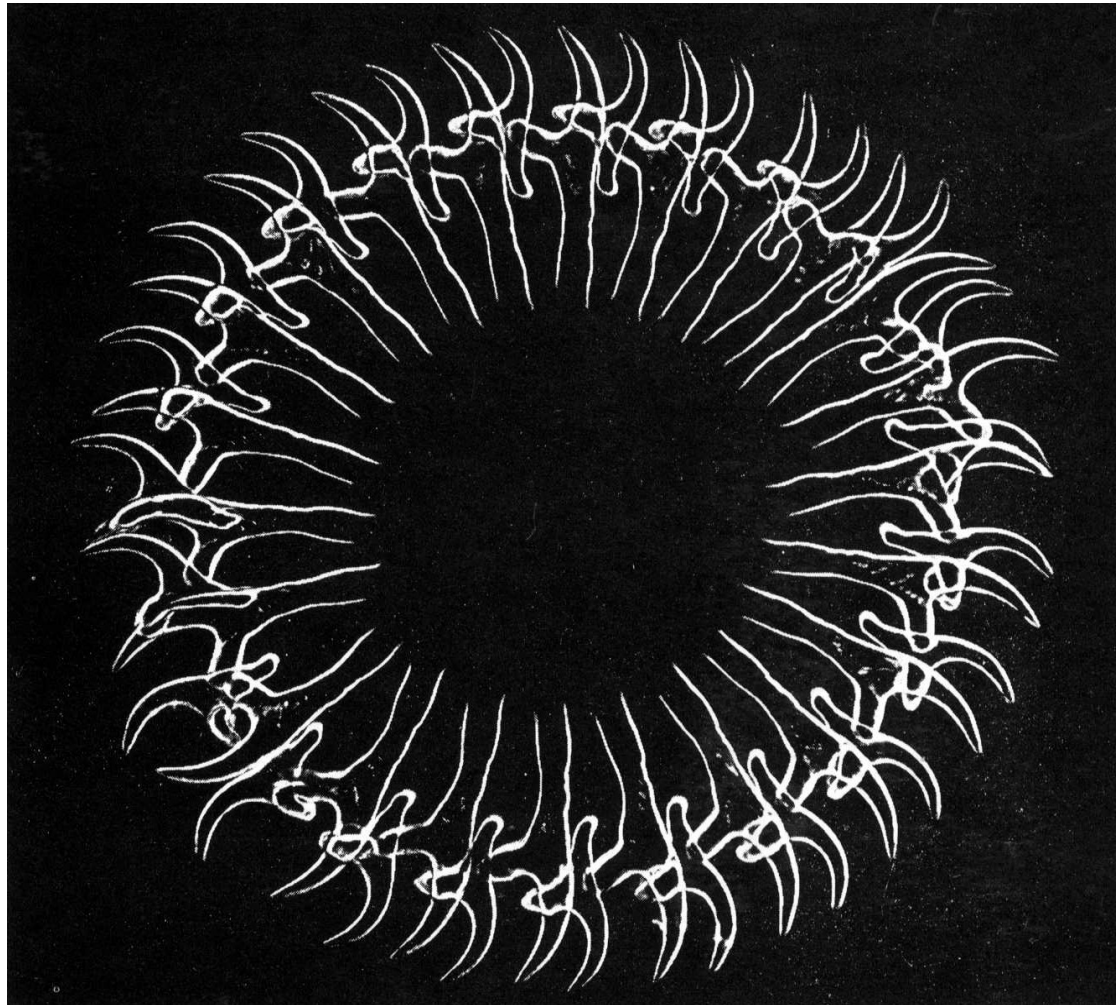


Adaptace helmintů k parazitismu II

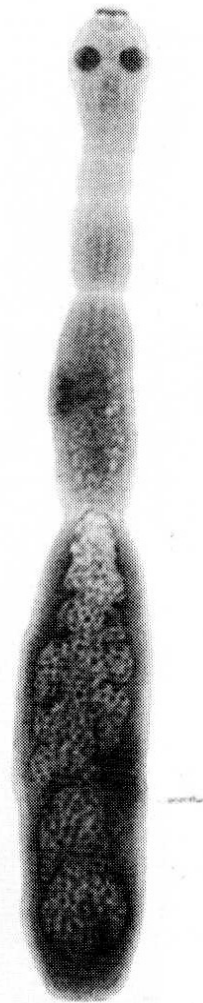
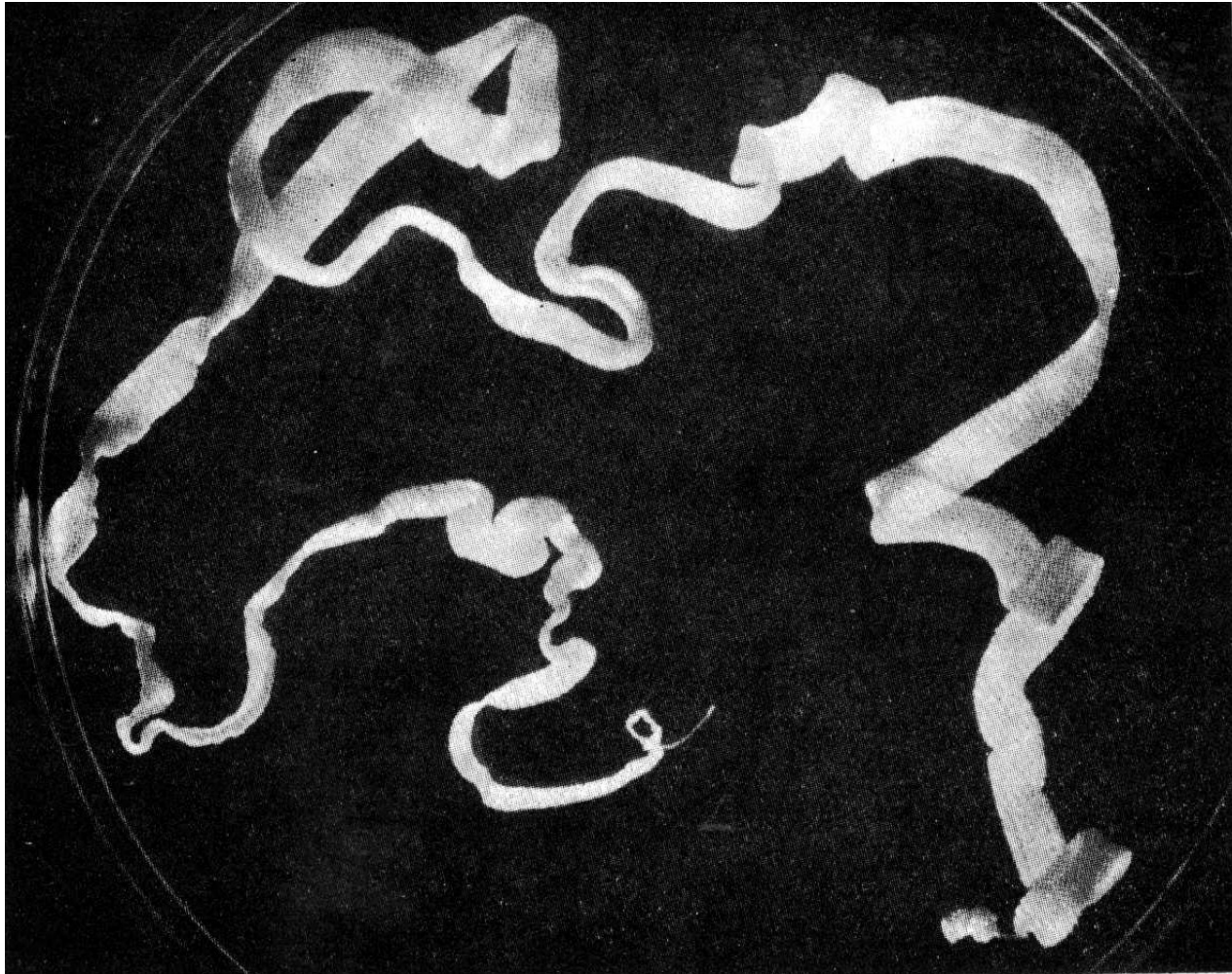
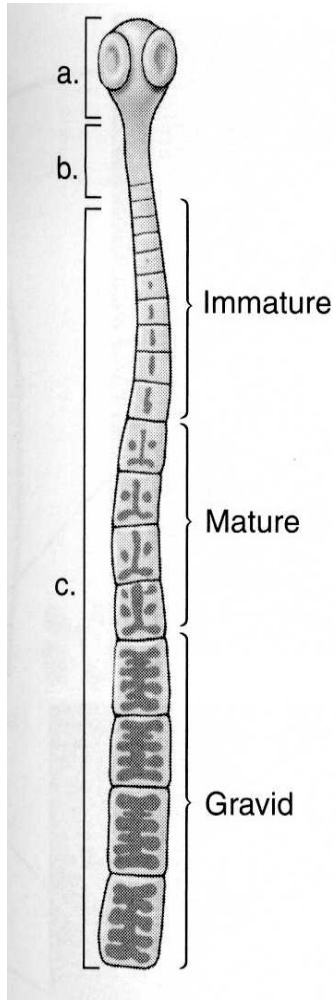
Tasemnice



Tasemnice - charakteristika

- Výhradně parazitická skupina
- Absence střeva
- Larvy s embryonálními háčky
 - 10 lycofora - Cestodaria
 - 6 hexacanth – Eucestoda
- Medicínsky a veterinárně významné
- Popsáno přes 4000 druhů – nejvíce řádů u ryb
- Nejpočetnější řád – Cyclophyllidea – ptáci a savci

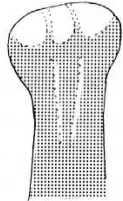
Scolex, krček, strobila



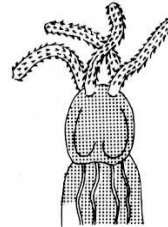
Tasemnice - morfologie

- Hlavička – scolex – přichycovací orgán
- Strobila – proglotidy (segmenty)
- Přichycovací orgány – 5 základních typů:
 - Mělké zářezy a rýhy – Caryophyllidea
 - Štěrbiny – bothrie – Pseudophyllidea
 - Svalnaté bothridie – Tetraphyllidea
 - Chapadélka – tentakule – Trypanorhyncha
 - Svalnaté přísavky - Cyclophyllidea

Scolexy různých řádů tasemnic



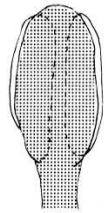
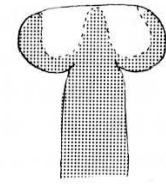
CARYOPHYLLIDEA



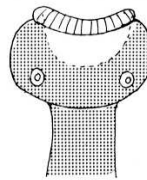
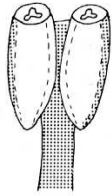
TRYPANORHYNCHA



SPATHEBOTHRIIDEA



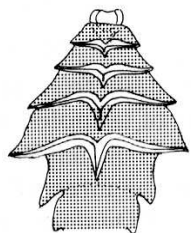
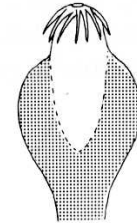
PSEUDOPHYLLIDEA



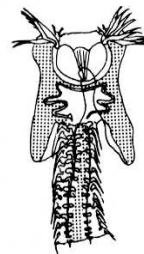
LECANICEPHALIDEA



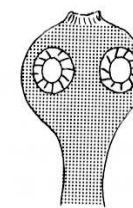
APORIDEA



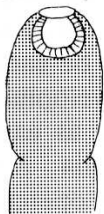
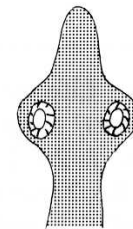
LITOBOTHRIDEA



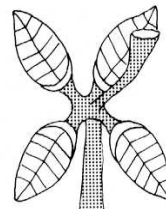
DIPHYLLIDEA



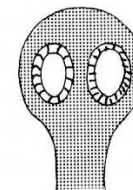
PROTEOCEPHALATA



NIPPOTAENIDEA



TETRAPHYLLIDEA



CYCLOPHYLLIDEA

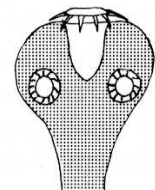
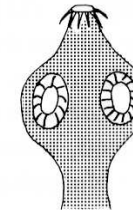
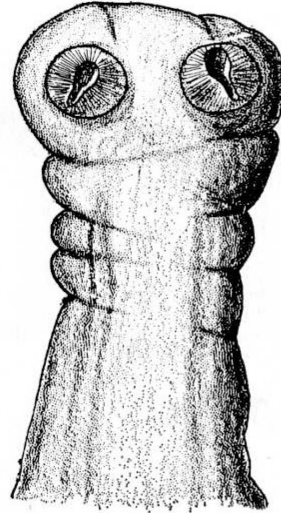


Fig. 1.48. Diagrammatic representation of scolices in different orders of tapeworm

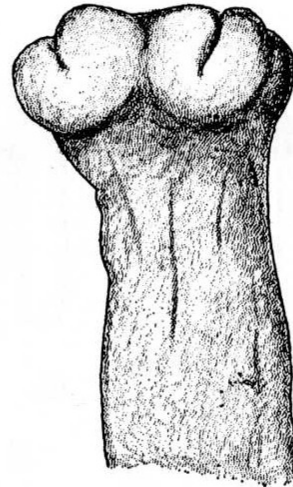
Typy scolexů tasemnic



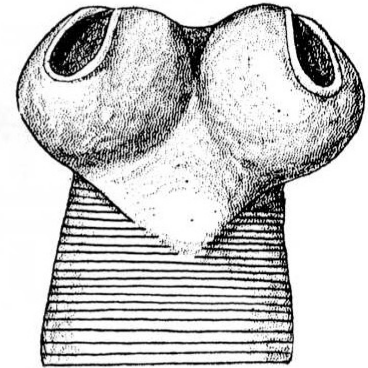
A



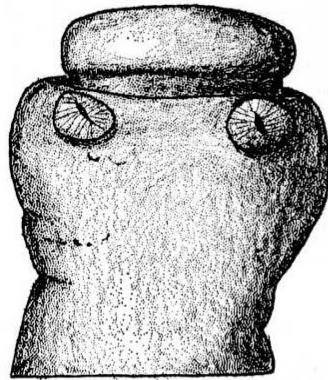
B



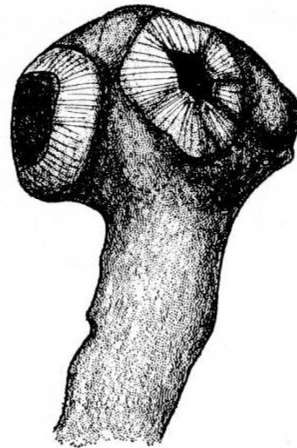
C



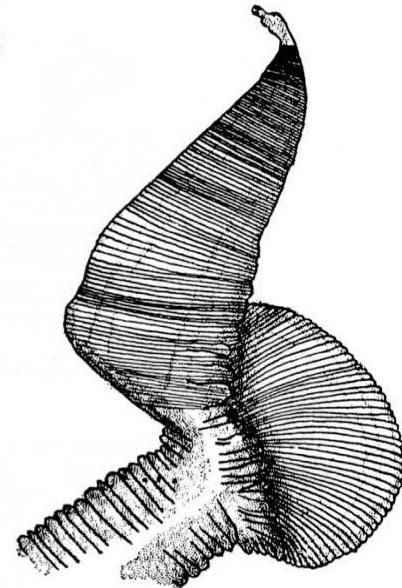
D



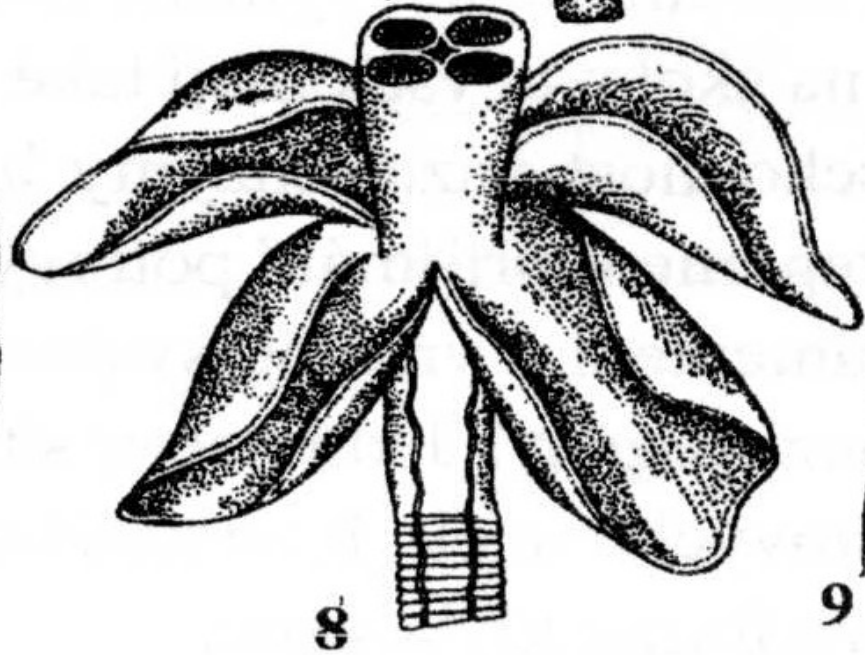
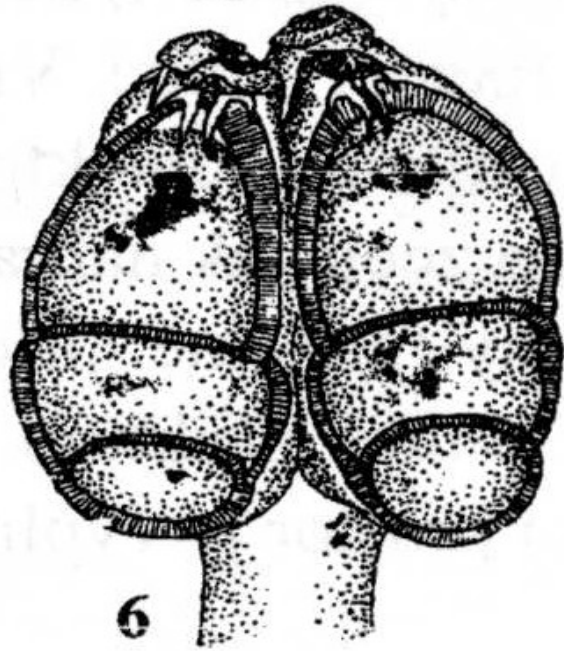
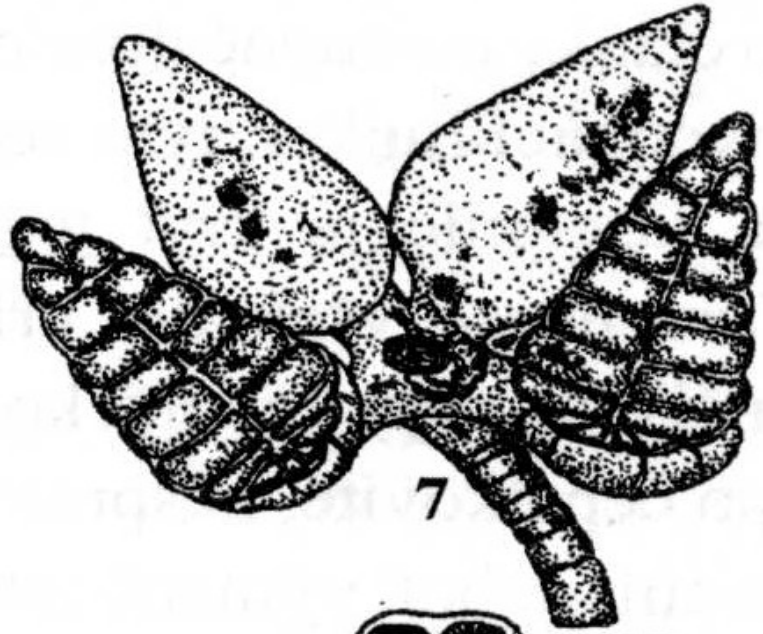
E

