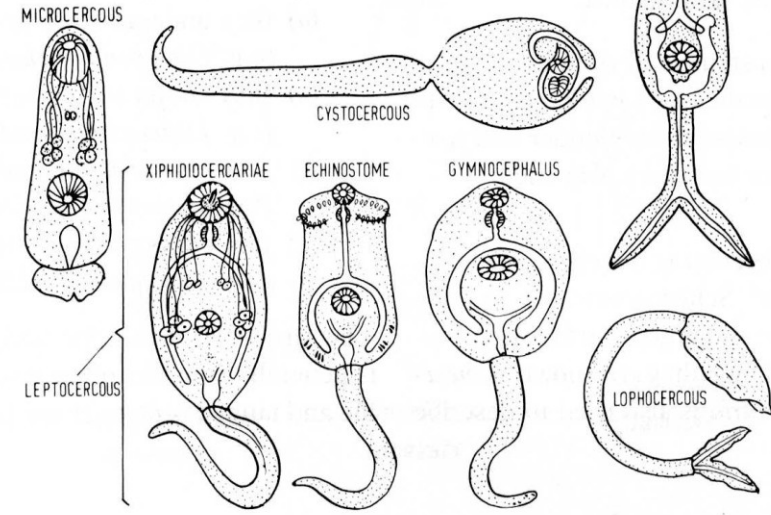
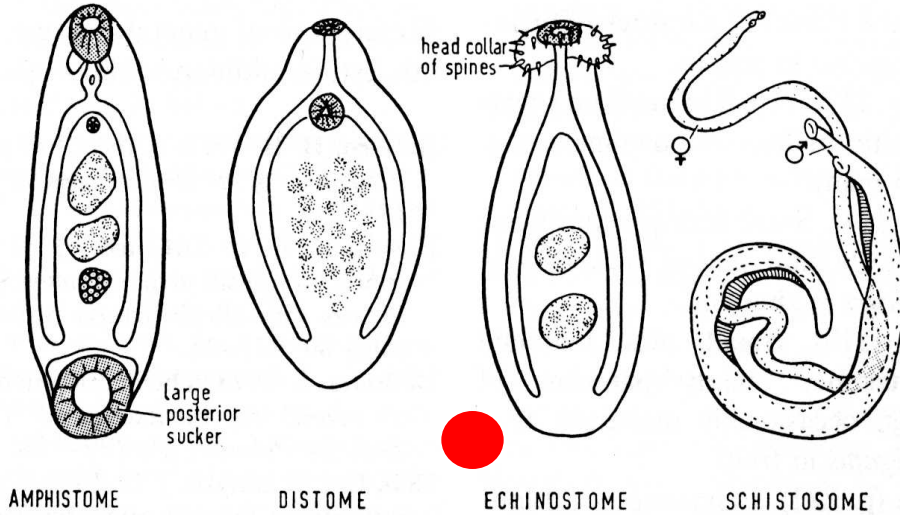
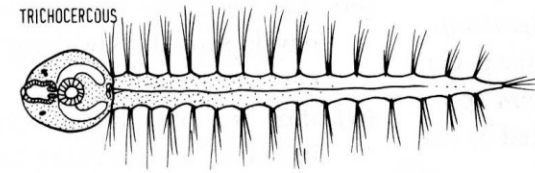
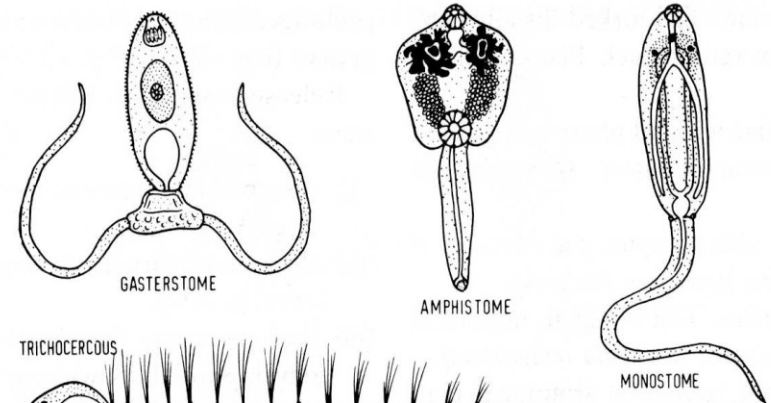
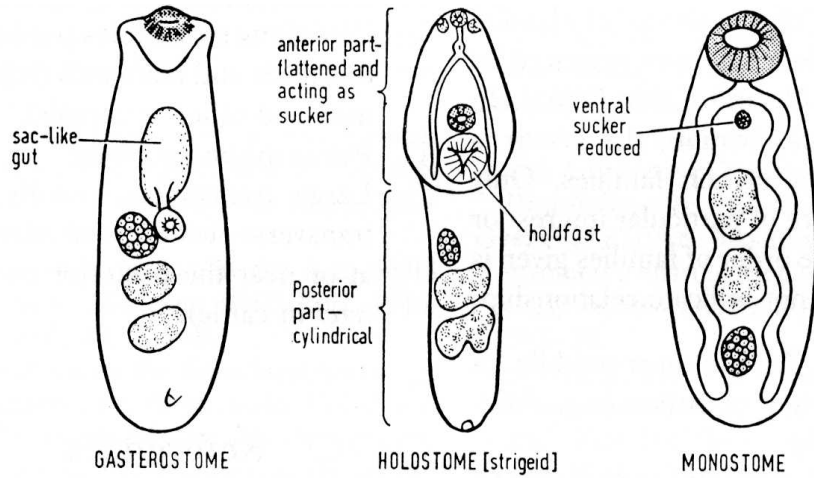