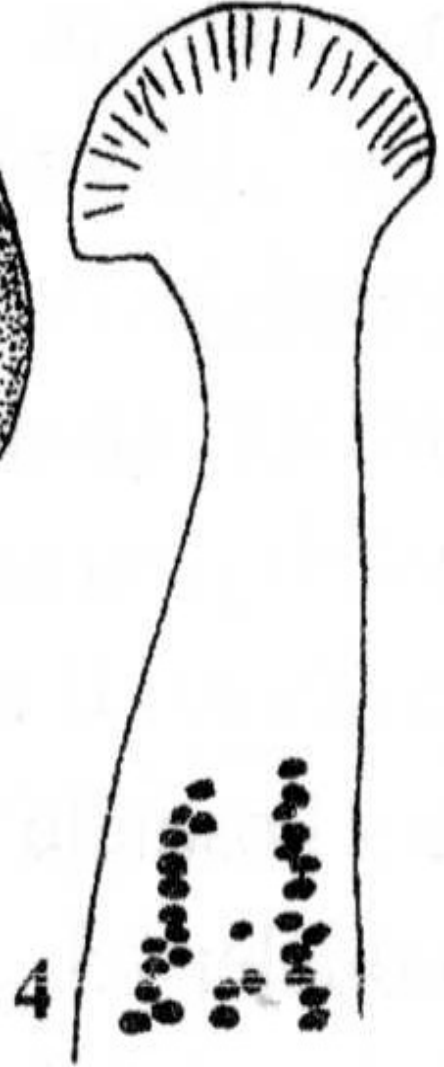
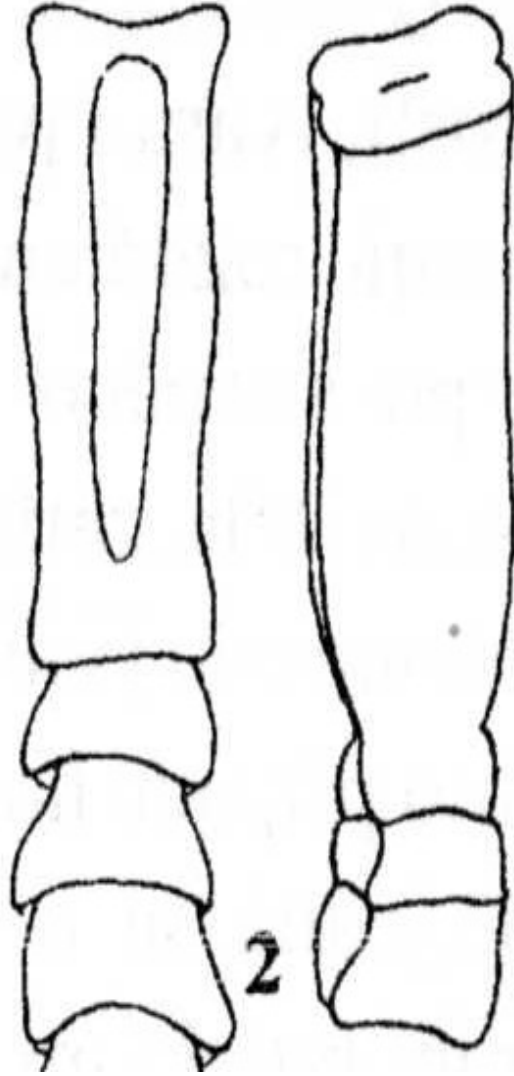
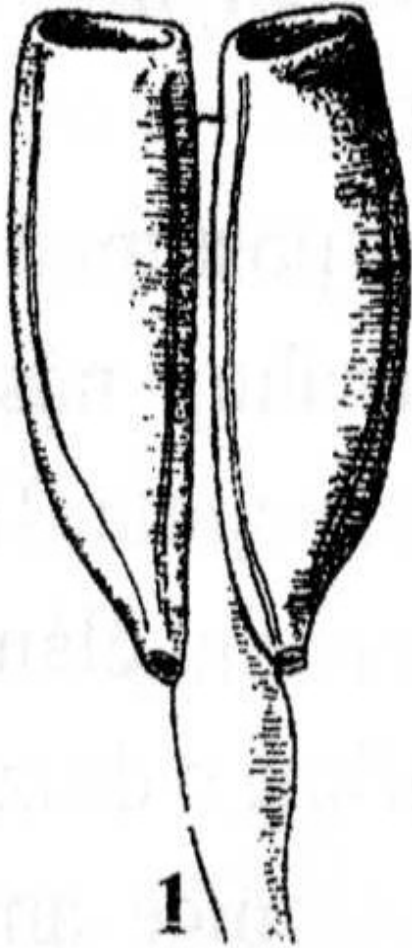


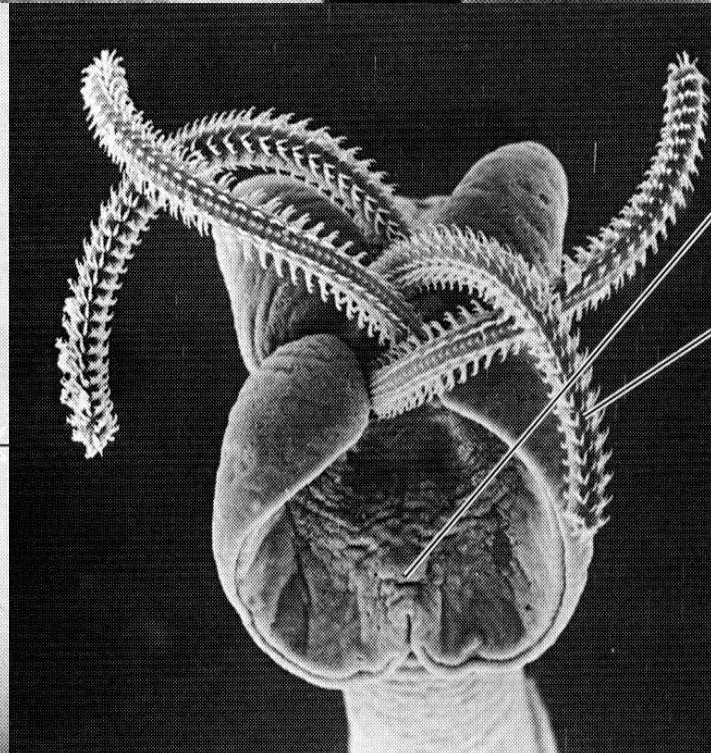
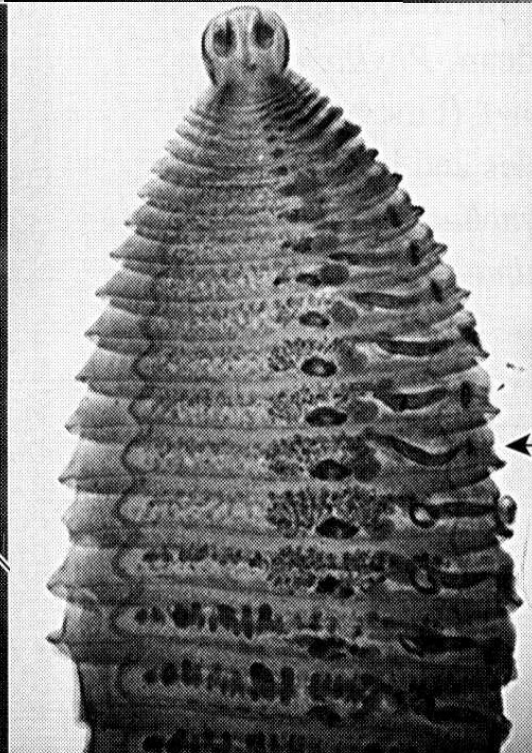
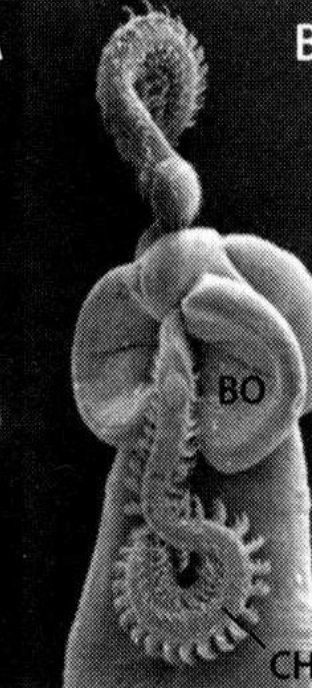
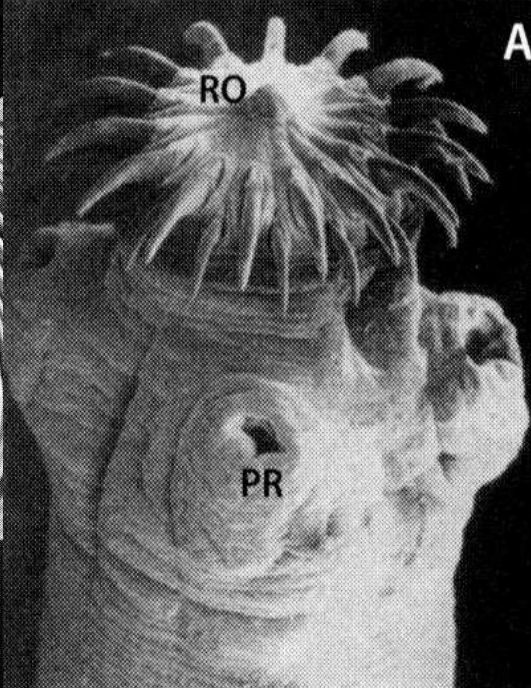
F



G



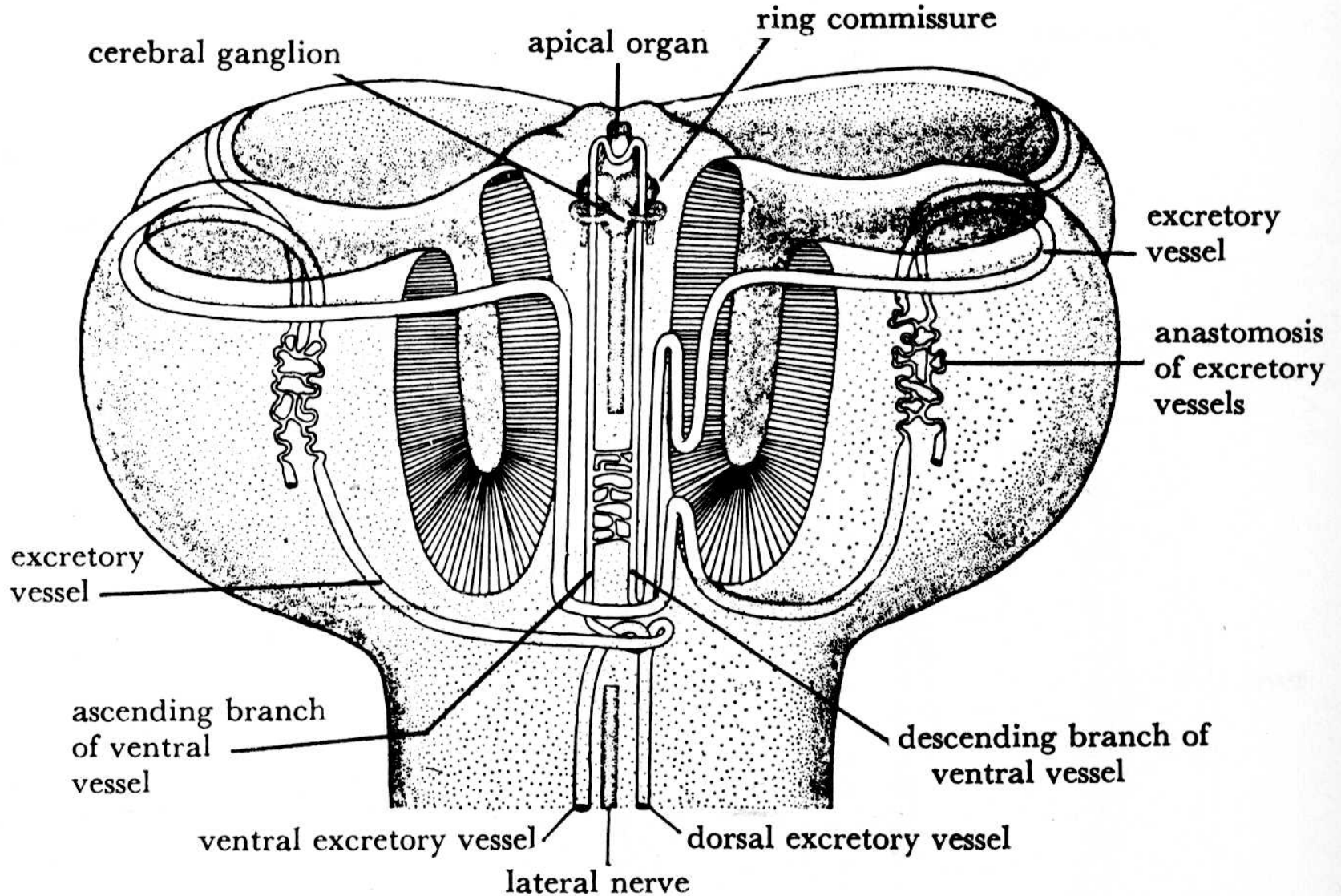




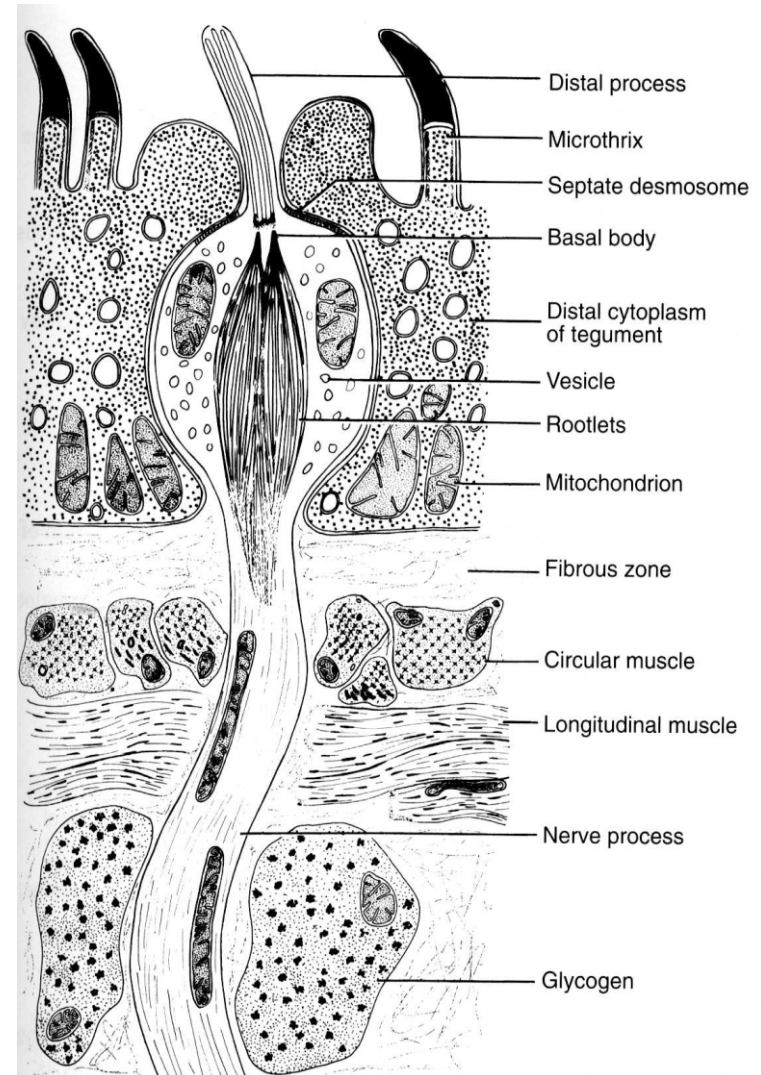
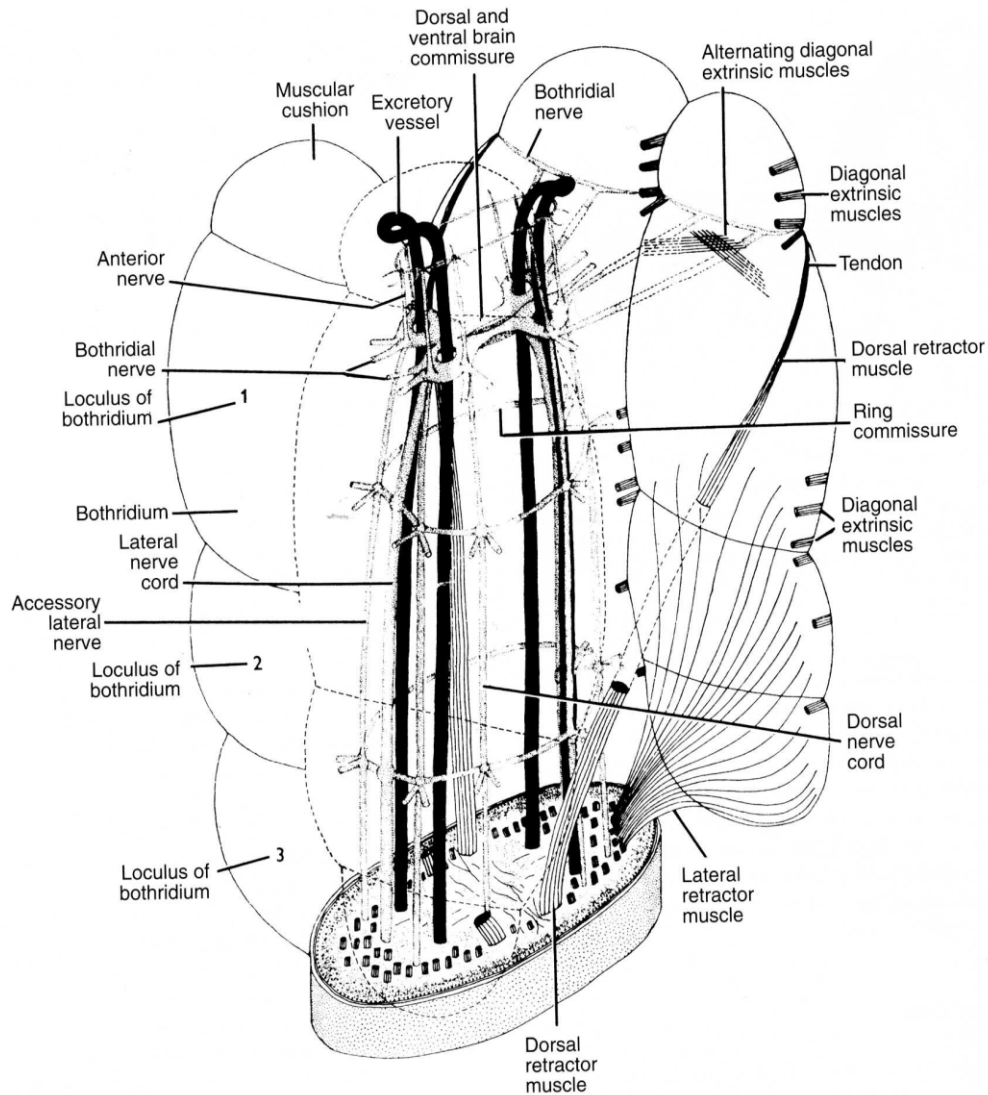
Tasemnice - anatomie

- Scolex – krček - germinativní zóna
- Strobila – proglotidy – články:
 - Apolytické články – odškrcovány články s vajíčky
 - Anapolytické články – vajíčka jsou oddělována s neoddělených článků
- Tegument – povrch těla
- Parenchym - pojivová tkáň
- Svalovina (tři vrstvy)
- Nervová soustava
- Exkreční soustava – protonefridie
- Pohlavní soustava – hermafroditi
- Příjem potravy – povrchem těla