# Morfologické typy motolic a cercárií

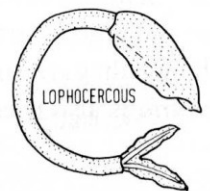
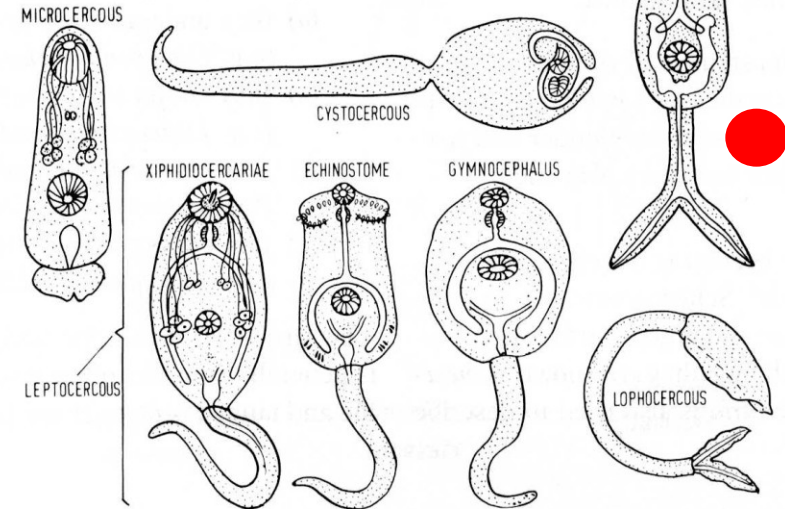
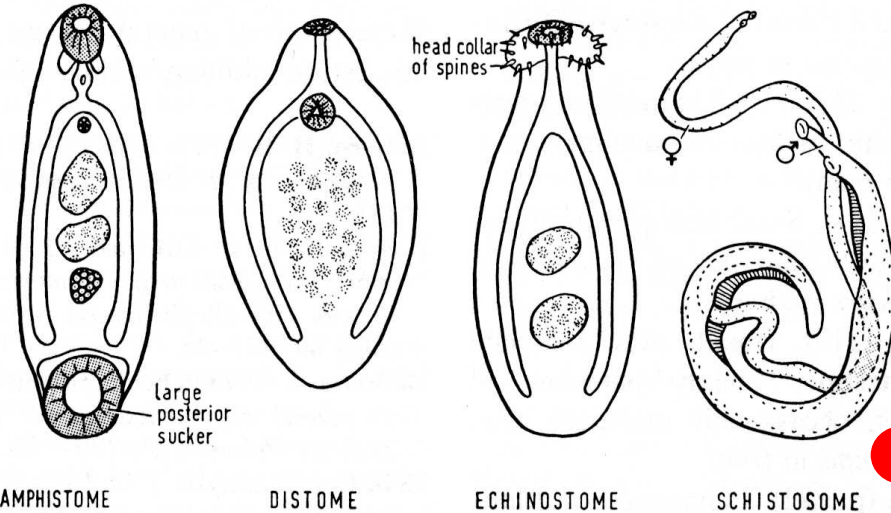
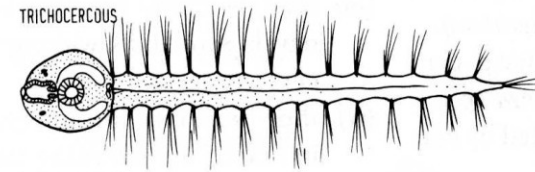
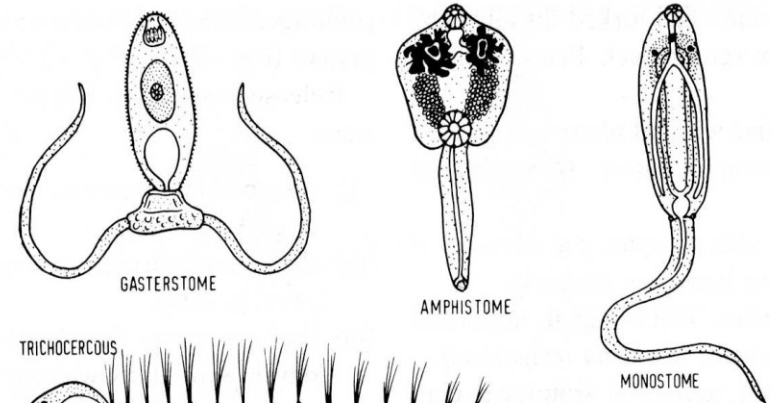
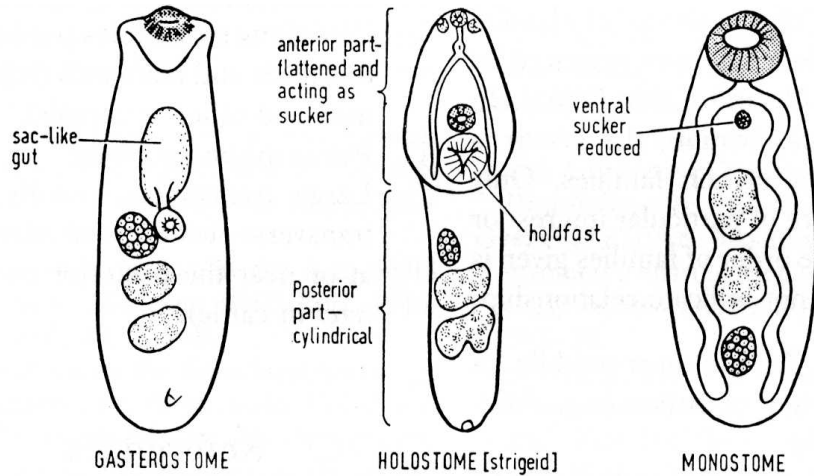




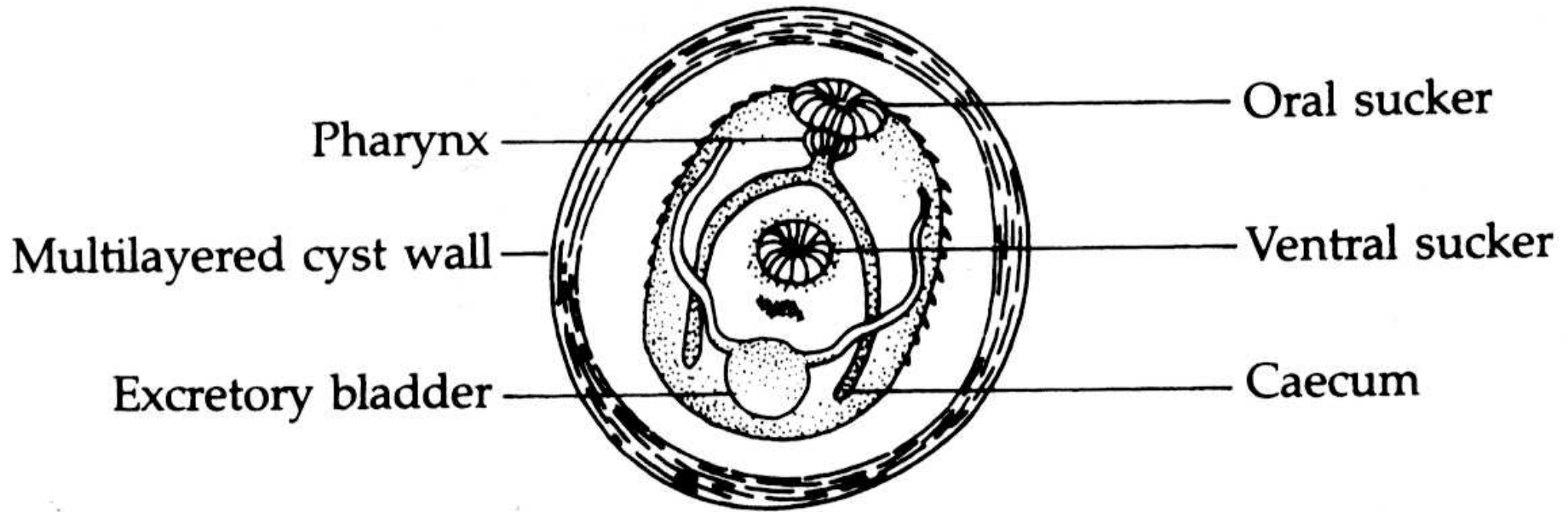
# Morfologické typy motolic a cercárií



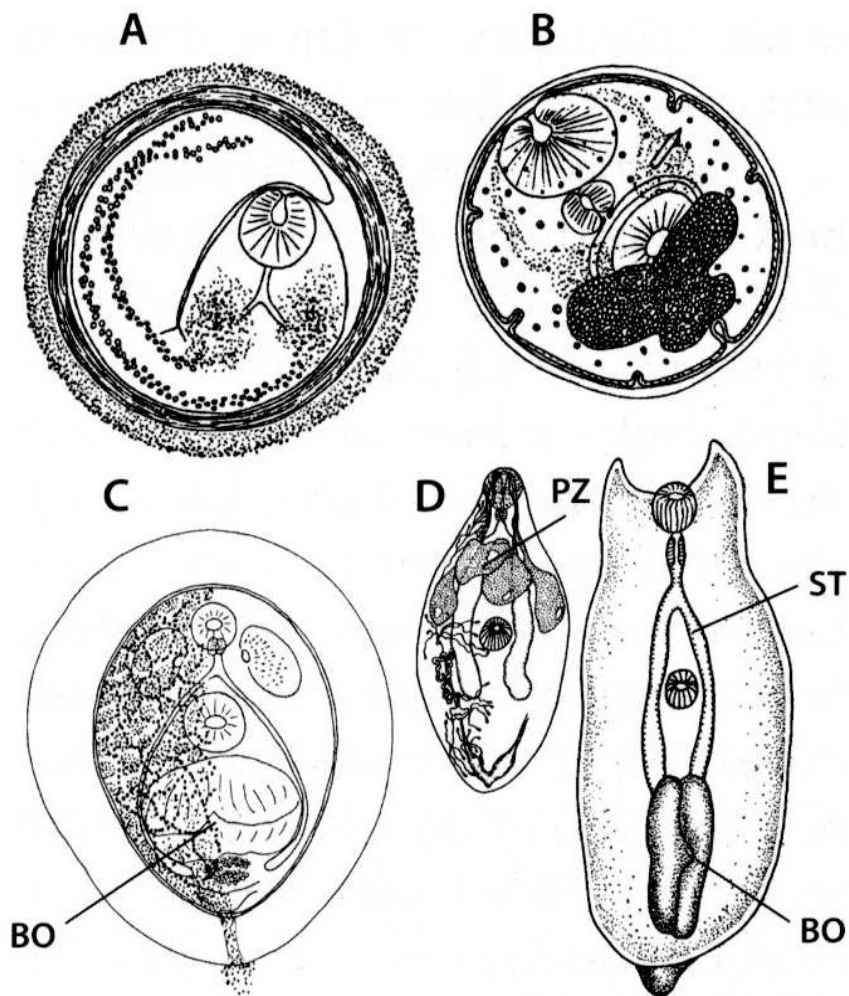
# Morfologické typy motolic a cercárií



# Metacerkárie - morfologie

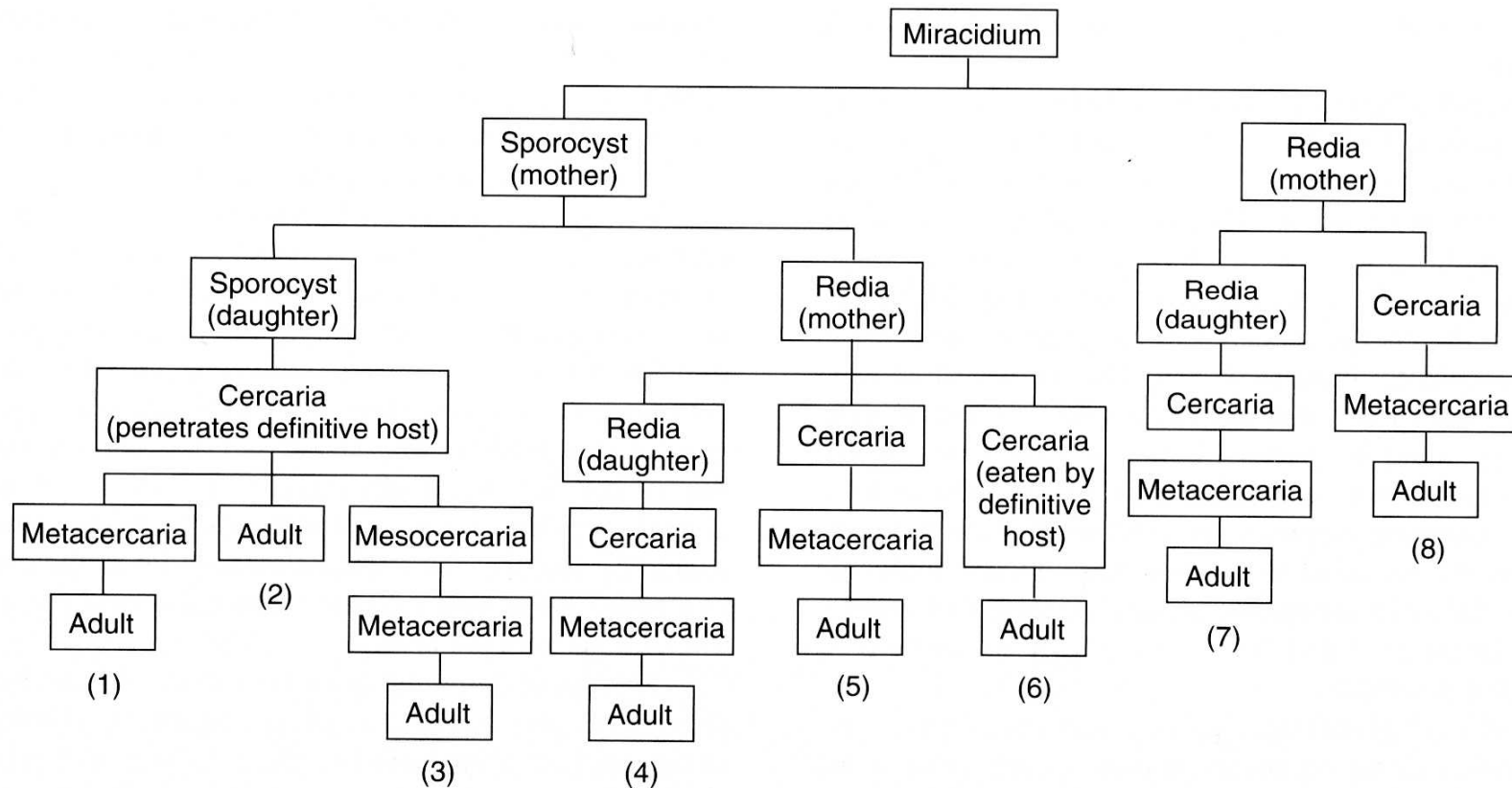


# Metacerkárie



**Obr. 3–12 Digenea. Vybrané typy metacerkárií. A – metacerkárie *Notocotylus attenuatus*, B – metacerkárie *Plagiorchis maculosus*, C – tetrakotyle *Cotylurus cornutus*, D – mezocerkárie *Alaria alata*, E – diplostomulum *A. alata*. BO – Brandesův orgán, PZ – penetrační žlázy, ST – střevo (A–C dle Našincová, 1992, upraveno; D, E dle Giňecinskaja, 1968, upraveno).**