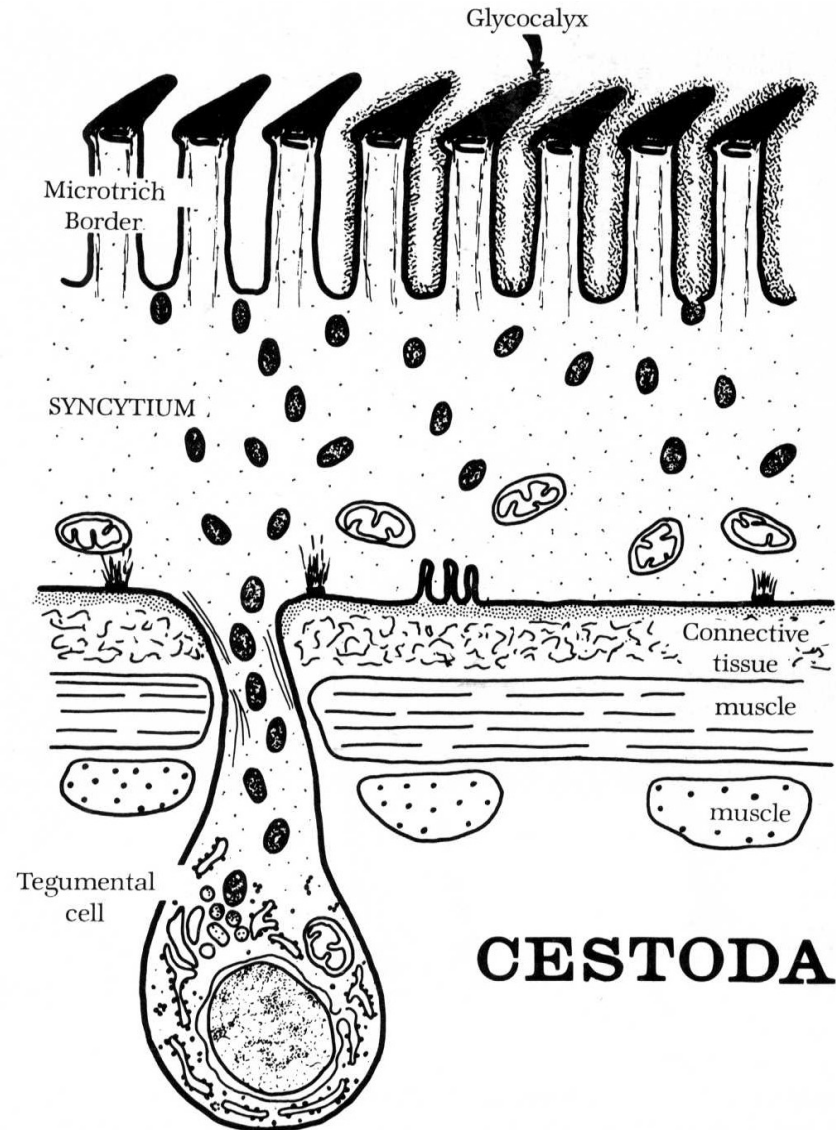
Schéma scolexu tase mnice



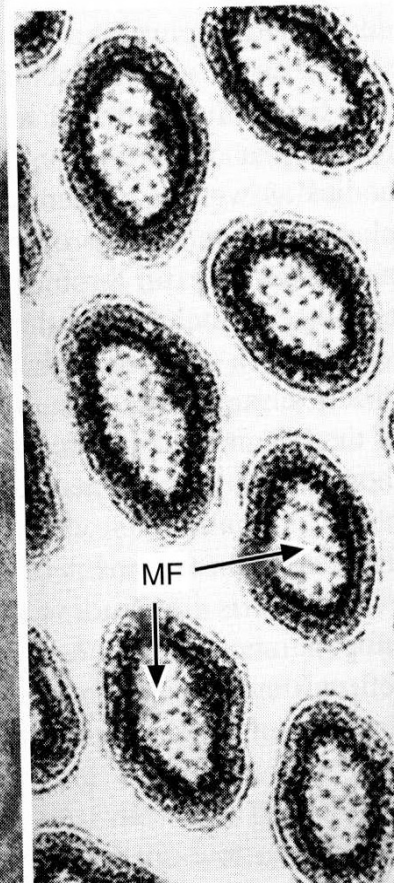
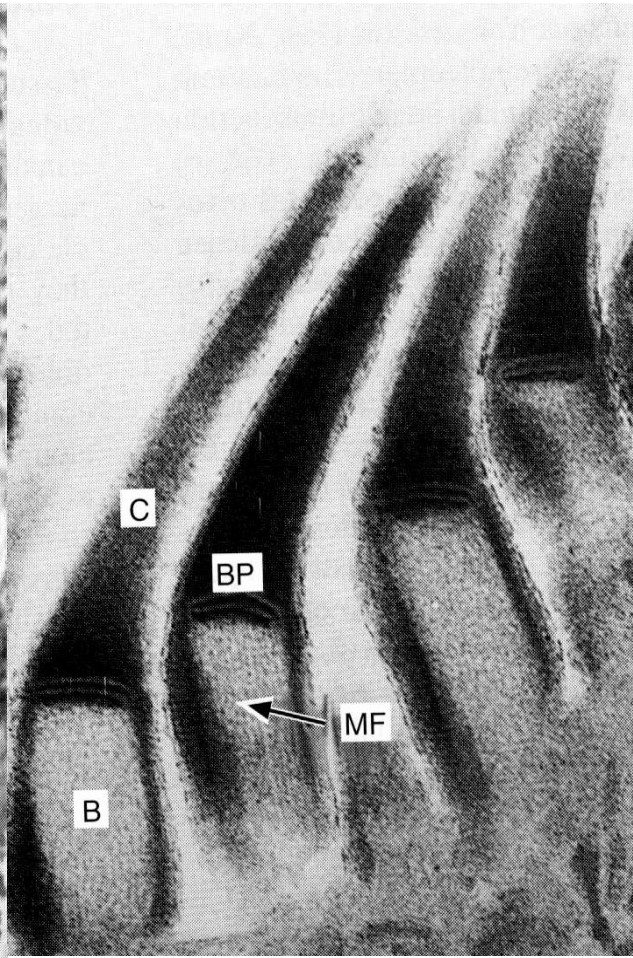
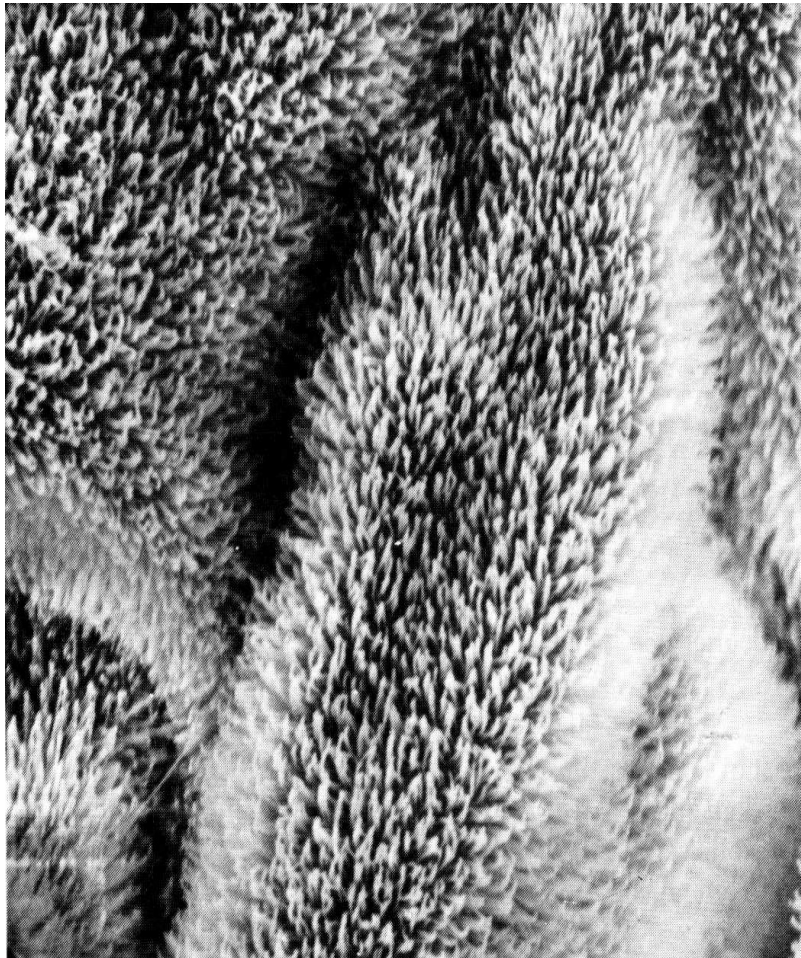
Smyslové orgány na scolexu



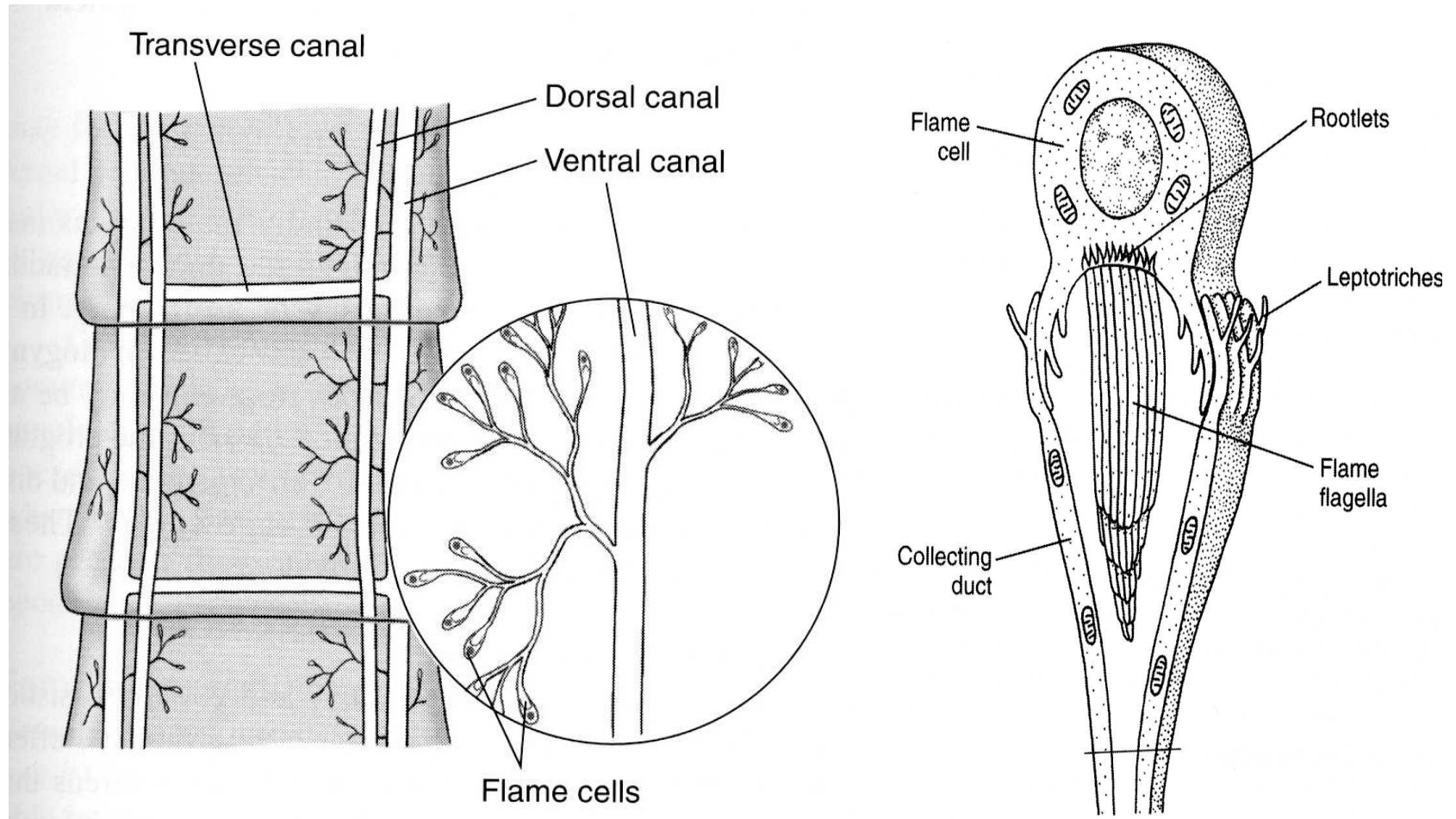
Tegument – povrch těla

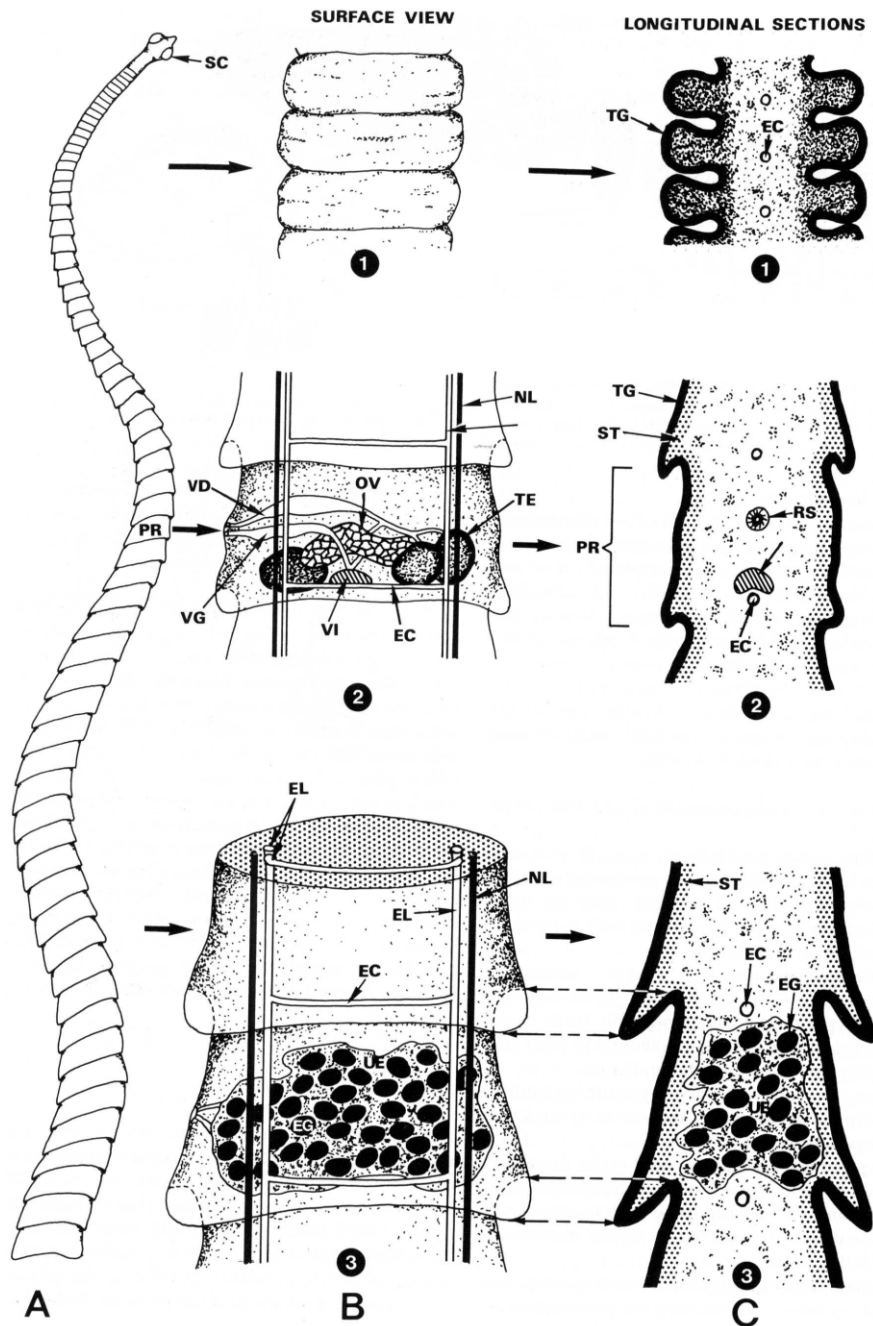


Mikrotrichy

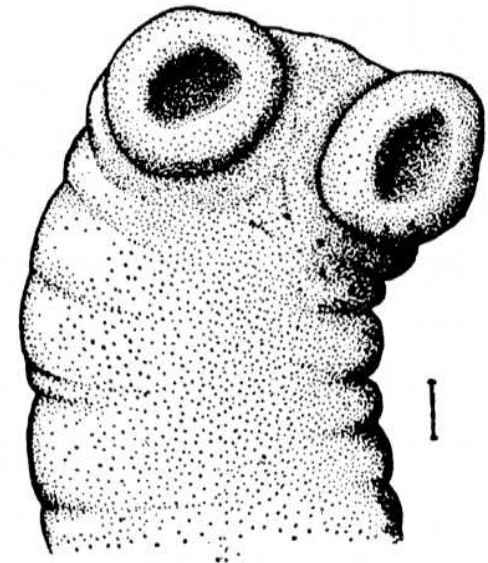


Exkreční soustava tasemnice





Anatomie strobily tasemnice



A
Fig. 3.98

B

C

Tasemnice – pohlavní soustava

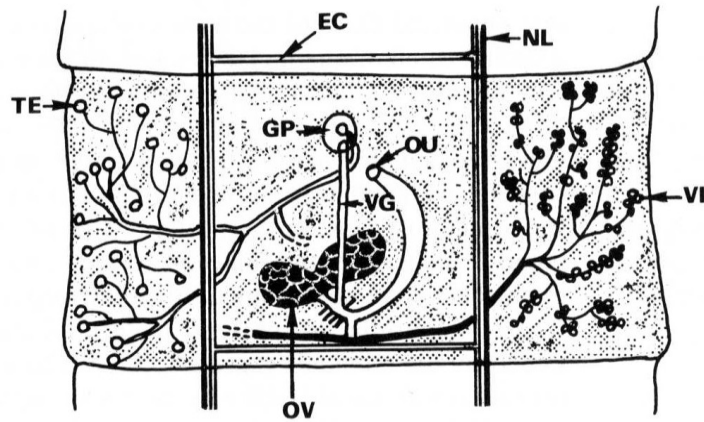
Samčí:

- Varlata – testes
- Vasa efferentia
- Vas deferens
- Vesicula seminalis
- Ductus ejaculatorius
- Cirrus a cirrový váček

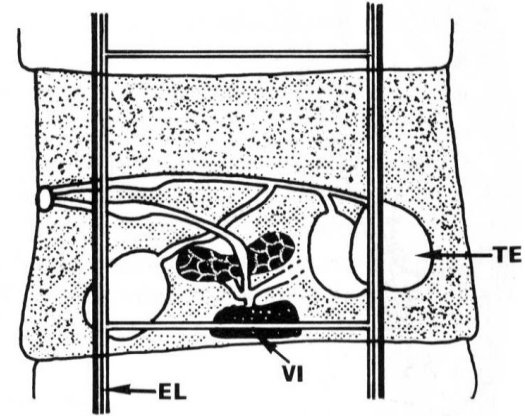
Samičí:

- Vaječník – ovarium
- Vejcovod – ovidukt
- Receptaculum seminis
- Žloutkové trsy – vitelaria
- Ootyp
- Mehlisovy žlázy
- Děloha – uterus
- Vagina