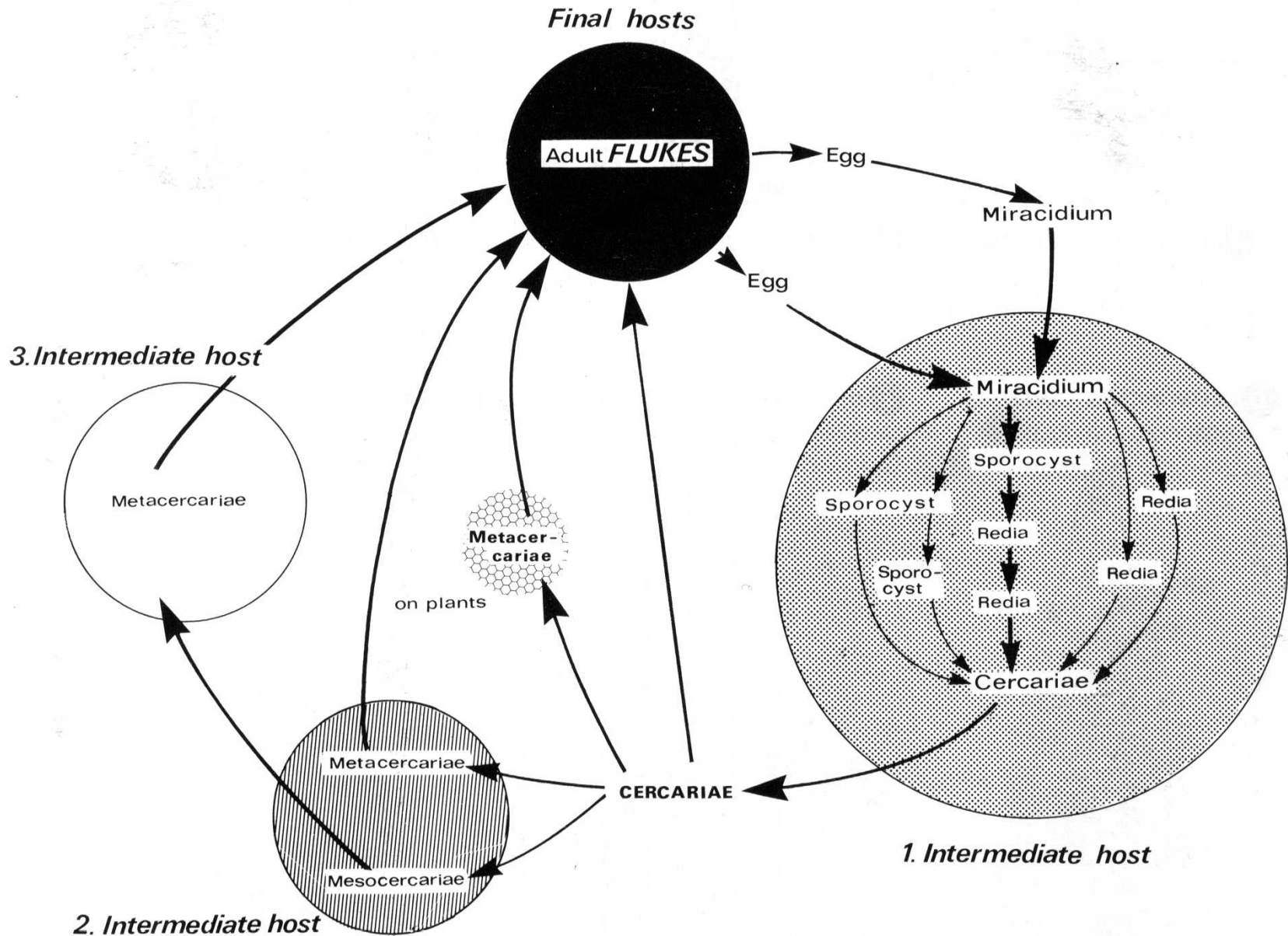
# Typy vývojových cyklů motolic



- (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



# Životní a vývojové cykly motolic

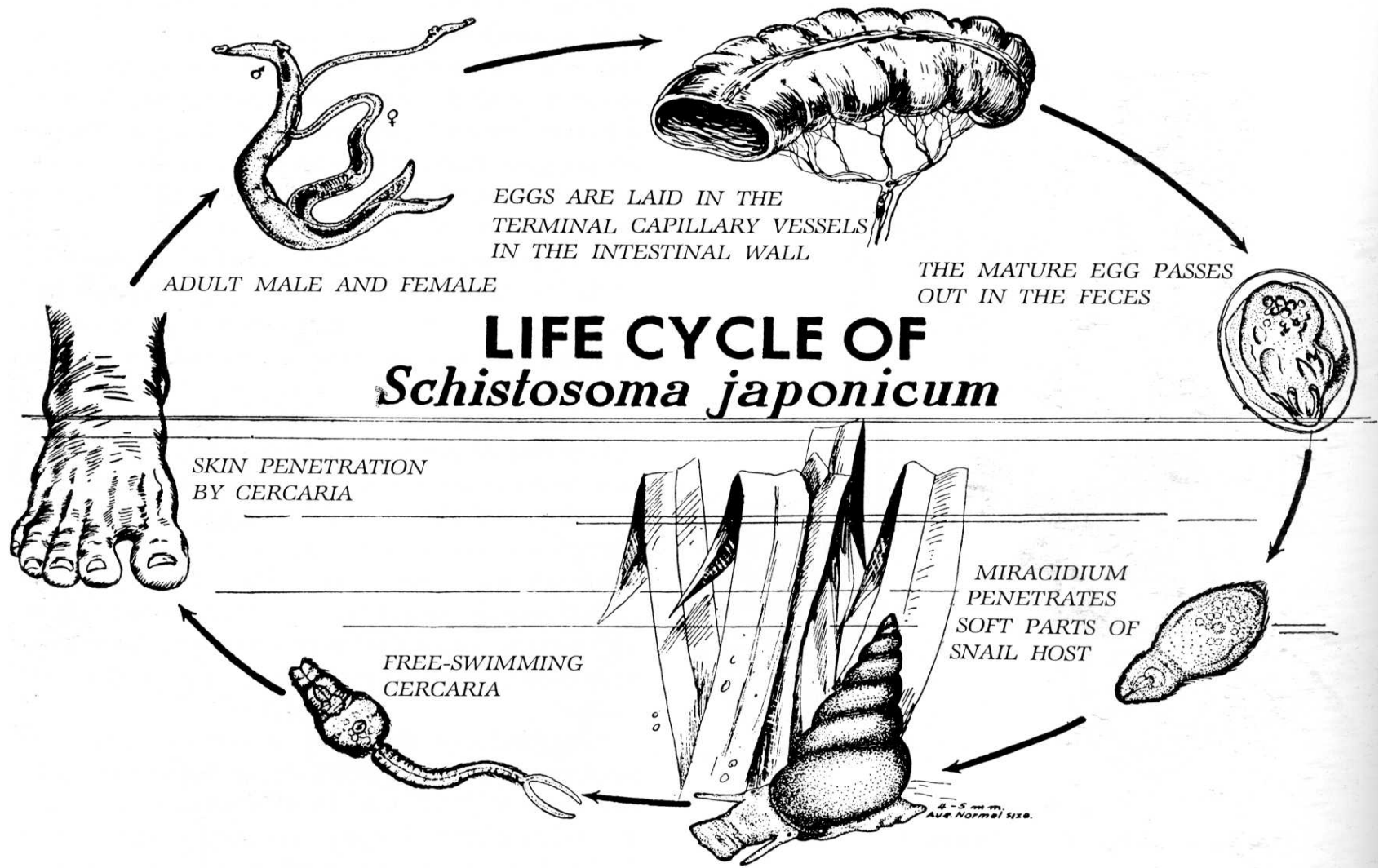




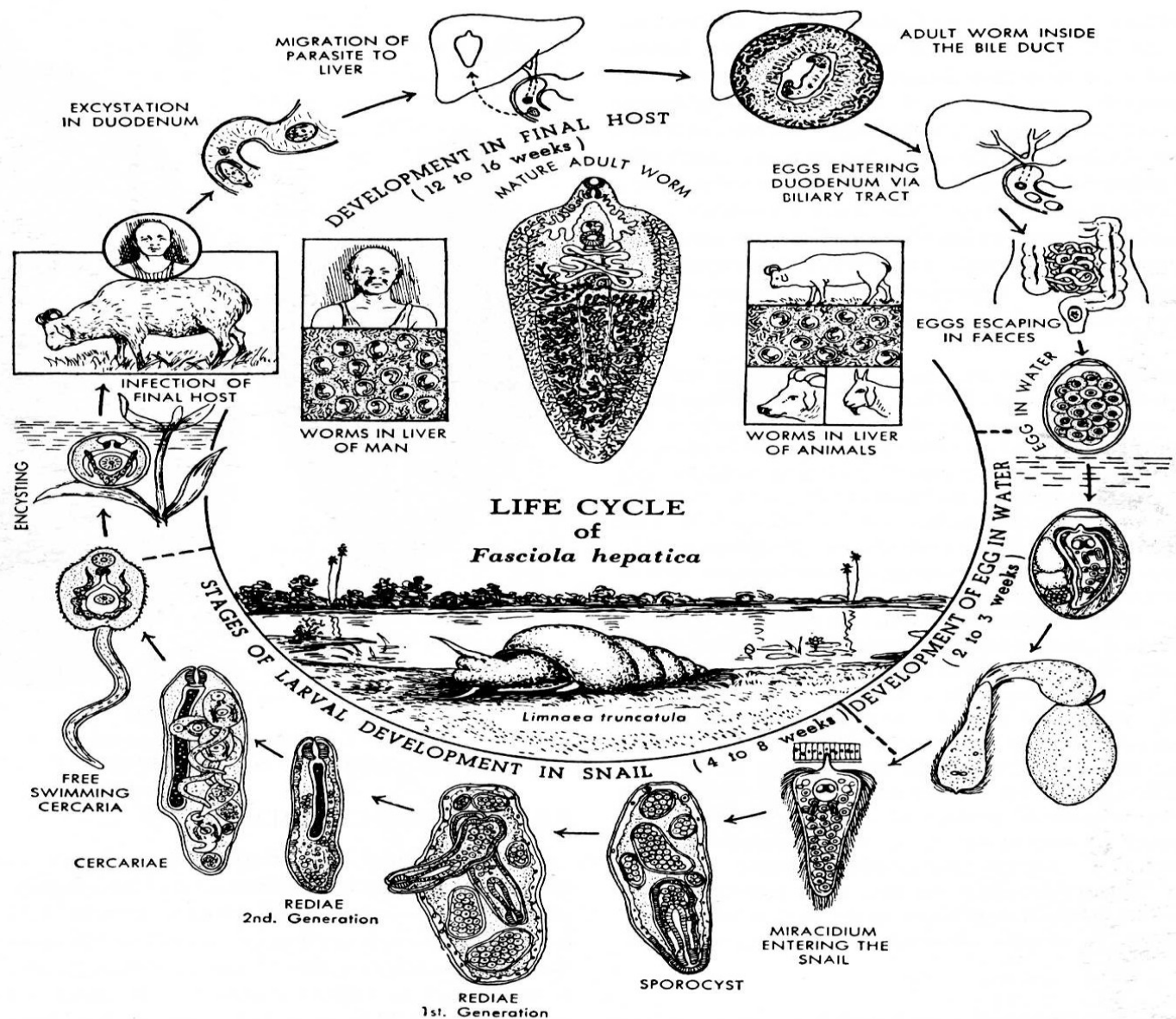
# Vývojové cykly motolic

- Jednohostitelský – monoxenní
- Dvouhostitelský (dixenní) s přímou penetrací cercárií – **Schistosoma hematobium** ●
- Dvouhostitelský (dixenní) s adoleskárií – **Fasciola hepatica** ●
- Tříhostitelský (trixenní) – (savec - měkkýš – členovec) – **Paragonimus westermani** ●
- Tříhostitelský (trixenní) – savec – měkkýš – obratlovec – **Clonorchis sinensis** ●
- Čtyřhostitelský - tetraxenní