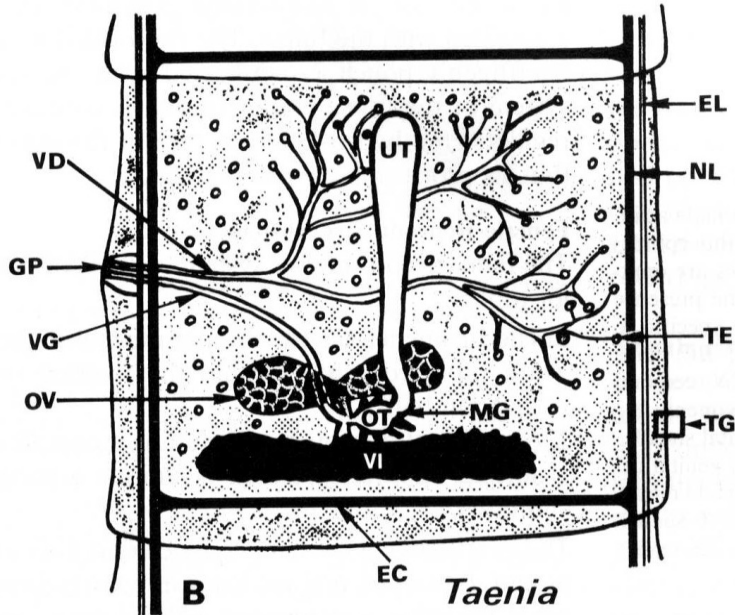
Srovnání stavby článků



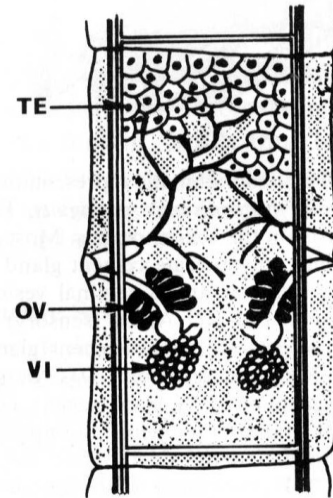
A *Diphylobothrium*



C *Hymenolepis*

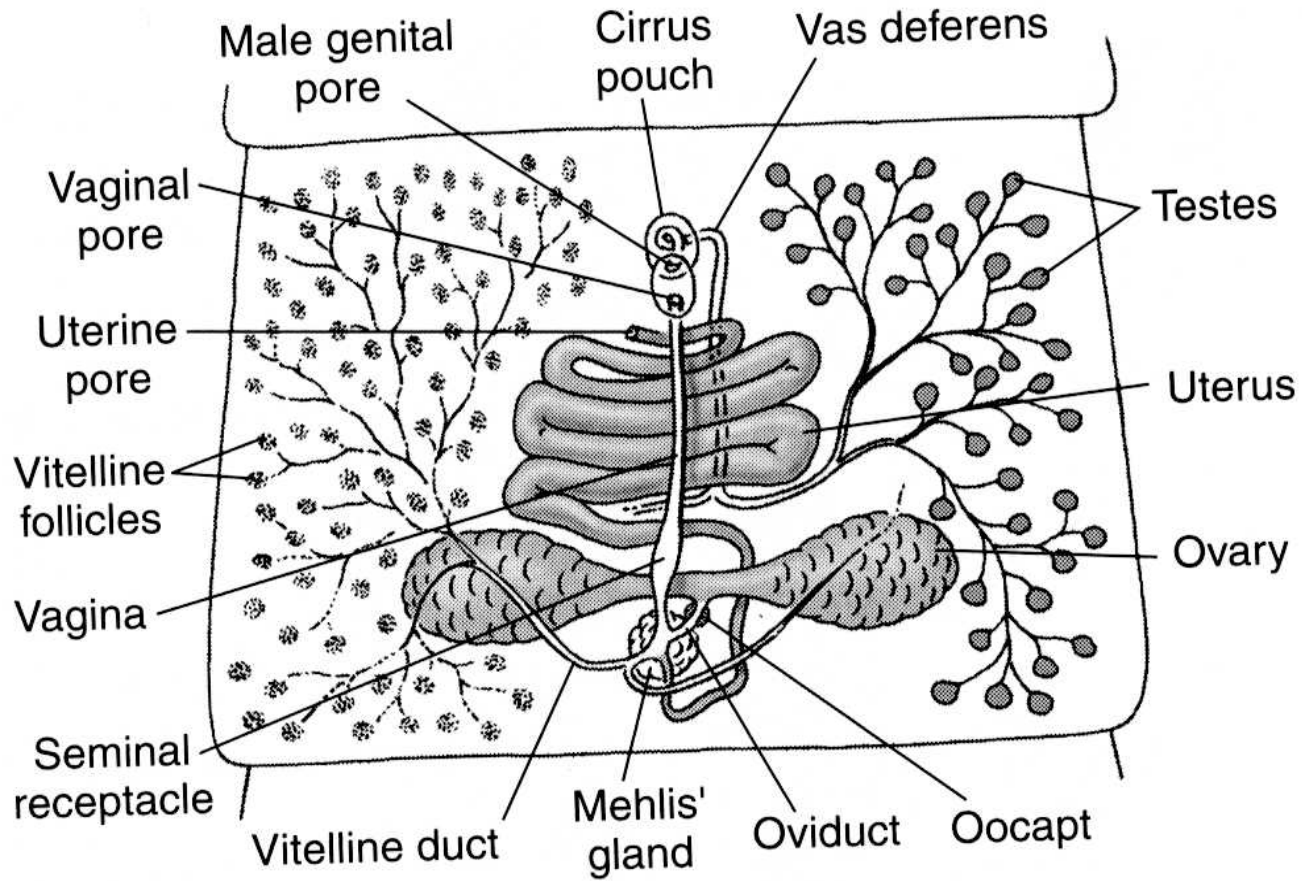


B *Taenia*

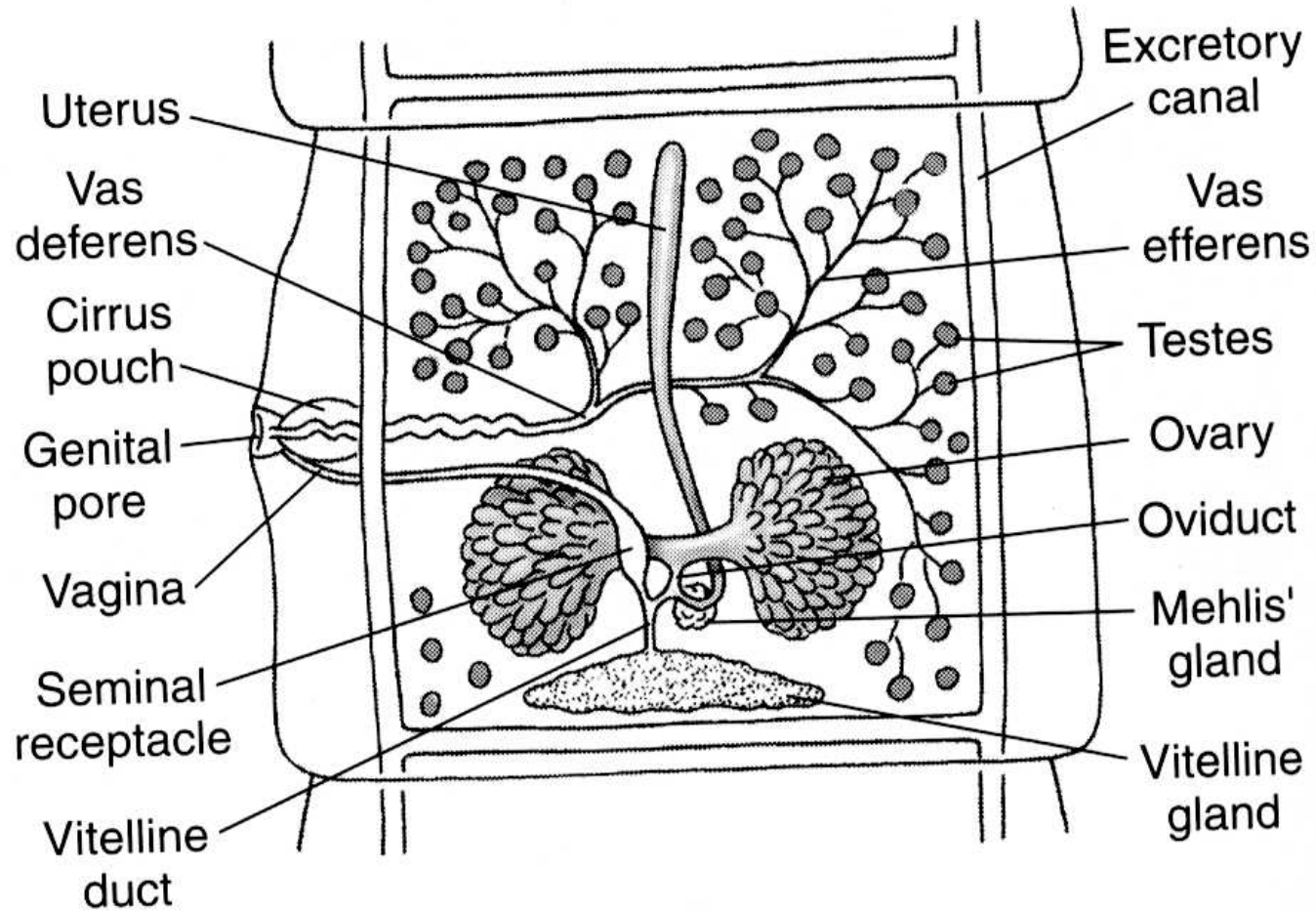


D *Dipylidium*

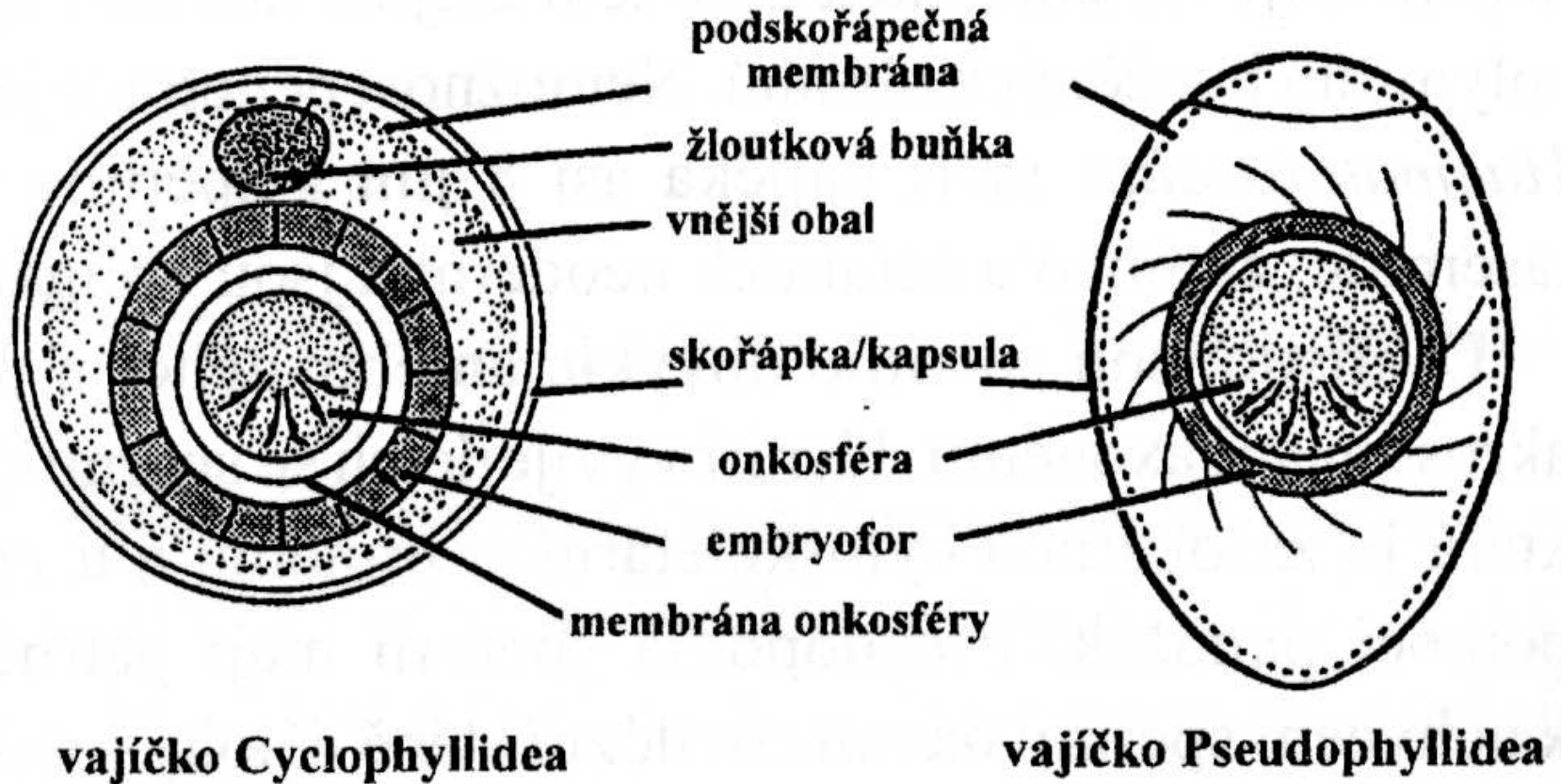
Pohlavní soustava akvatické tasemnice



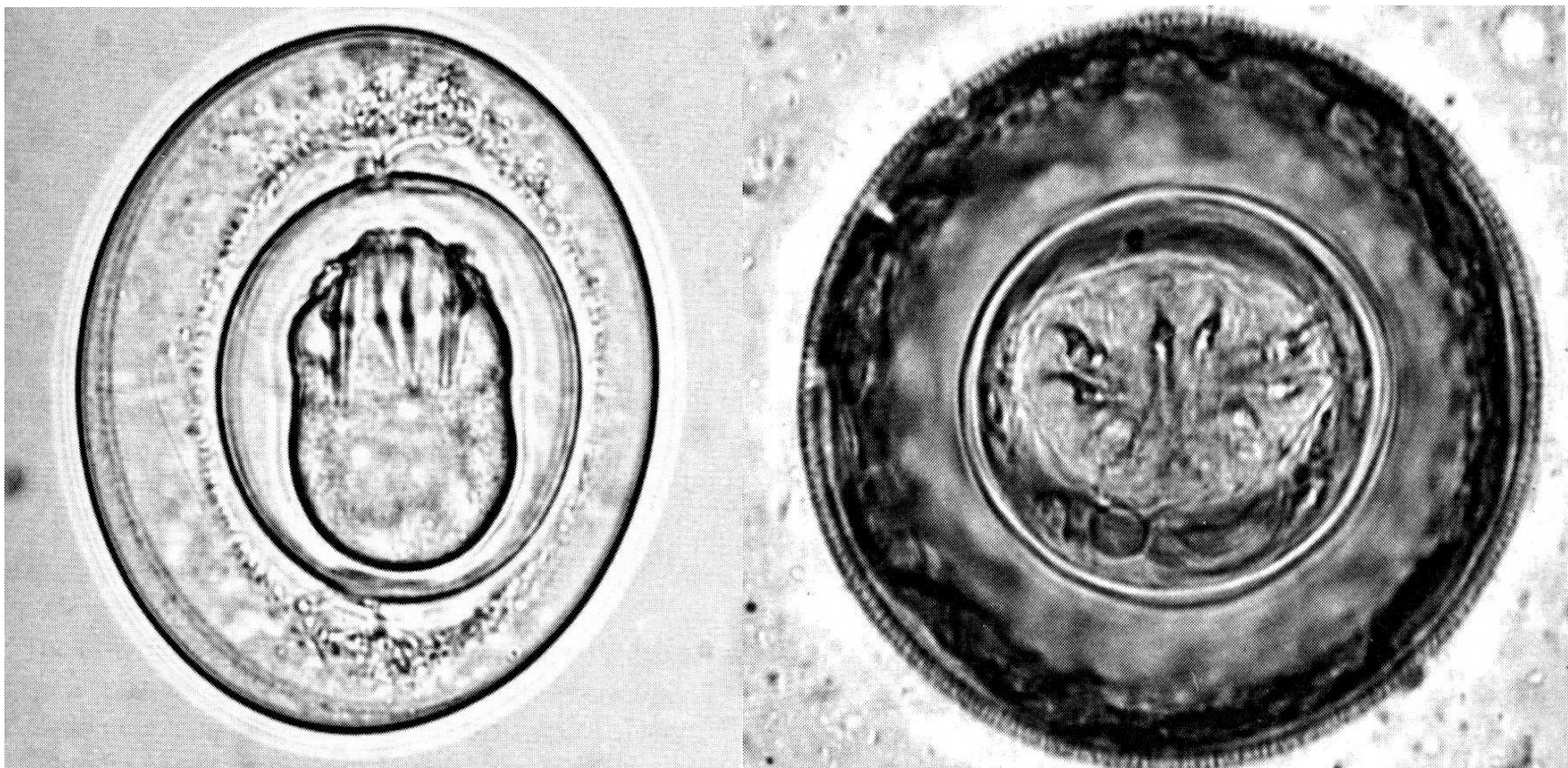
Pohlavní soustava terestrické tasemnice



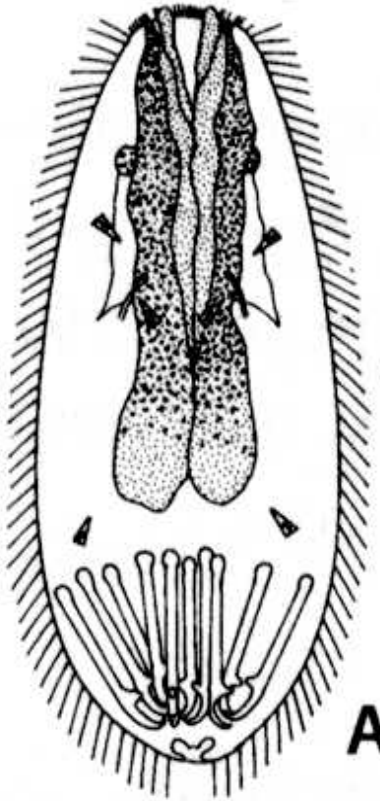
Vajíčka tasemnic



Vajíčka tasemnic



Larvální stádia tasemnic



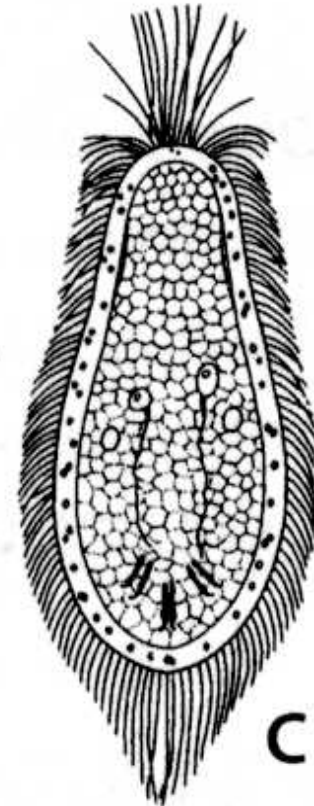
A

lycophora (A)



B

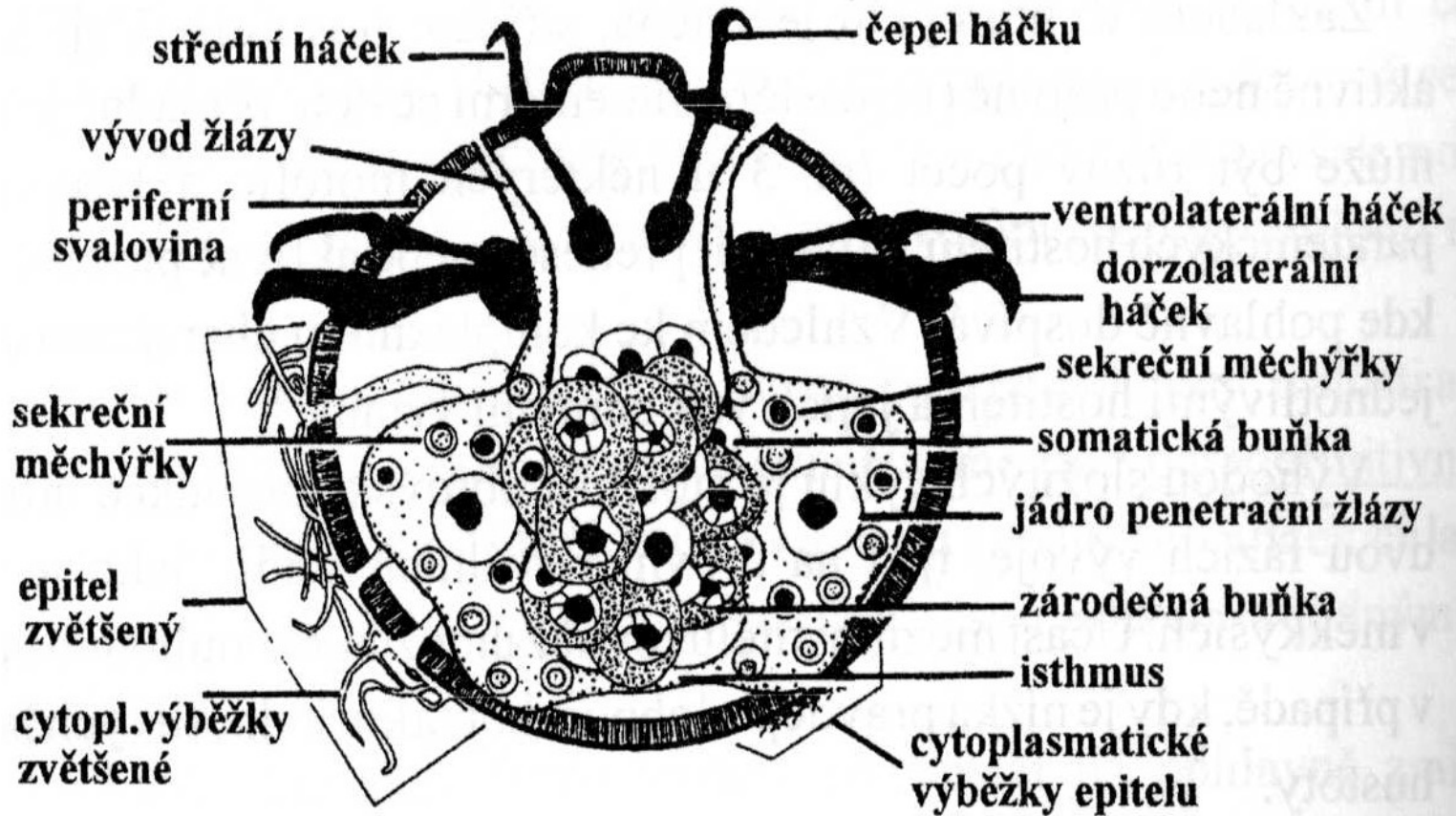
oncosphera (B)



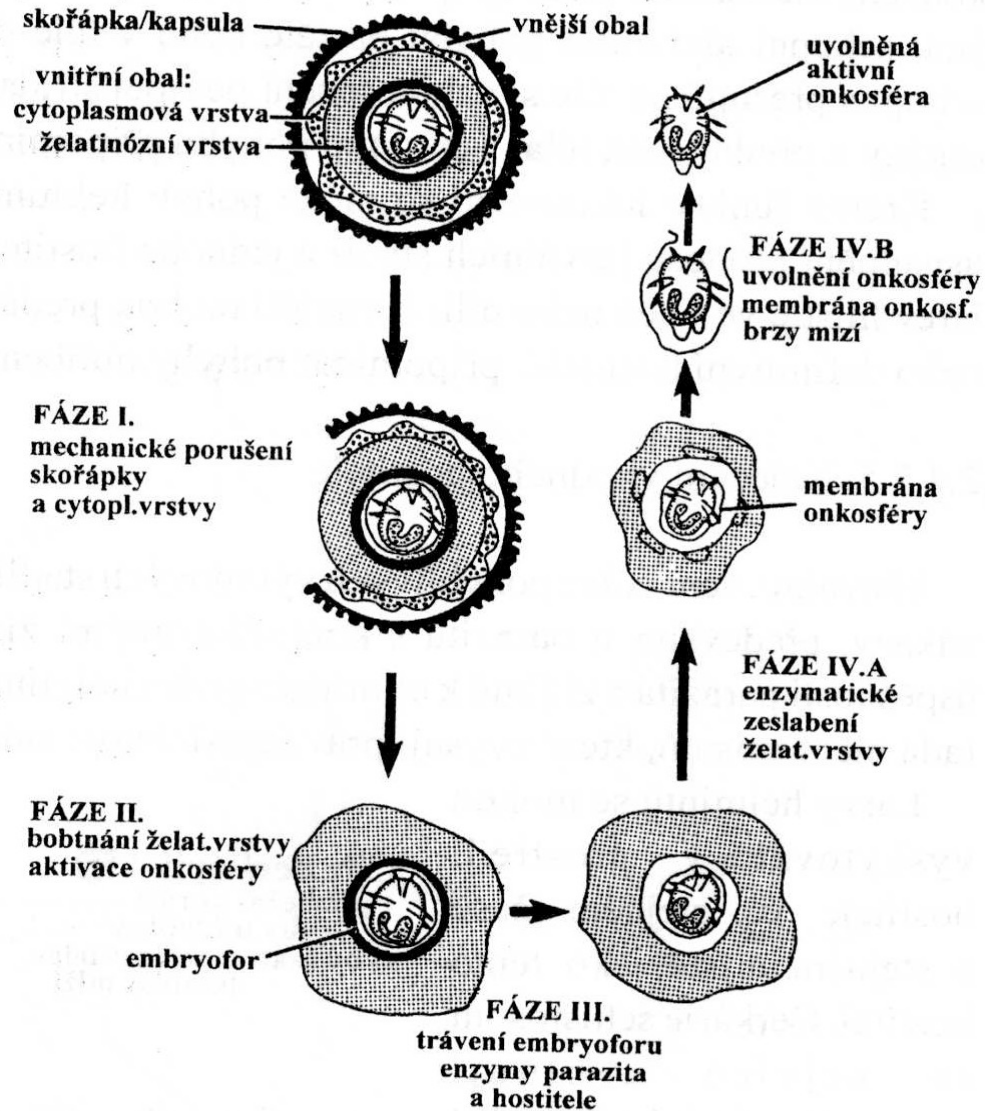
C

coracidium (C)

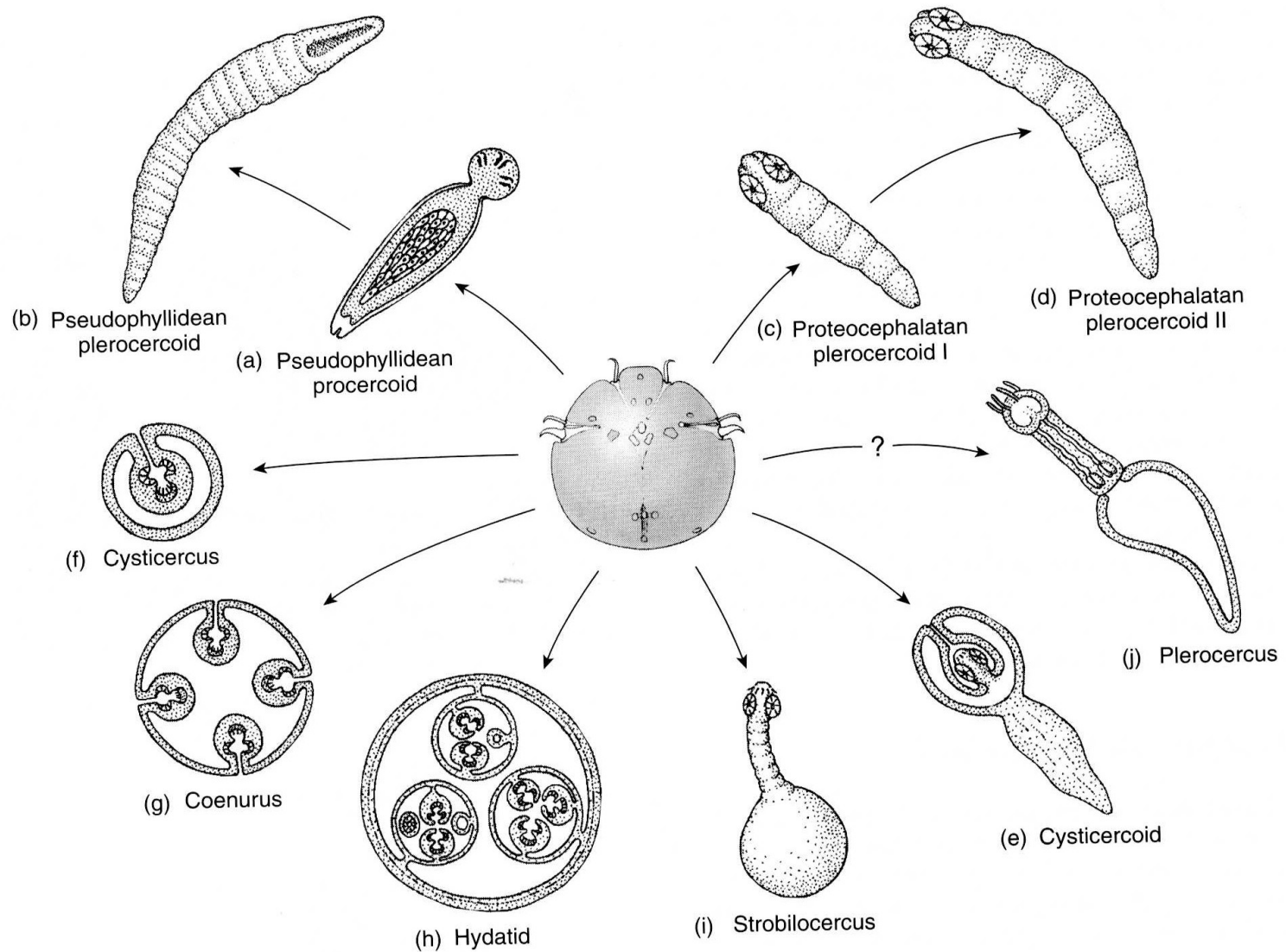
Anatomie onkosféry



Stádia líhnutí onkosféry



Základní typy metacestodů

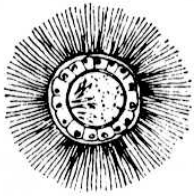


Larvální stádia – akvatický cyklus

PSEUDOPHYLLIDEA



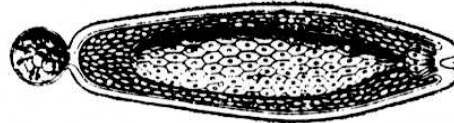
EGG



CORACIDIUM



ONCOSPHERE

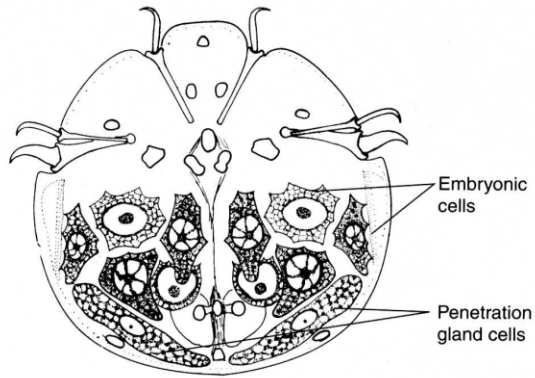


PROCERCOID LARVA

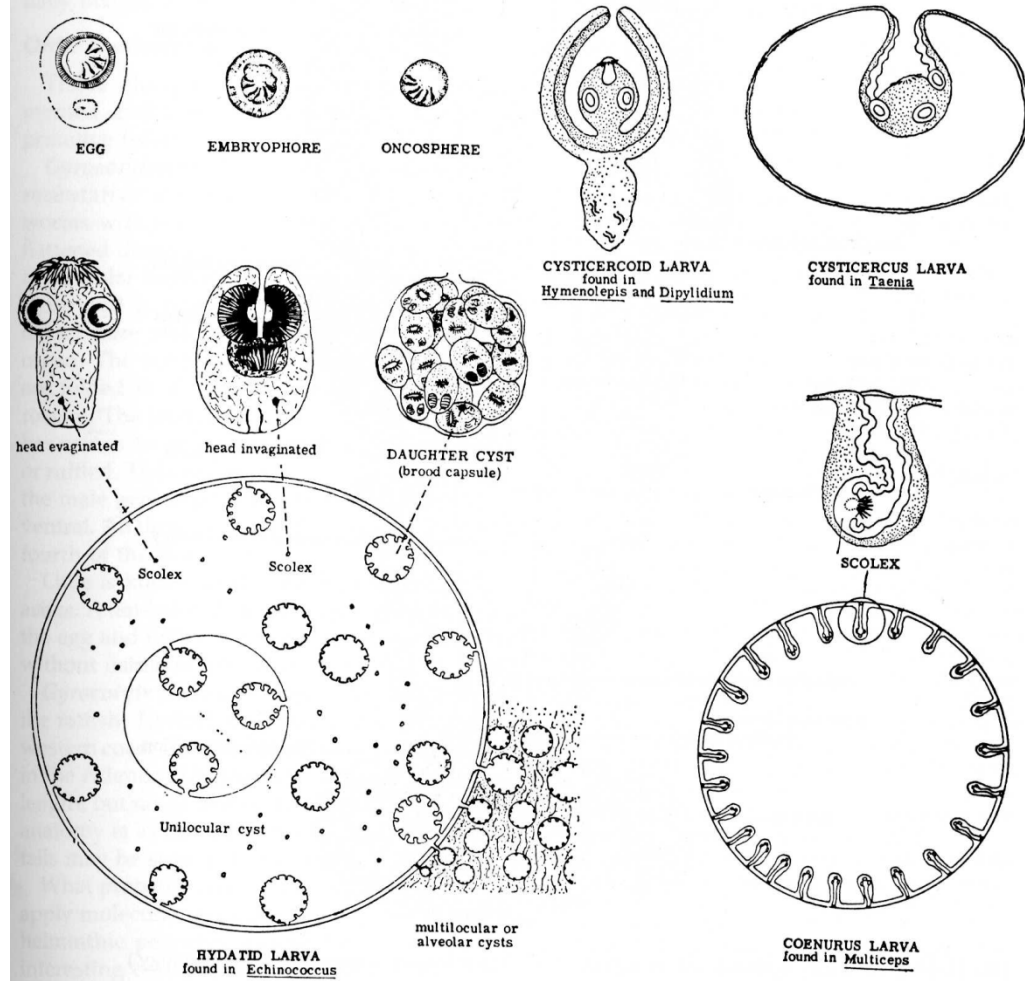


PLEROCERCOID OR
SPARGANUM LARVA

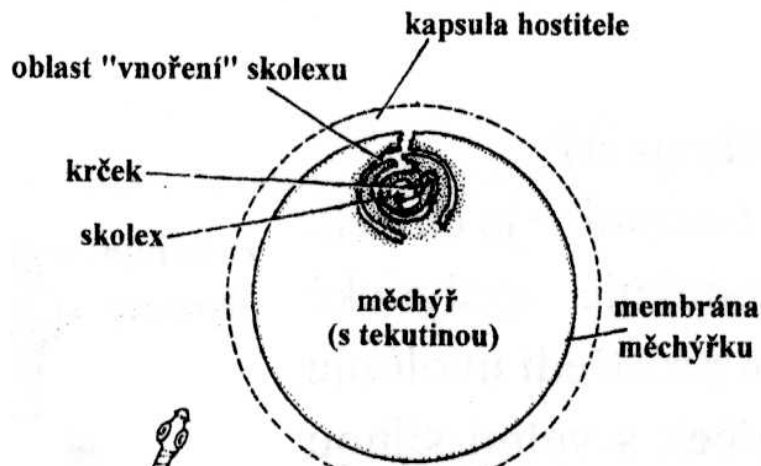
Larvální stadia – terestrický cyklus



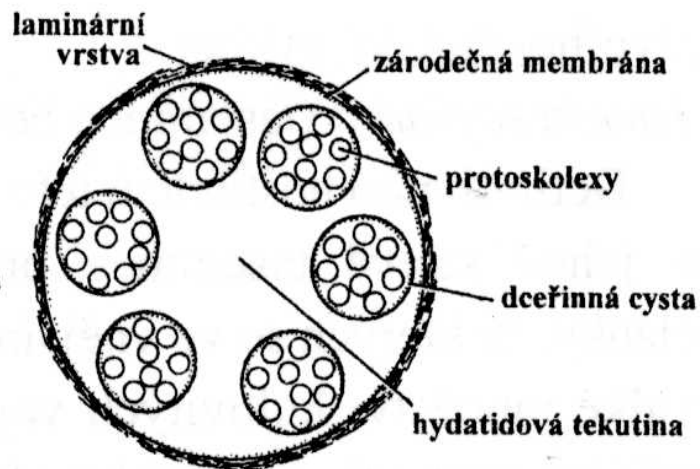
CYCLOPHYLLIDEA



Cystická larvální stádia



CYSTICERKUS (T. solium)



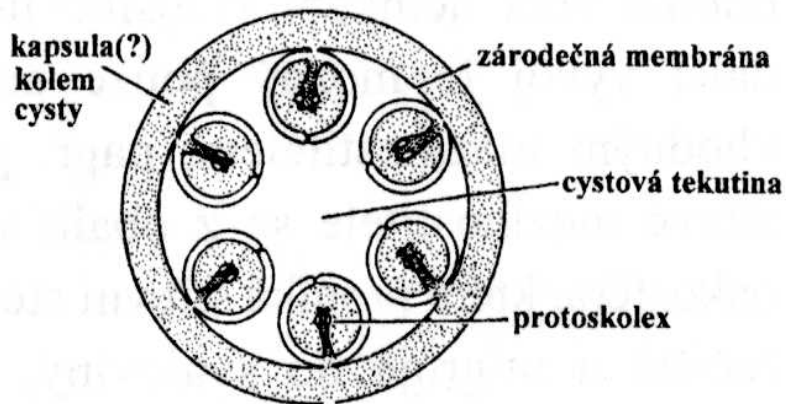
HYDATIDA (E. granulosus)



STROBILOCERKUS (T. taeniaeformis)



CYSTICERKOID (H. nana)



COENURUS (T. serialis)

Typy vývojových cyklů

- **Jednohostitelský** – monoxenní – *Archigetes sieboldi*
- **Dvojhostitelské** - dixenní – *Taenia saginata*
- **Trojhostitelské** – trixenní – *Hymenolepis nana*
- **Čtyřhostitelské** – tetraxenní –
Diphyllobothrium latum

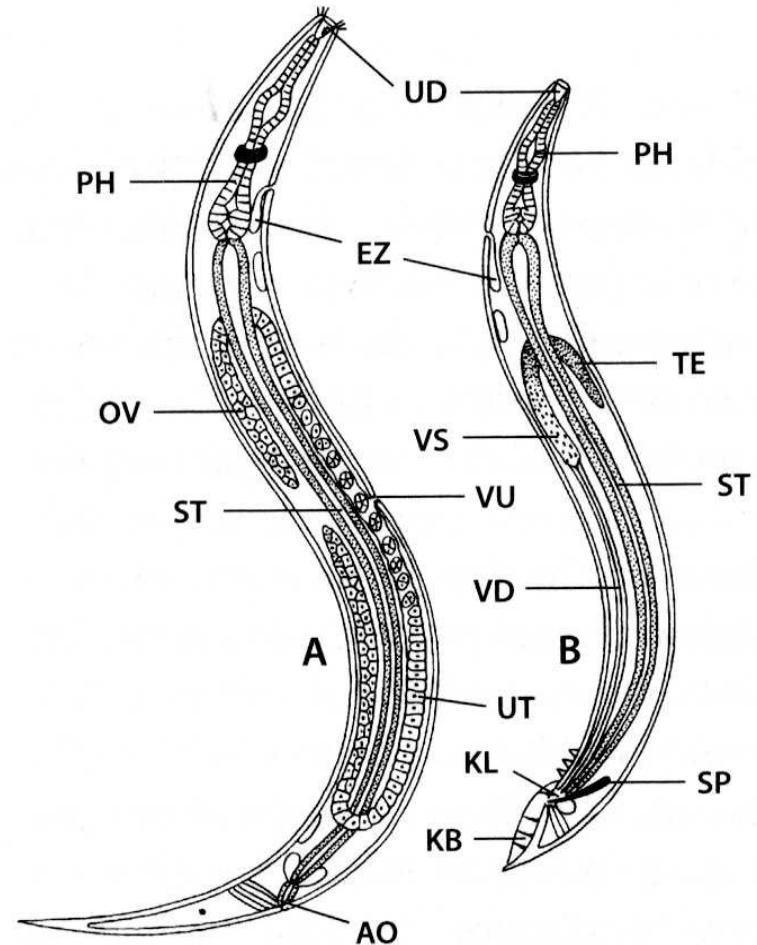
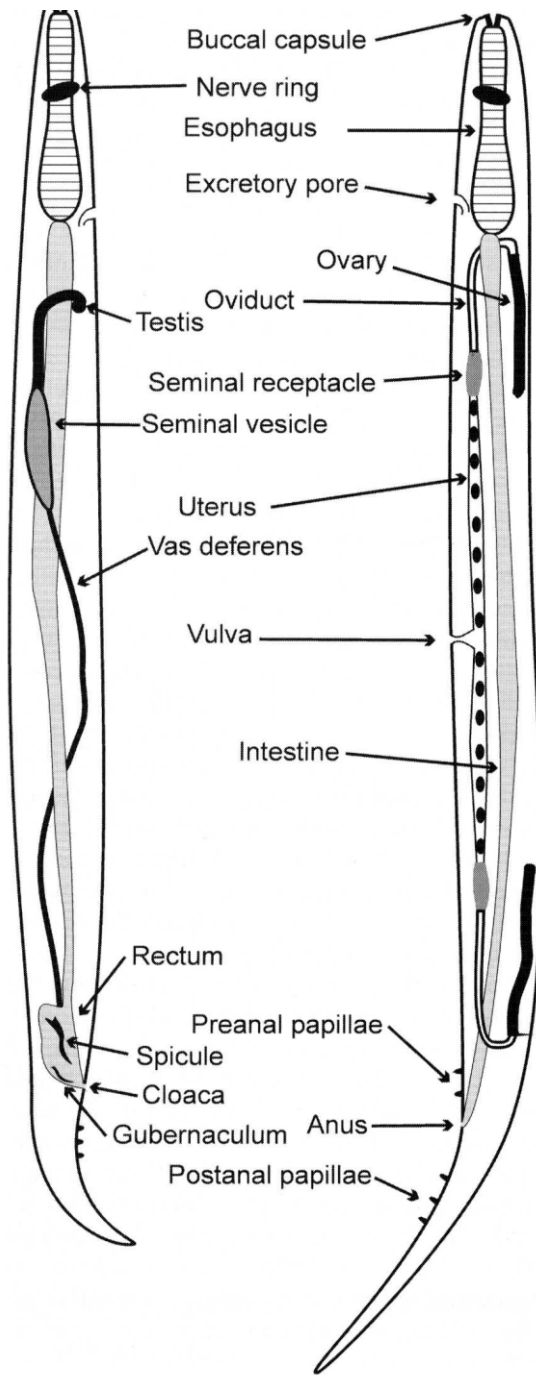


HLÍSTICE

Nematoda - charakteristika

- Velmi rozmanitá skupina
- Cizopasnící x volně žijící (půda, voda)
- Paraziti – živočichové (bezobratlí), rostliny
- Adaptace k parazitismu
- Význam – původci onemocnění člověka zvířat

Nematoda základní morfologie

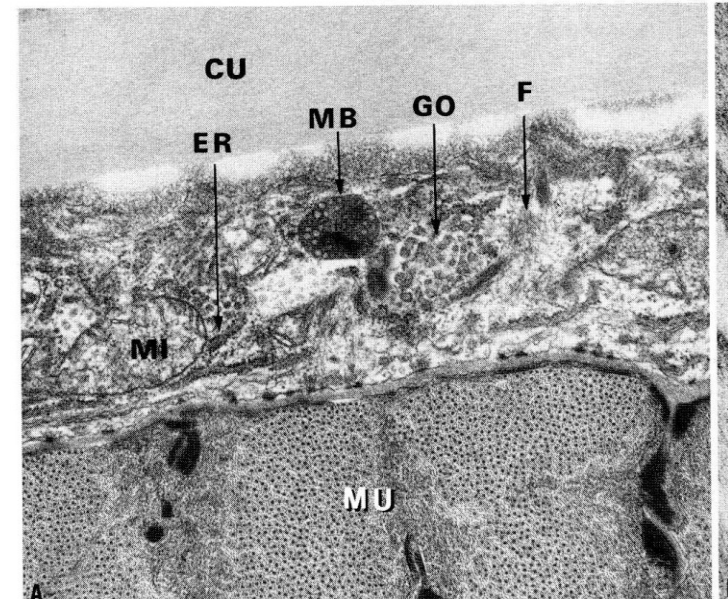
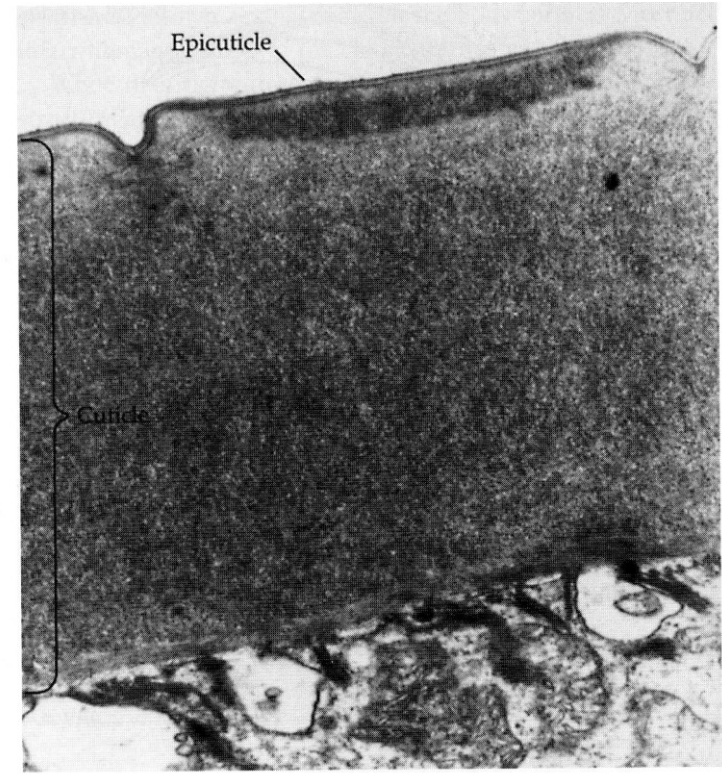
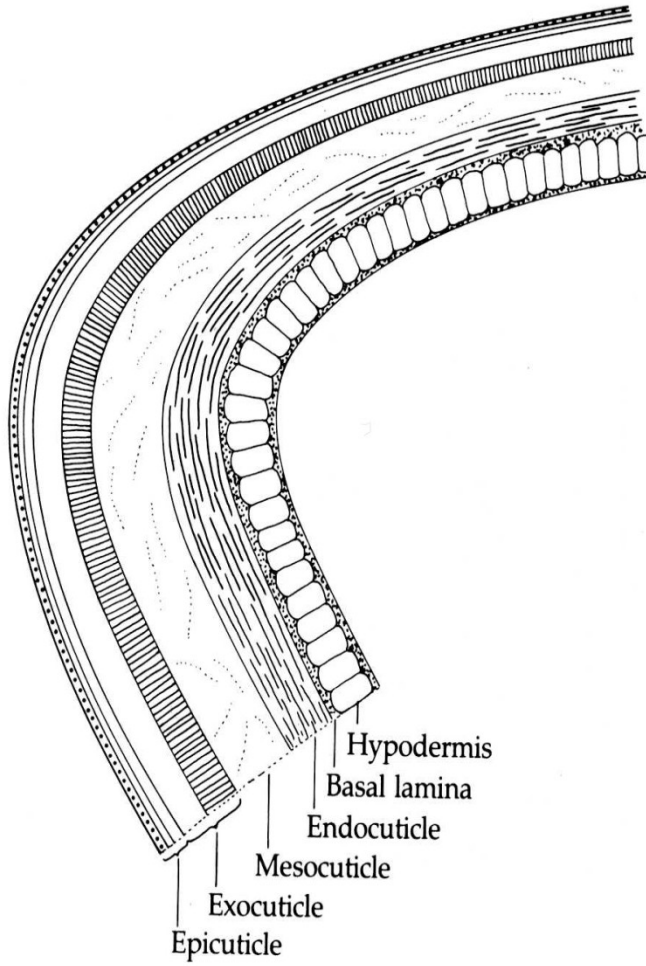


Obr. 3-53 Nematoda. Základní anatomie

Nematoda – morfologie I

- Protáhlé až niťovité tělo
- Nesegmentované
- Velikost – až 8 m (*Placentonema gigantissima*)
- Povrch těla – **kutikula** - mnohovrstevný útvar – exoskelet
- **Hypodermis** – pod kutikulou
- Podpovrchová **svalovina** – tři typy uspořádání:
 - 1) **polymyární** – *Ascaris* – mnoho výběžků v každém kvadrantu
 - 2) **meromyární** – *Oxyuris* – malý počet svalových buněk v kvadrantu - max 2
 - 3) **holomyární** – *Trichuris* – velký počet svalových buněk – tvoří jednolitou vrstvu