# Dvouhostitelský (dixenní) s přímou penetrací cerkárií – **Schistosoma japonicum** ●

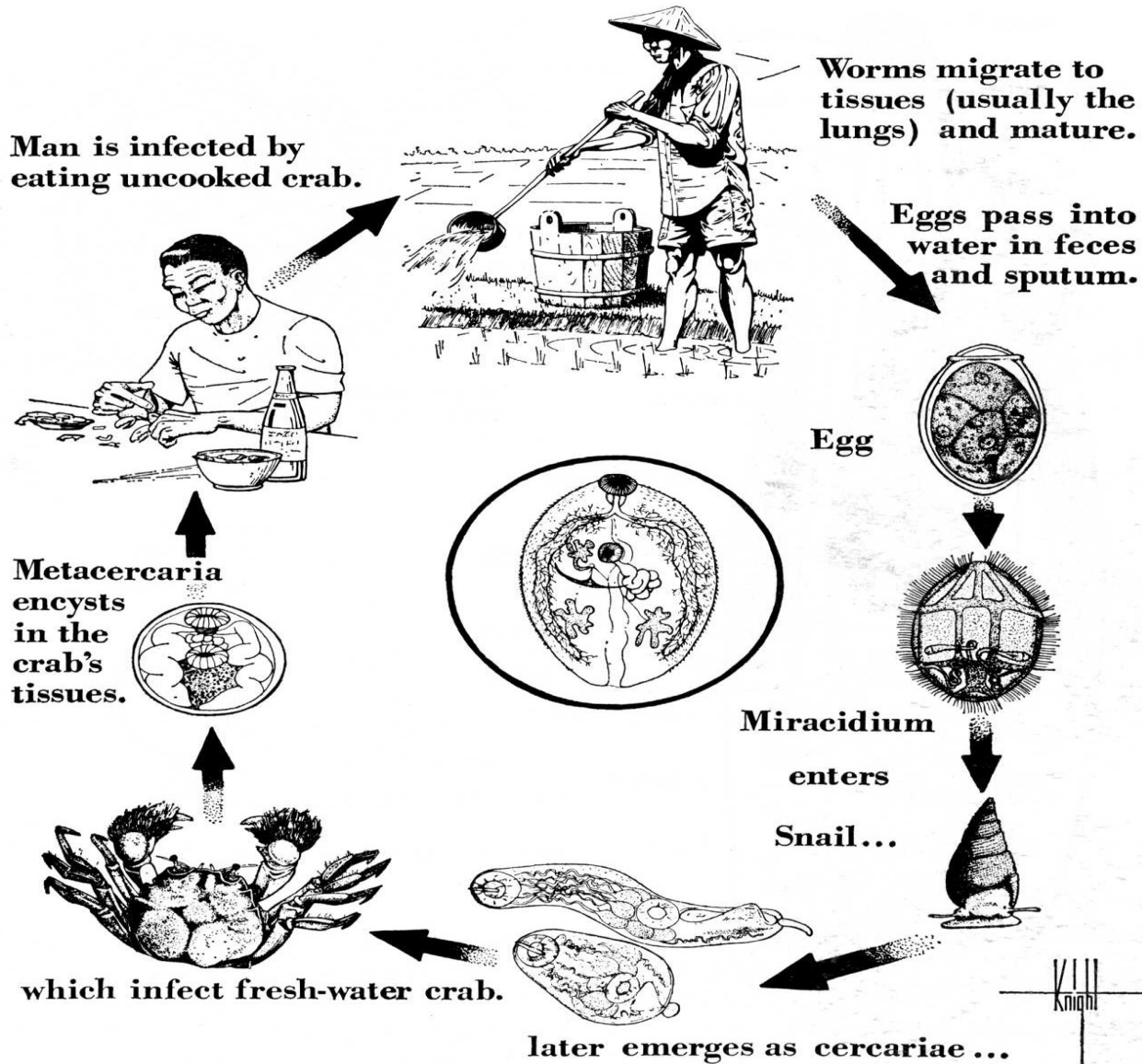


# Dvouhostitelský (dixenní) s adoleškárií – Fasciola hepatica ●



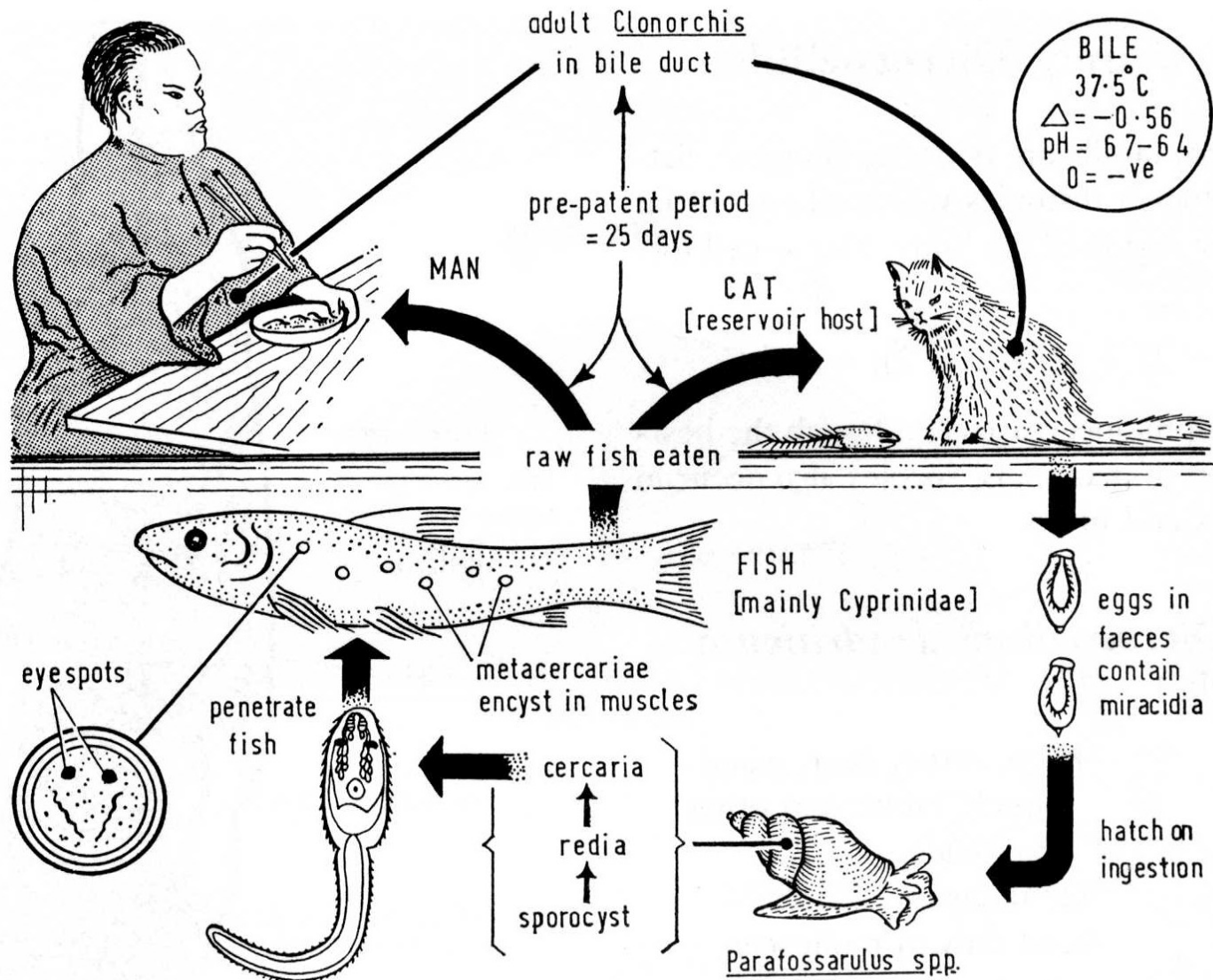


# Tříhostitelský (trixenní) – (savec - měkkýš – členovec) – *Paragonimus westermani* ●





# Tříhostitelský (trixenní) – savec – měkkýš – obratlovec – **Clonorchis sinensis** ●



# Schéma životních cyklů motolic napadajících člověka

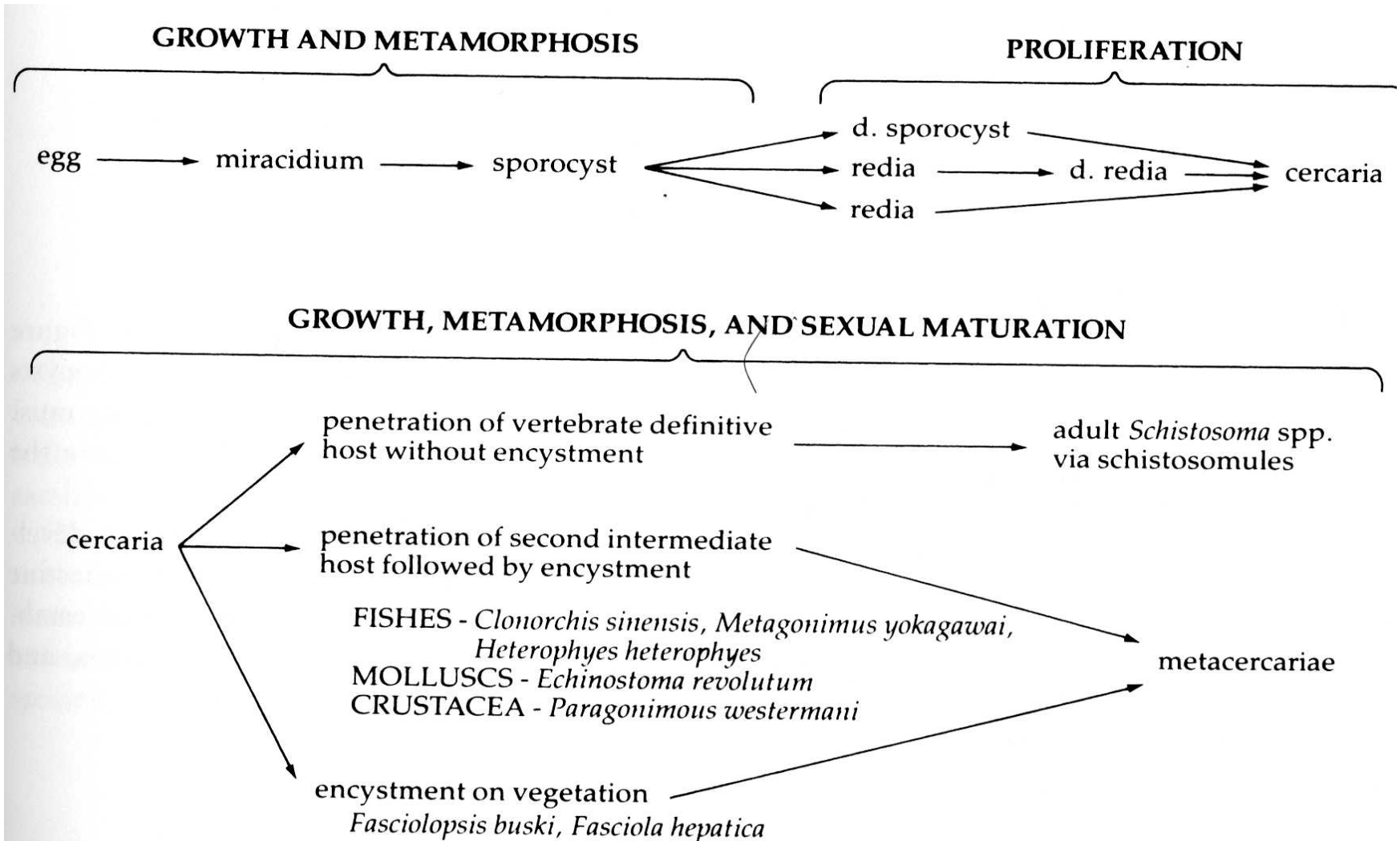


FIGURE 9-17

Flowchart showing life cycles of trematodes that infect humans.