Kutikula



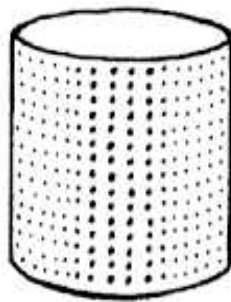
Hypodermis

Typy kutikulárních útvarů

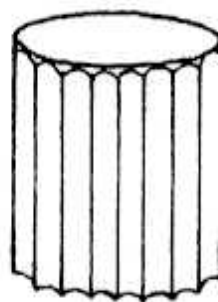


D

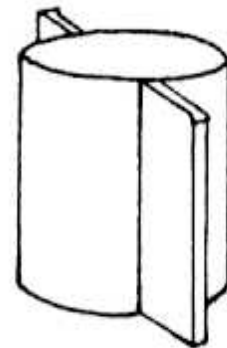
1



2

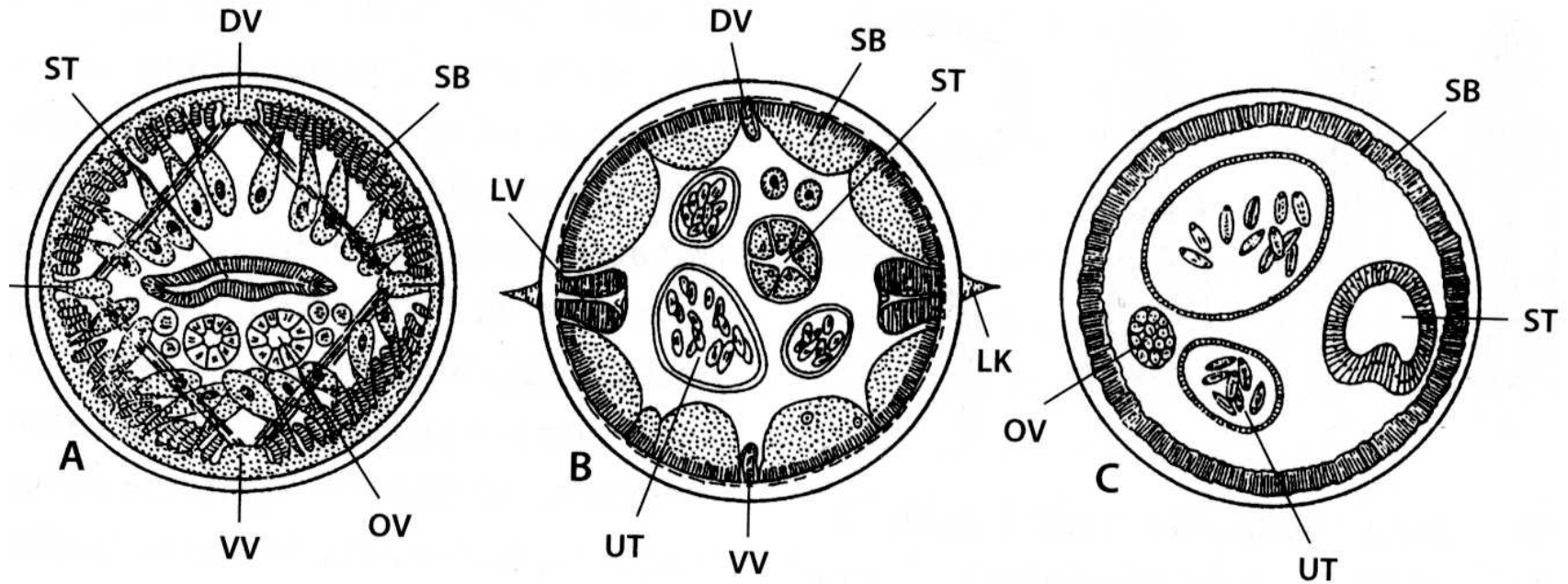


4



5

Organizace svaloviny



Polymyární

Meromyární

Holomyární

Nematoda – morfologie II

- **Nervová soustava** – 2 páry nervových vláken, spojky, jícnový prstenec
- Nervová zakončení:
 - amfidy** – na ústních papilách
 - dereidy** – po stranách hlavového konce
 - fazmidy** – senzorické žlázy ústící pórem (Aphasmida, Phasmida)
 - smyslové **papily** a **sety**

Nervová soustava

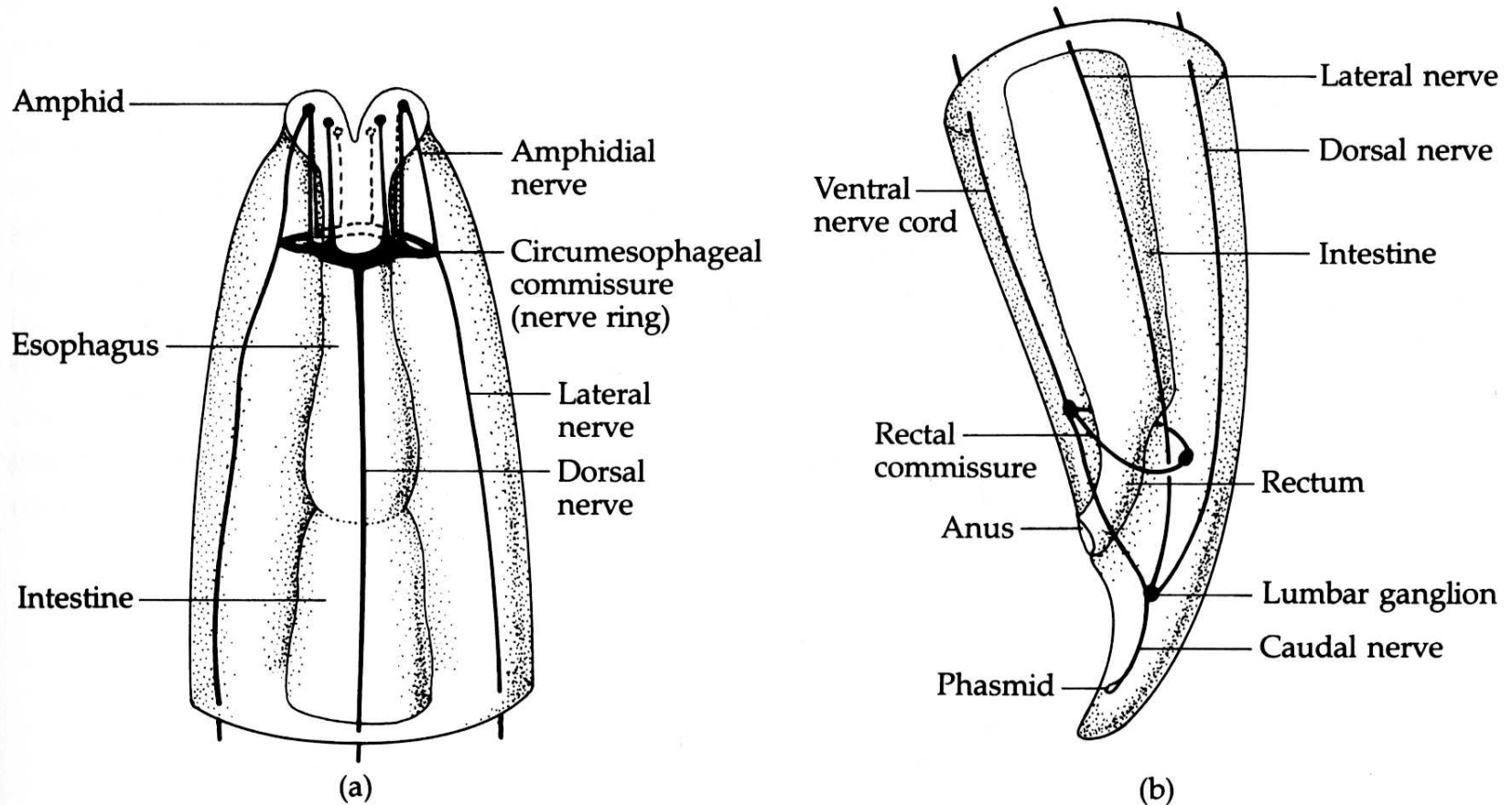
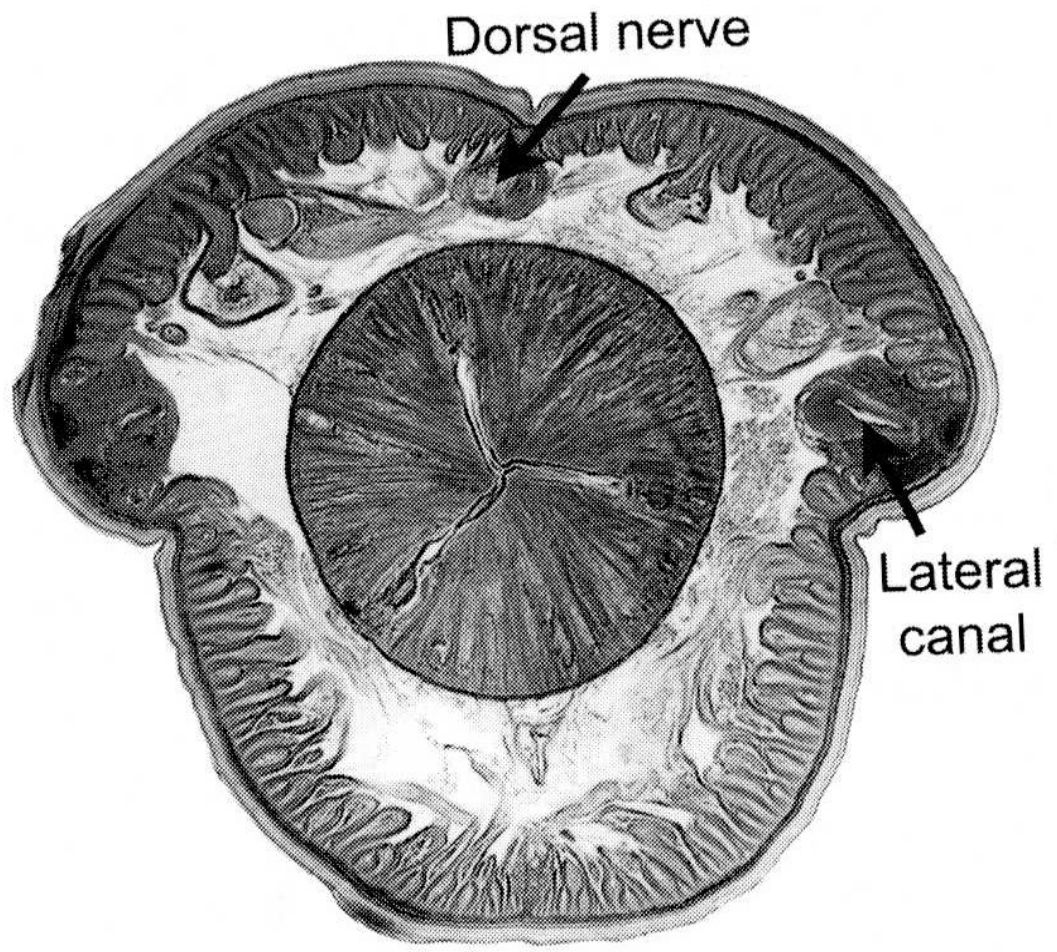
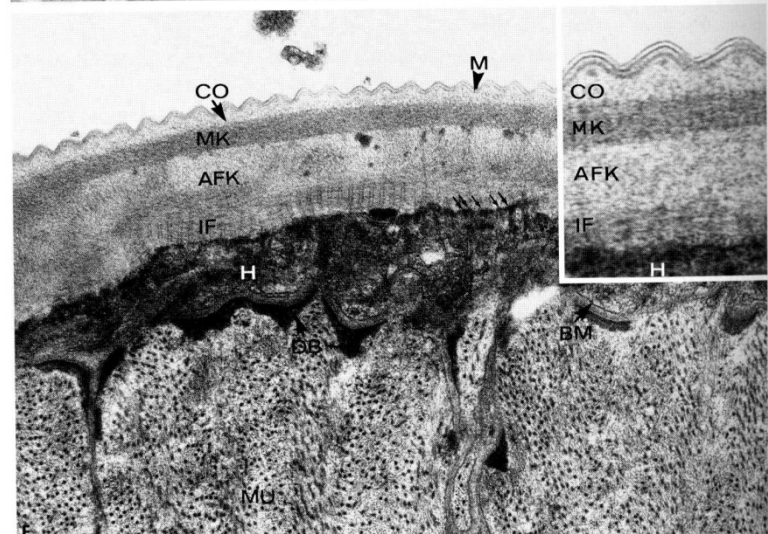
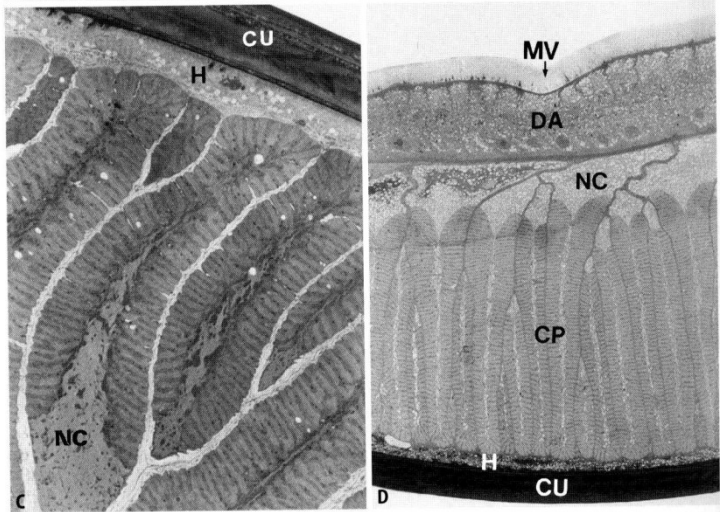
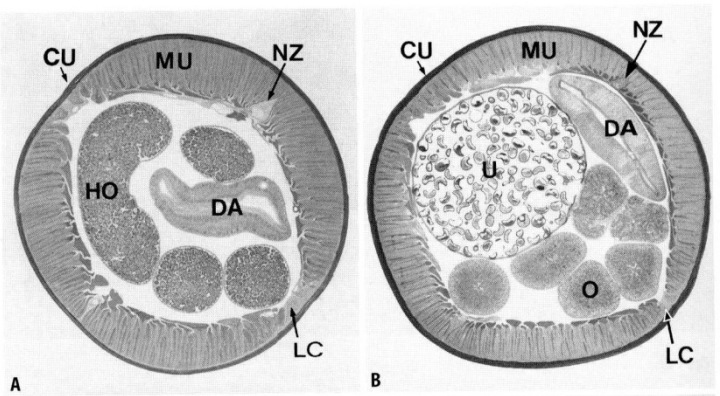


FIGURE 15-8

Nematode nervous system.

(a) Anterior end. (b) Posterior end.

Příčný řez tělem



Propojení SS s nervovou soustavou

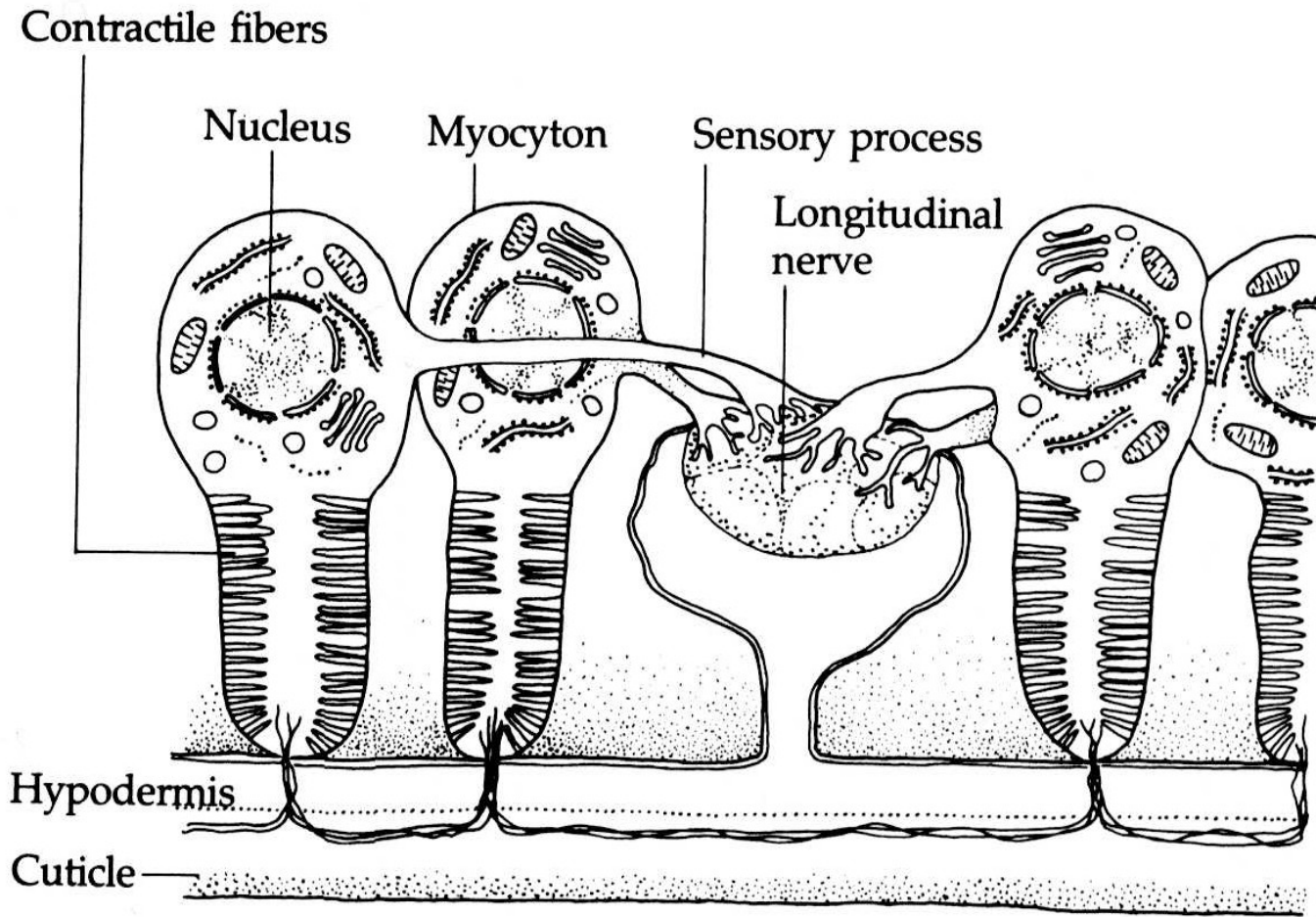
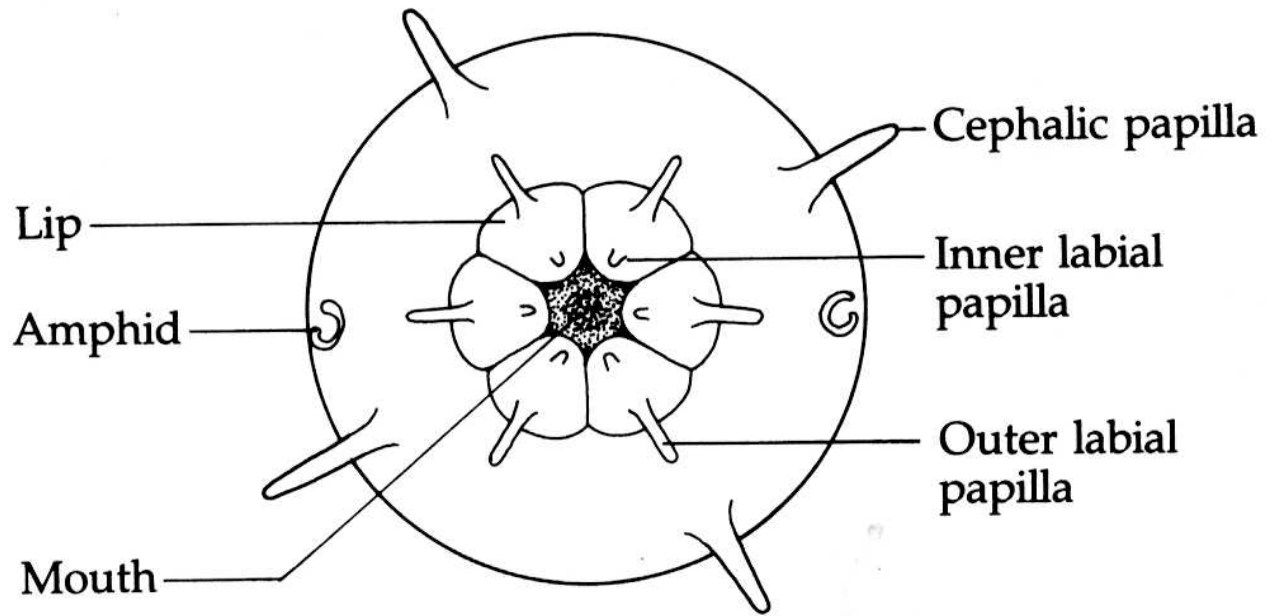


FIGURE 15-6
Arms of four myocytes forming junctions with a nerve.

Smyslové orgány hlístic

FIGURE 15-9
Labial and cephalic papillae.

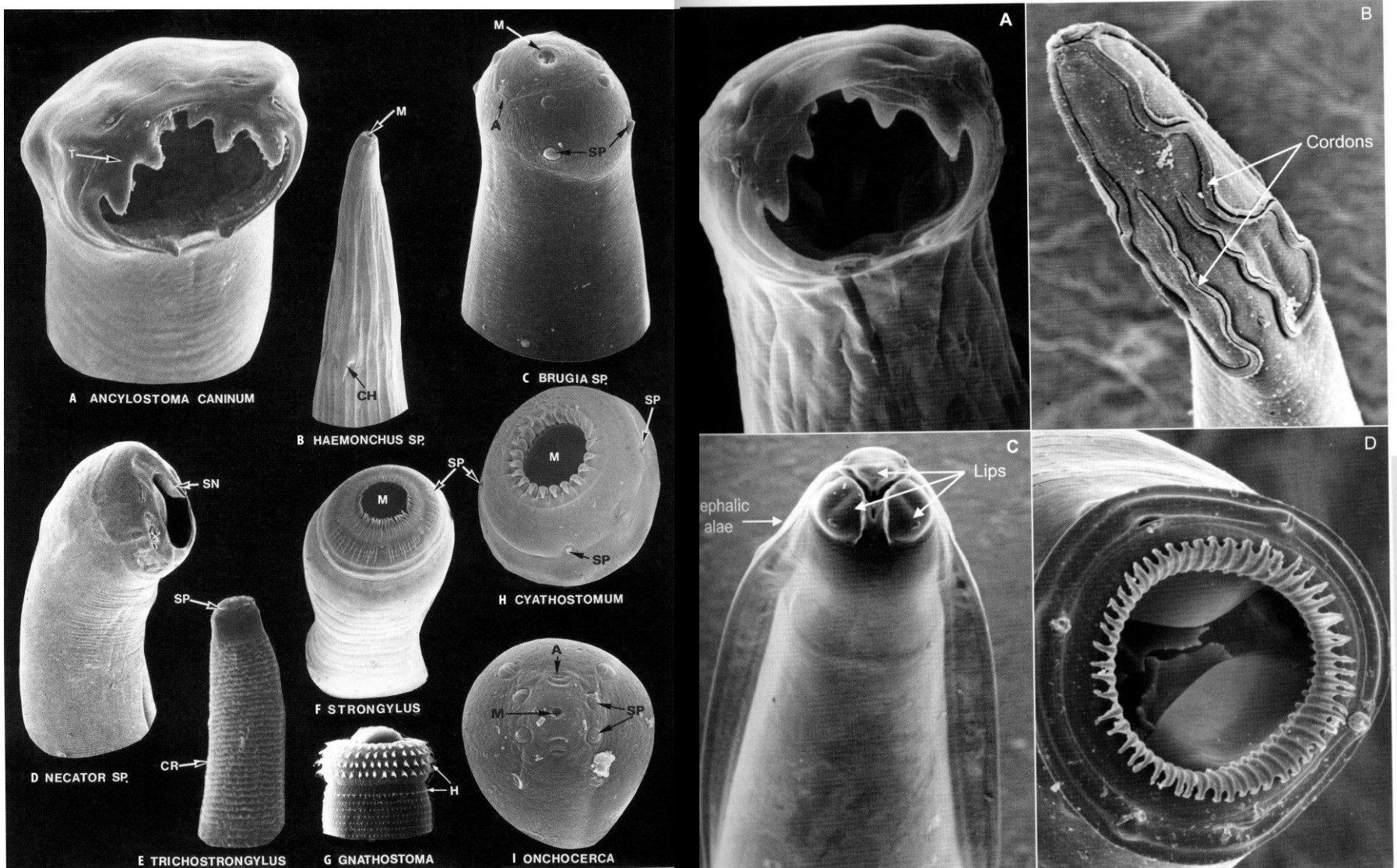
En face view of nematode showing relationship of mouth, lips, amphids, and papillae.