# Klasifikace – přehled hlavních skupin I

- Sanguinicolidae
- Aporocotylidae
- Transversotrematidae
- Paramphistomatidae
  - **Gastrodiscoides hominis**
- Paragonimidae
  - **Paragonimus westermani**
- Plagiorchidae
- Dicrocoellidae
  - **Dicrocoelium dentriticum**

# Klasifikace – přehled hlavních skupin II

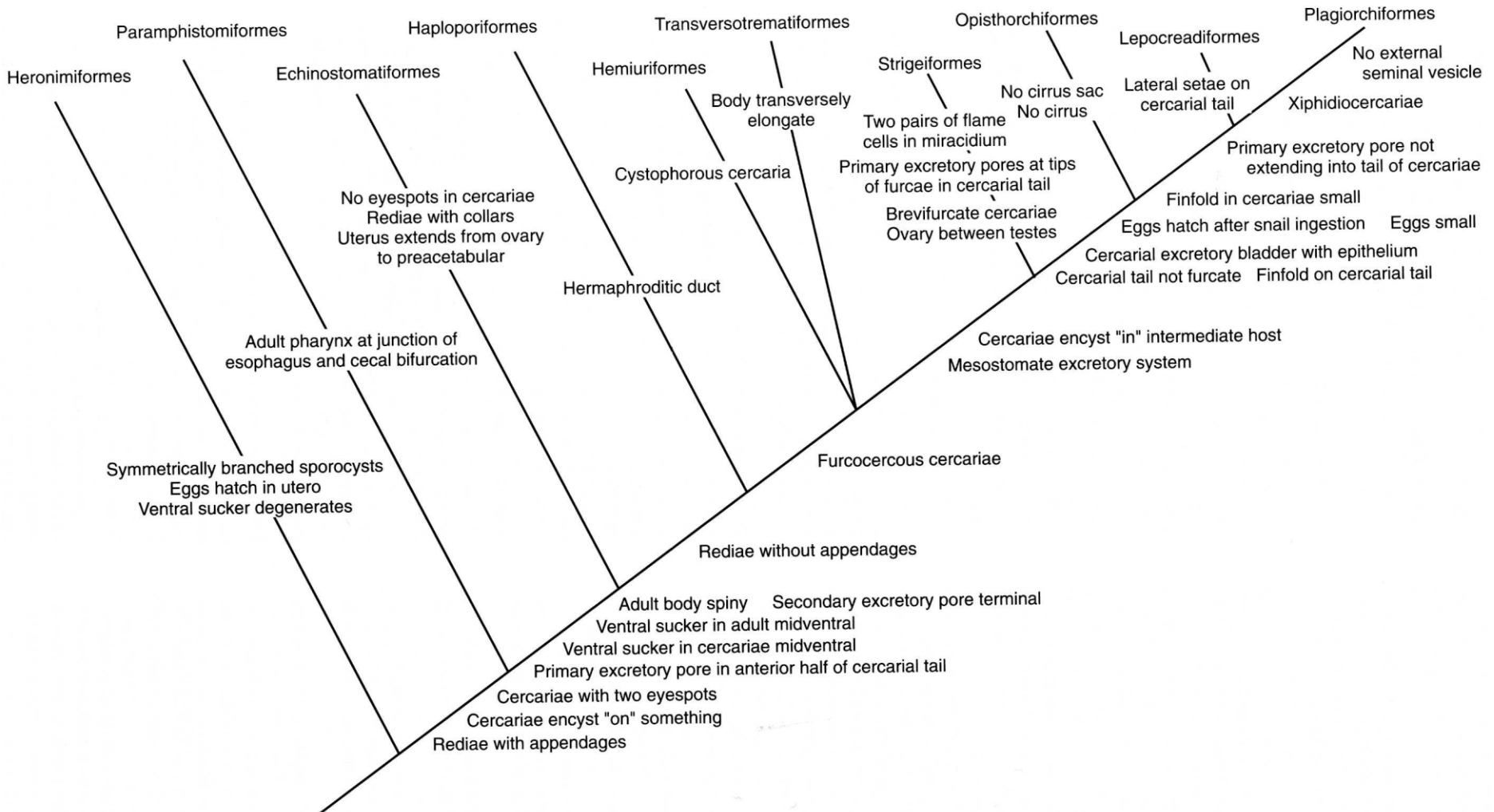
- Fasciolidae
  - **Fasciola hepatica**
  - **Fasciolopsis busci**
- Heterophyidae
  - **Heterophyes heterophyes**
  - **Metagonimus yokogawai**
- Opistorchidae
  - **Opistorchis felinus**
  - **Opistorchis viverrini**
  - **Clonorchis sinensis**
- Echinostomatidea
  - **Echinostoma revolutum**
- Troglotrematidae
- Notocotylidae
- Bucephalidae



# Klasifikace – přehled hlavních skupin III

- Didymozzoidea
- Hemiuridae
- Strigeidní motolice
- Strigeidae
- Diplostomatidae
- Schistosomatidae
  - **Schistosoma haematobium**
  - **Schistosoma mansoni**
  - **Schistosoma japonicum**
  - **Schistosoma intecalatum**
  - **Schistosoma mekongi**
  - **Trichobilharzia**
  - **Ornithobilharzia**