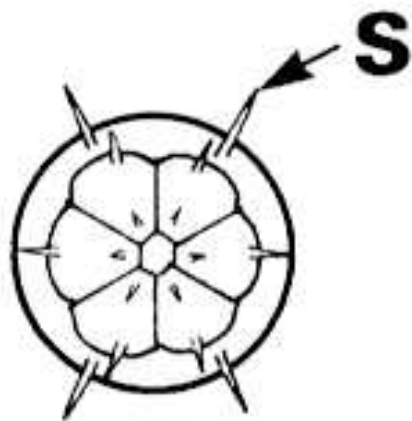
Nematoda – morfologie III

- **Trávicí soustava** – dobře vyvinutá
 - **Ústní otvor** - na předním konci těla
 - **Ústní aparát** – ústní kapsula, papily, pysky, trny, zuby nebo sklerity
 - **Jícen** (oesophagus) žlaznatý a svalnatý – typy: dorylamoidní, oxyuroidní, rhabditoidní – bulbus – změna během ontogeneze
 - Trubicovité **střevo** – **anální otvor**
- **Vylučovací soustava** – **exkreční buňky** (renety) – **exkreční kanálky** (chordy) – **exkreční sinus** ústící na povrch – morfologické typy – „U“ „H“

Typy předního konce těla hlístic



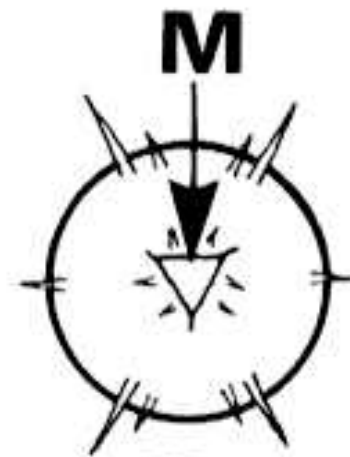
Organizace ústního otvoru



6 pysků

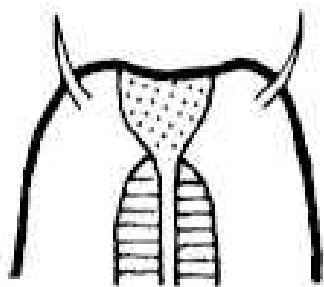


3 pysky

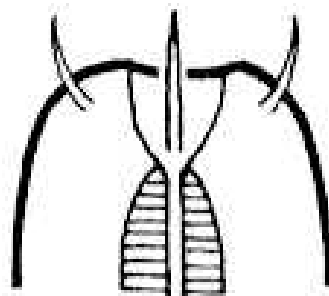


Bez pysků

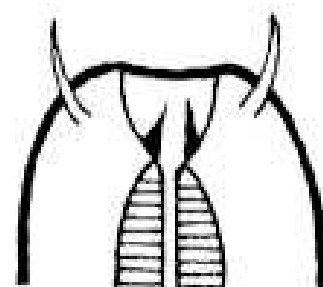
Organizace ústní dutiny



Neozbrojený

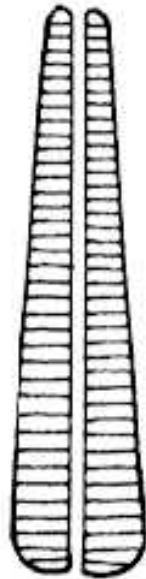


Stylet

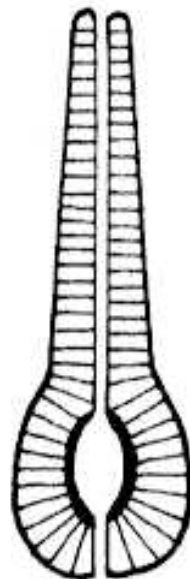


Zuby

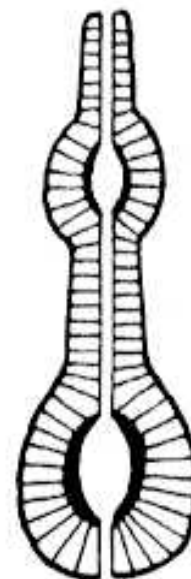
Morfotypy svalnatého jícnu



Nedělený

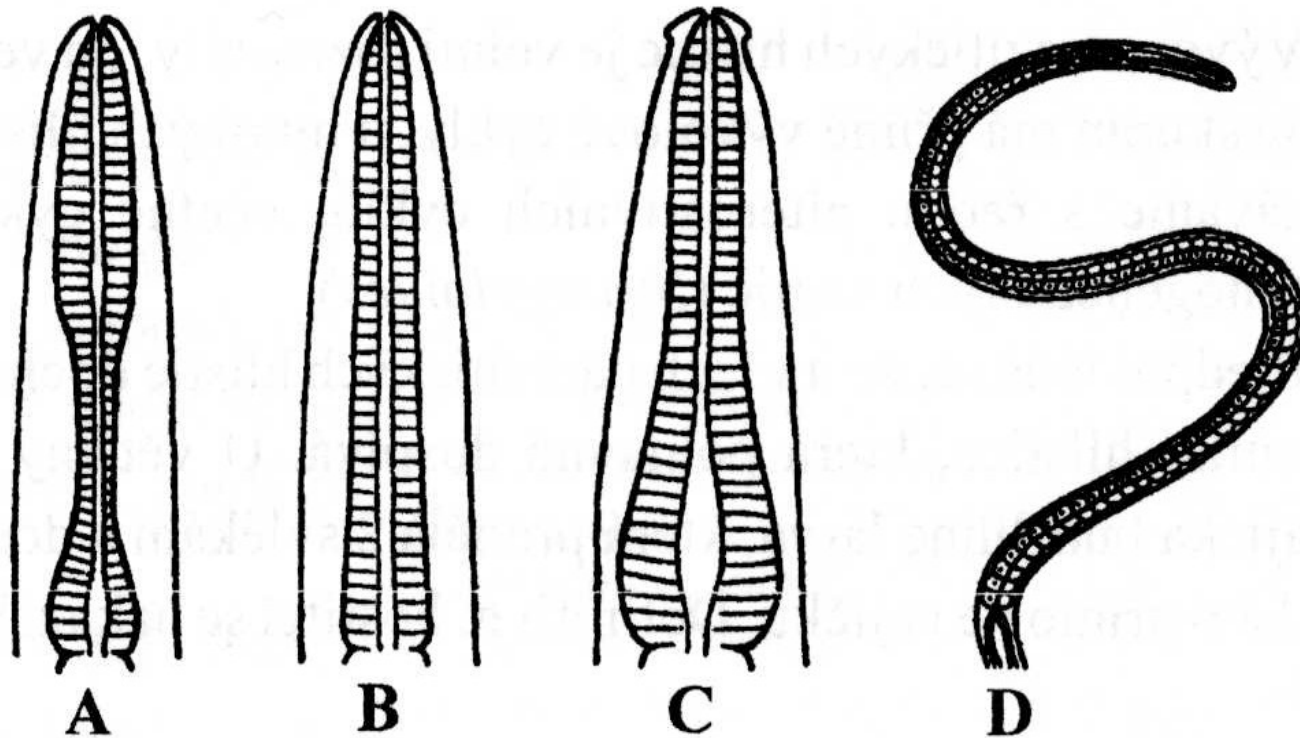


Bulbus



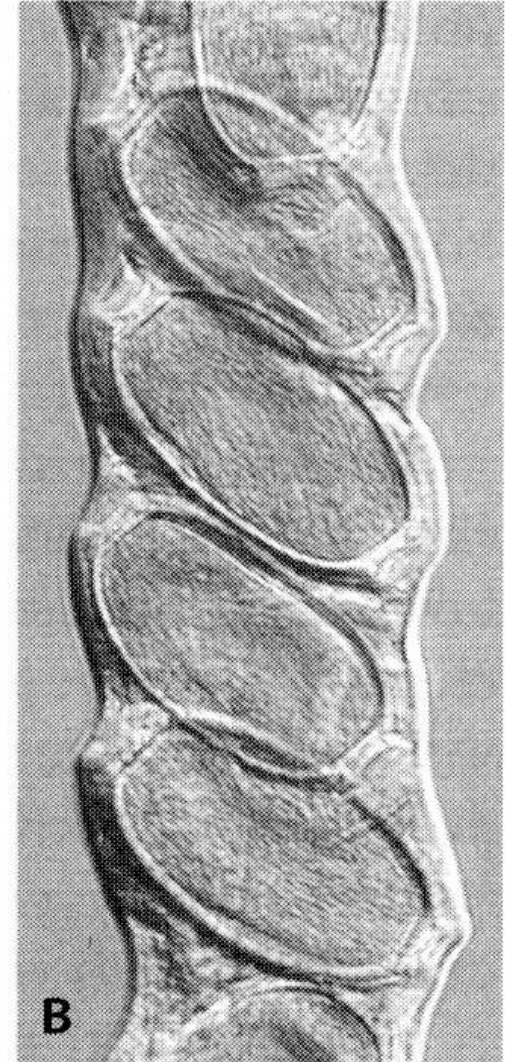
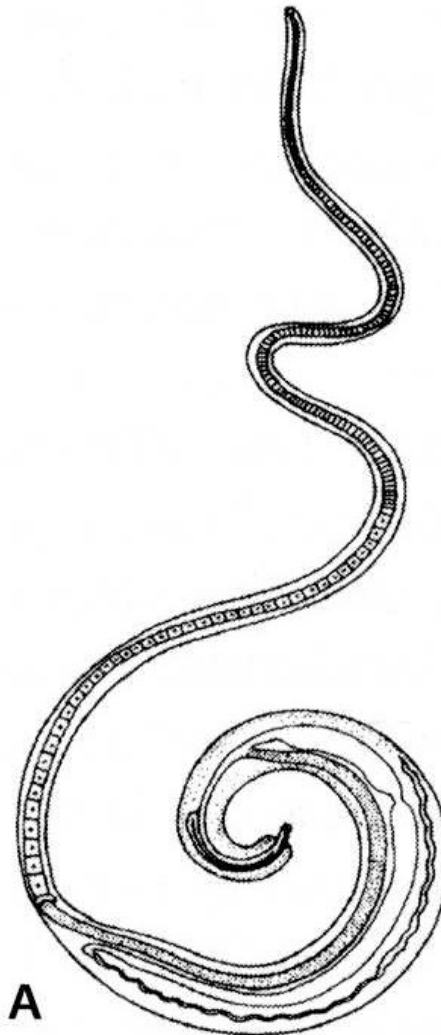
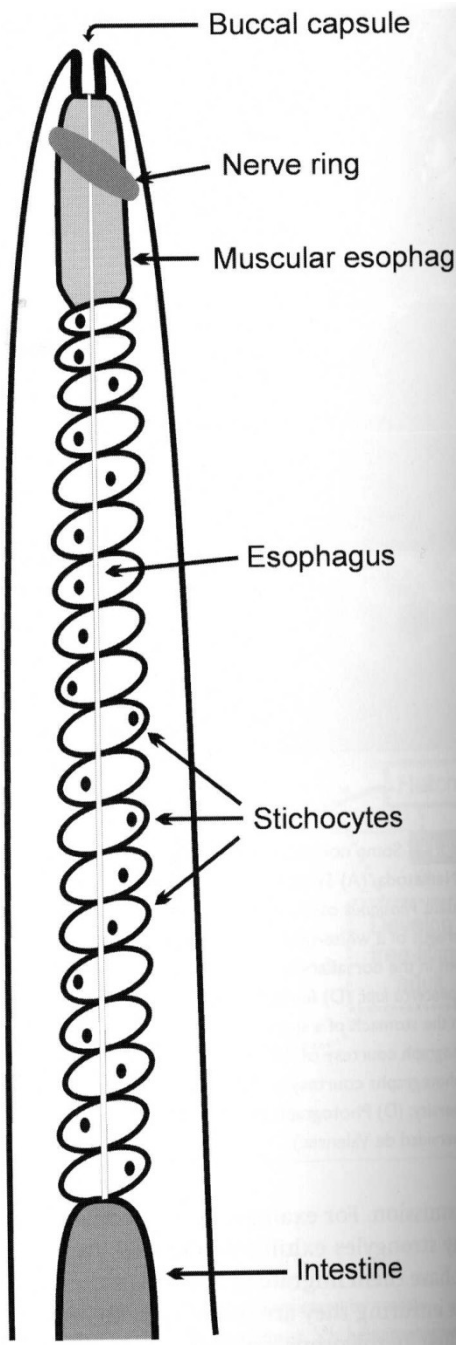
2 Bulby

Terminologie morfotypů jícnu



Obr. 68. Základní typy jícnu hlístic (Hiepe 1985, upraveno)
A-rhabditoidní (rhabditiformní); B-strongyloidní (filariformní);
C-oxyuroidní; D-trichuroidní.

Jícen se stichocyty



Systematický význam tvaru jícnu

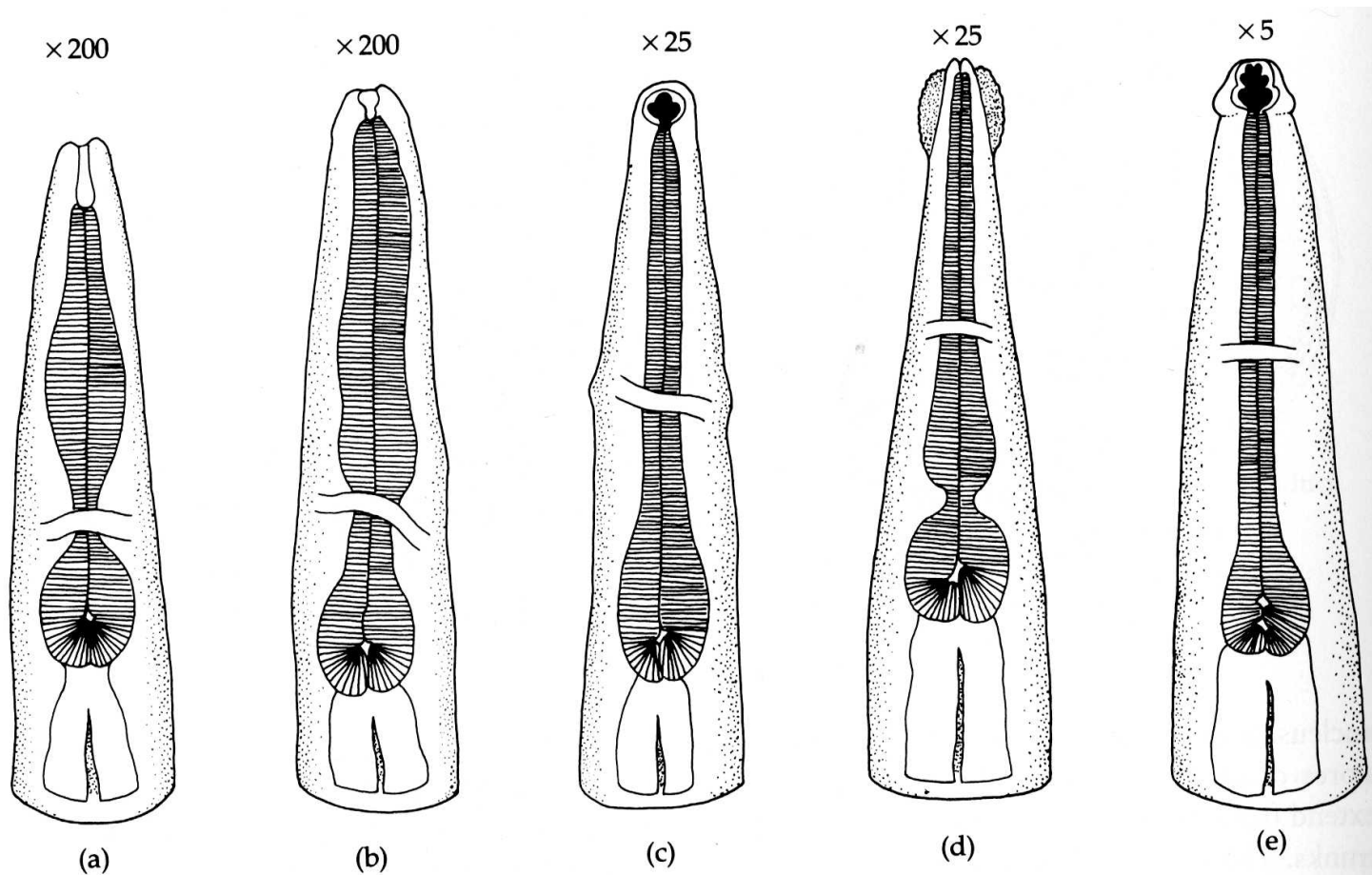


FIGURE 15-7

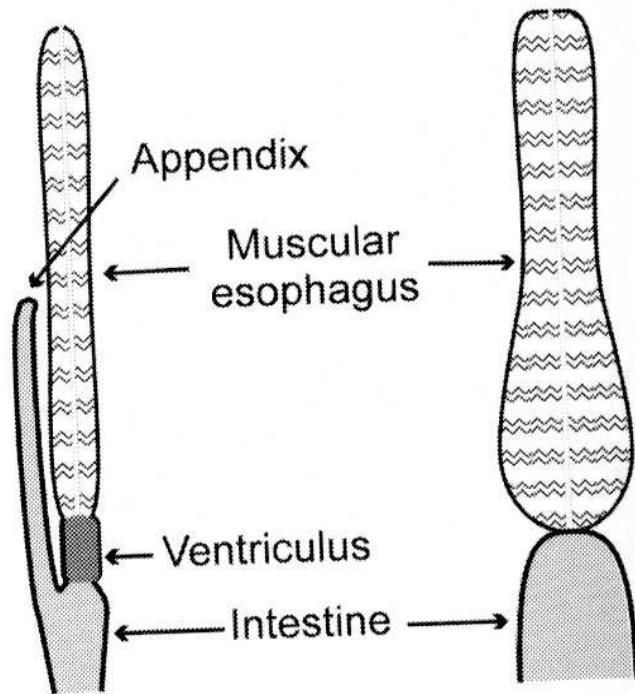
Variations in foregut of some nematodes.

(a) *Rhabditis hominus*. (b) *Strongyloides stercoralis*. (c) *Ancylostoma duodenale*. (d) *Enterobius vermicularis*. (e) *Ascaris lumbricoides*.