# Hypotetická fylogeneze Digeneí

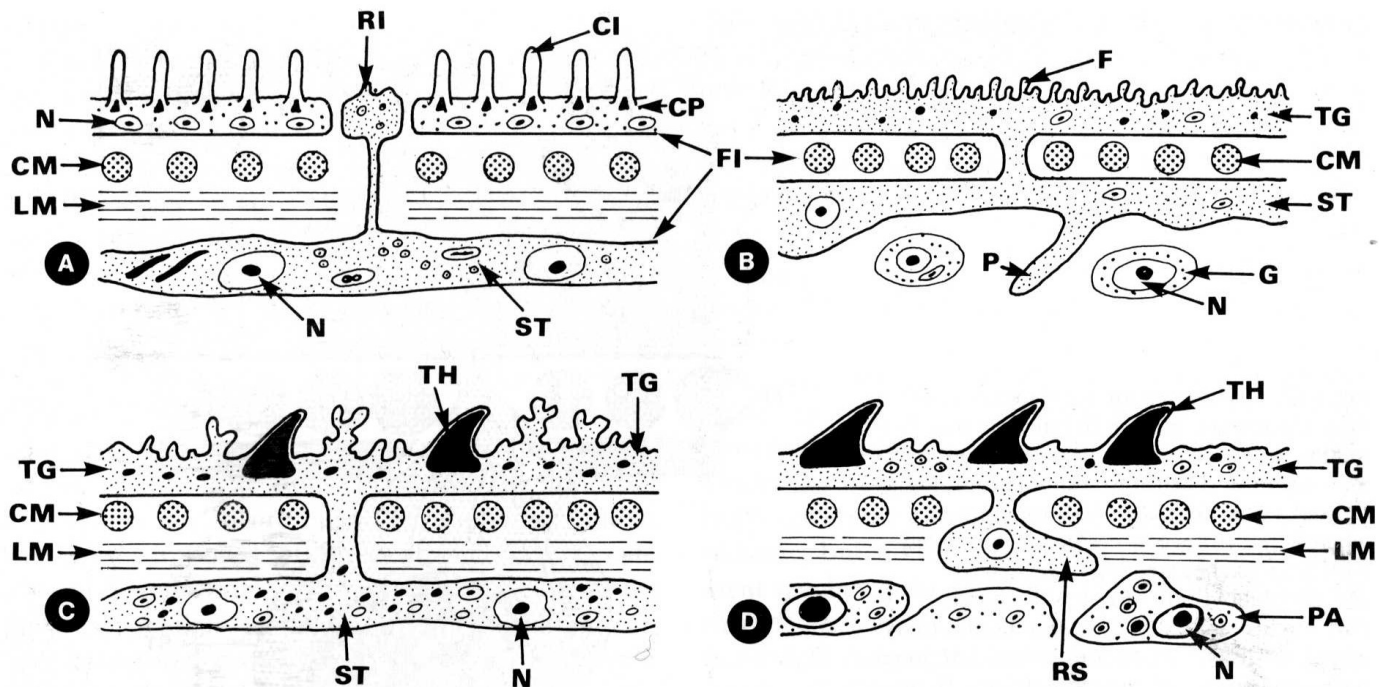


**Figure 15.28** A hypothetical phylogenetic tree for the orders of Digenea.

Redrawn from Daniel R. Brooks and Deborah A. McLennan, *Parascript: Parasites and the language of evolution*. Copyright © 1993 by the Smithsonian Institution. Used by permission of the publisher.

Děkuji za pozornost

# Vývoj tegumenmtu - schisto



**Fig.3.58 A-D.** Diagrammatic representation of the development of the syncytial tegument in digeneans (*Schistosoma mansoni*). **A** Miracidium which is covered by ciliary plates and ridges formed by the subtegumental layer. **B** Mother sporocyst after detachment of ciliary plates. **C** Daughter sporocysts are covered by a syncytial tegument, which is connected by bridges with the subtegumental layer. **D** Cercariae: the subtegumental layer becomes reduced, and later paren-

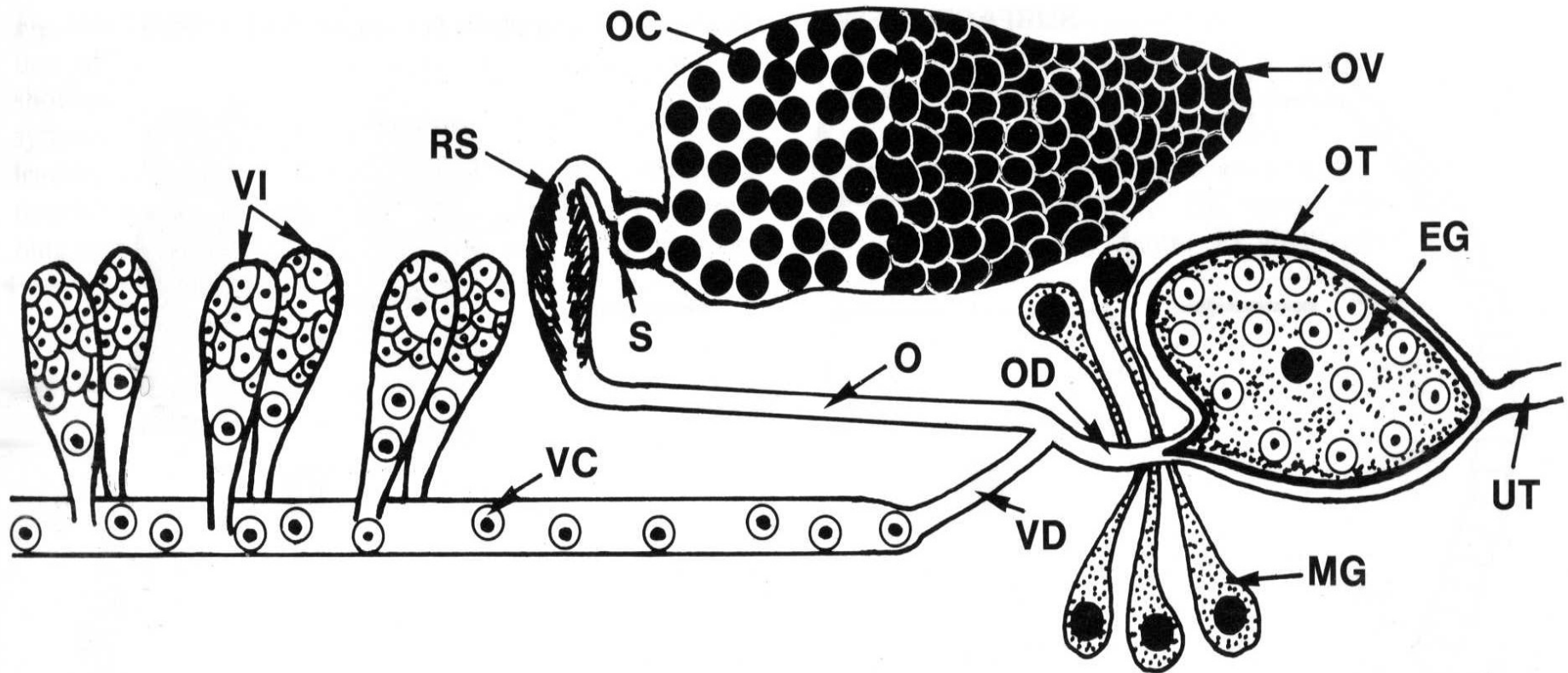
chymal cells will contact the syncytial tegument. *CI*, Cilia; *CM*, circular muscles; *CP*, ciliary plate; *F*, foldings; *FI*, fibrous layer; *G*, germinal cells; *LM*, longitudinal muscles; *N*, nucleus; *P*, protruding subtegument; *PA*, parenchymal cell; *RI*, ridge; *RS*, remnants of the subtegument; *ST*, subtegumental layer; *TG*, tegument; *TH*, tegumental thorn (hook)



# Samičí reprodukční soustava schisto

3.4.5 Reproductive Organs

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**Fig.3.97.** Diagrammatic representation of the reproductive organs of a female of *Schistosoma mansoni* (after Gönnert 1955 and Mehlhorn and Piekarski 1981). *EG*, Egg (containing the zygote and vitellary cells); *MG*, Mehlis's glands;

*O*, oviduct; *OC*, oocyte; *OD*, ovovitellary duct; *OT*, ootype; *OV*, ovary; *RS*, receptaculum seminis; *S*, sphincter; *UT*, uterus; *VC*, vitellary cell; *VD*, vitellary duct; *VI*, vitellarium