Typy napojení jícnu na střevo

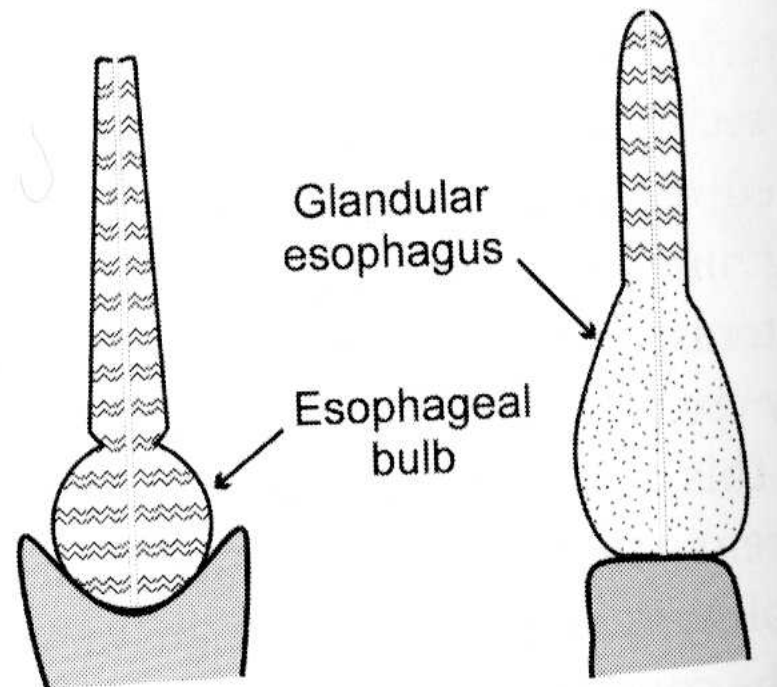
Ascaridida

Strongylida



Oxyurida

Spirurida



Napojení jícnu na střevo

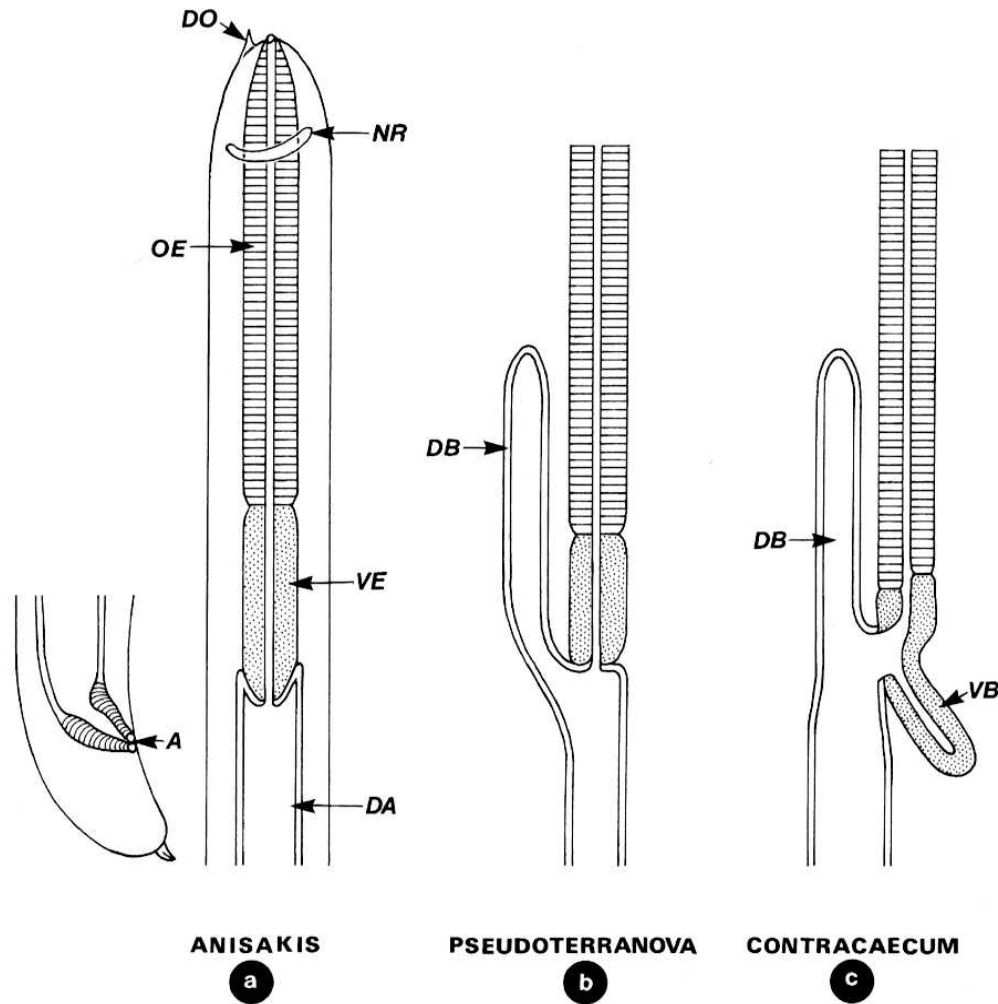


Fig. 2. Schematic representation of diagnostically useful intestinal features of human pathogenic marine ascarids (a-c). A, anus; DA, intestine; DB, intestinal enlargement; DO, thorn; NR, nerve ring; OE, esophagus; VB, enlarge-

Vylučovací soustava hlístic

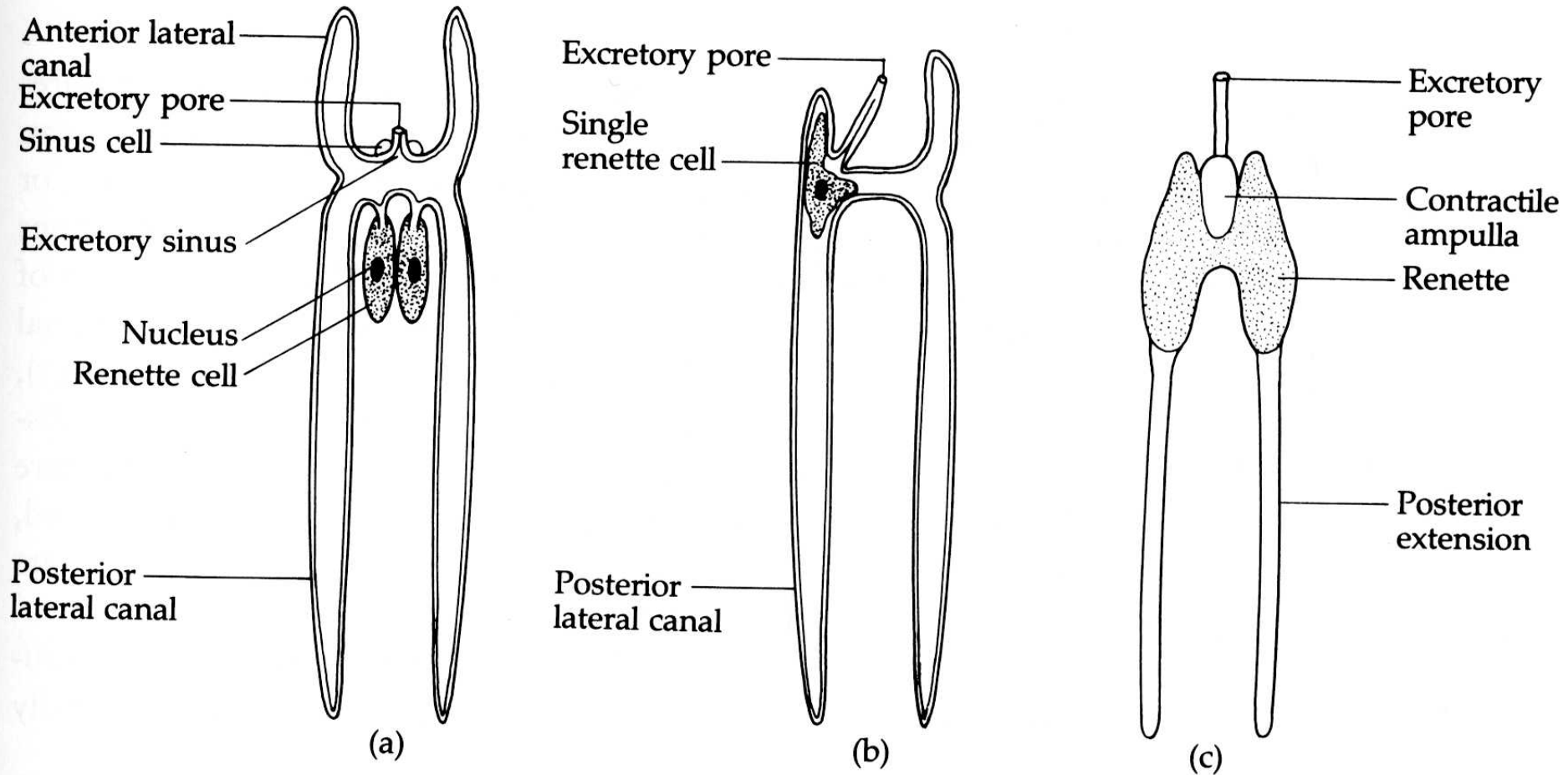


FIGURE 15-10

Nematode excretory systems.

(a) Rhabditoid type. (b) Ascaroid type. (c) Juvenile *Ancylostoma*.

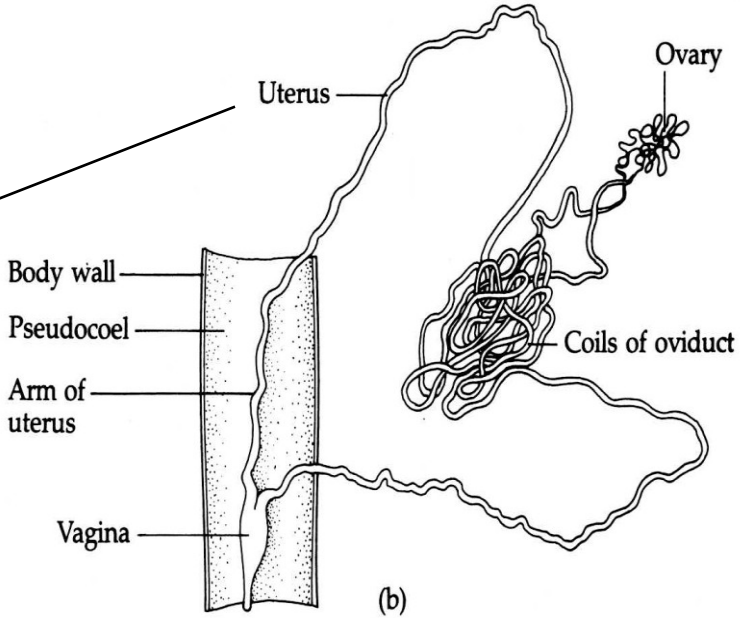
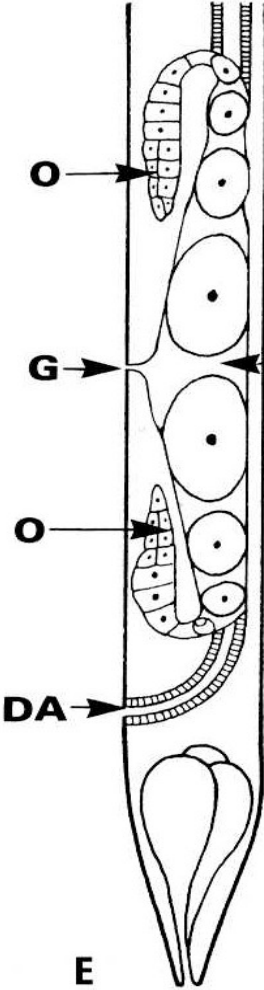
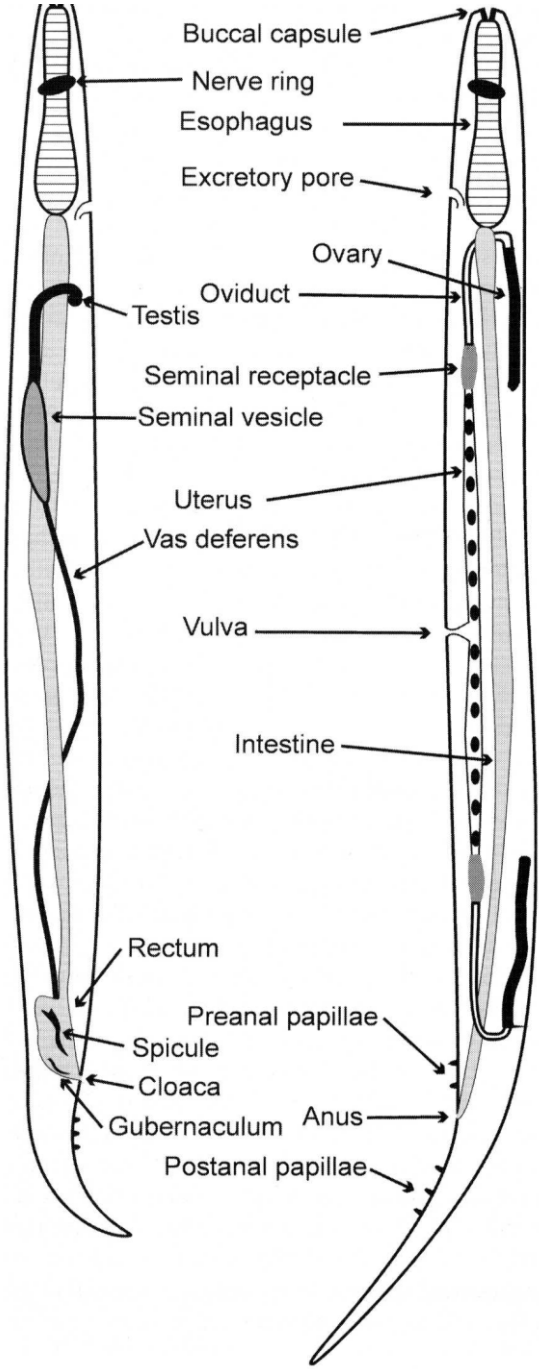
Nematoda – morfologie IV

- **Pohlavní soustava** – dobře vyvinuta
- **Gonochoristi**
- Partenogenetické generace a hermafroditi (u některých skupin)
- Většina hlístic – **oviparie**, méně často **ovoviviparie** (L1 se rodí v děloze samice)

- **Samičí soustava** – většinou 2 vaječníky – trubicovitá děloha - svalnatá vagina (vajíčka) - vulva ústící na porch těla

- **Samčí soustava** – nepárové varle – velká a malá ejakulární žláza a kloaka, zadní konec těla samce – bursa copulatrix – morfologie - žebra, papily – spikuly – gubernakulum (telamon)

Samičí pohlavní soustava



E

Vajíčka hlístic

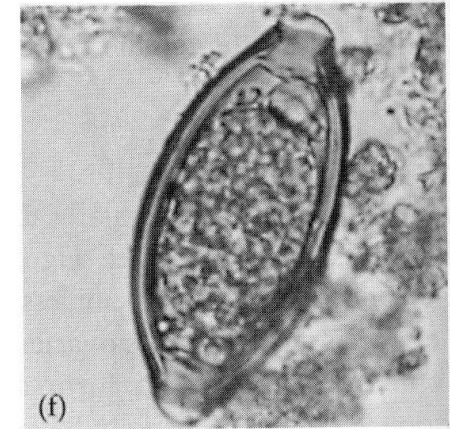
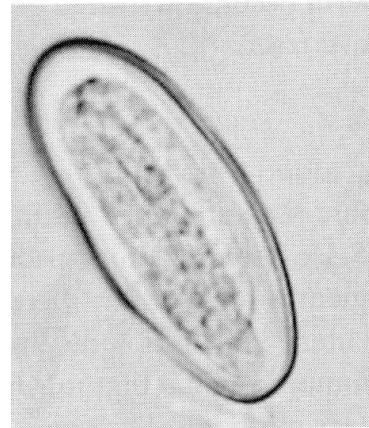
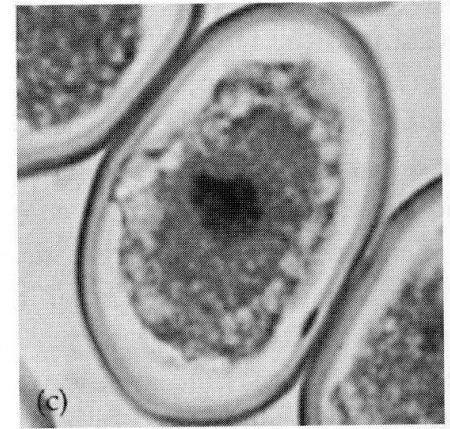
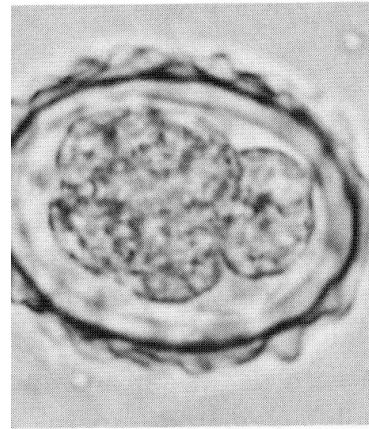
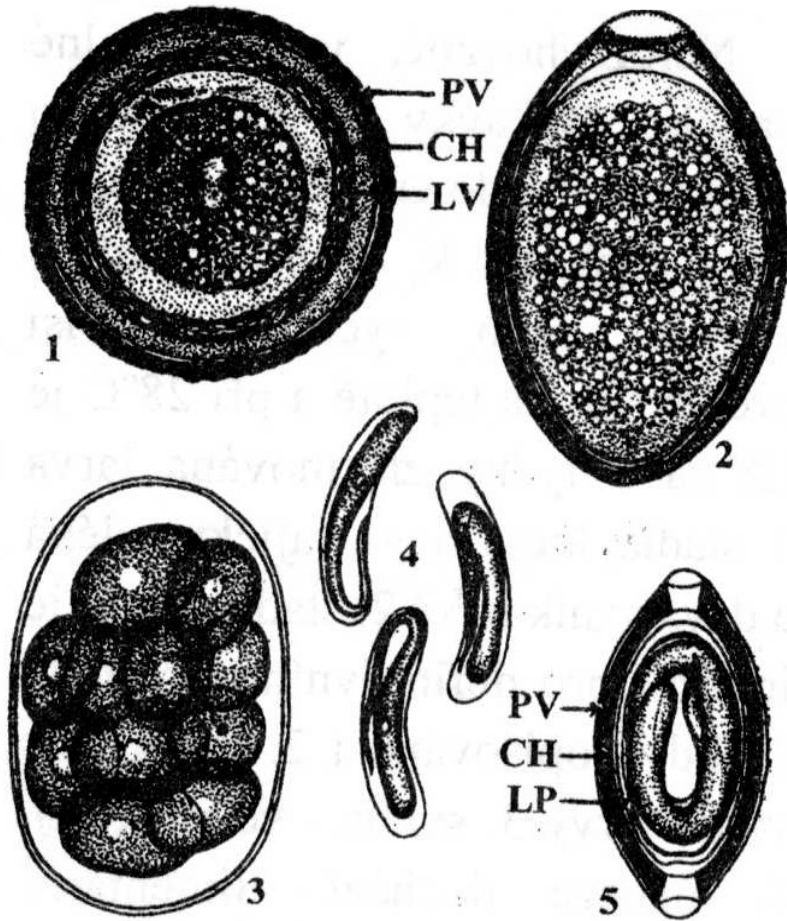
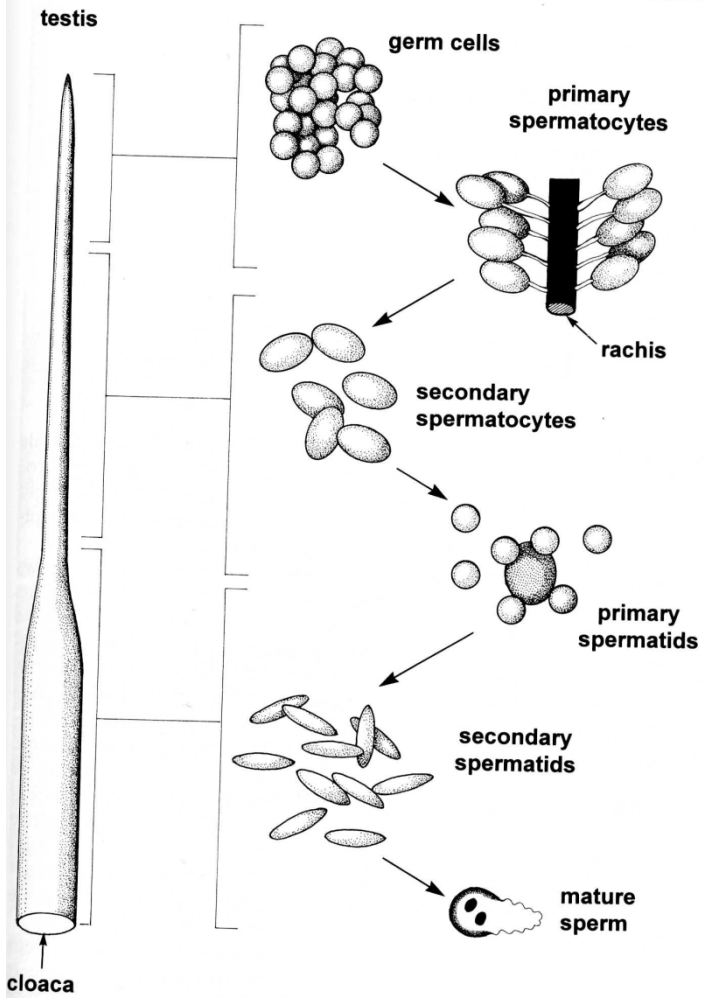
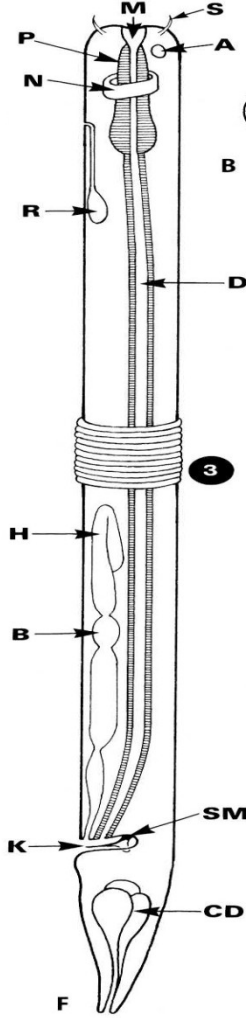
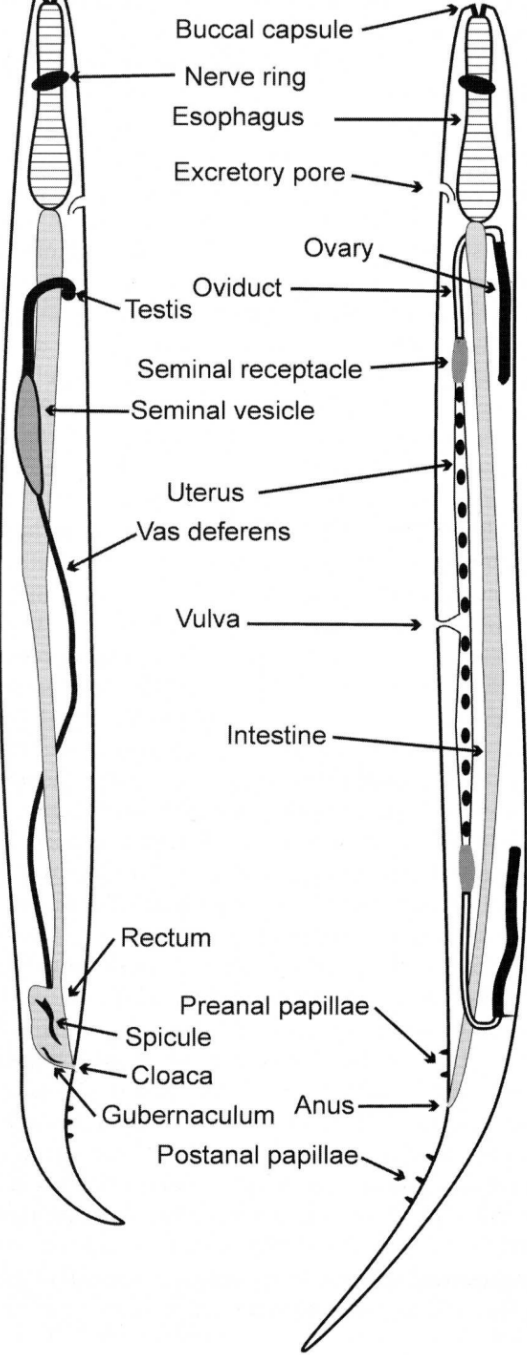


FIGURE 15-15

Some nematode eggs and larvae.

(a) *Strongyloides stercoralis* rhabditiform larva. (b) *Ascaris lumbricoides* normal fertilized egg with developing larva. (c) *Ascaris lumbricoides* unfertilized egg. (d) Hookworm egg. (e) *Enterobius vermicularis* egg. (f) *Trichuris trichiura* egg.

Samčí pohlavní soustava



Spermiogeneze hlístic

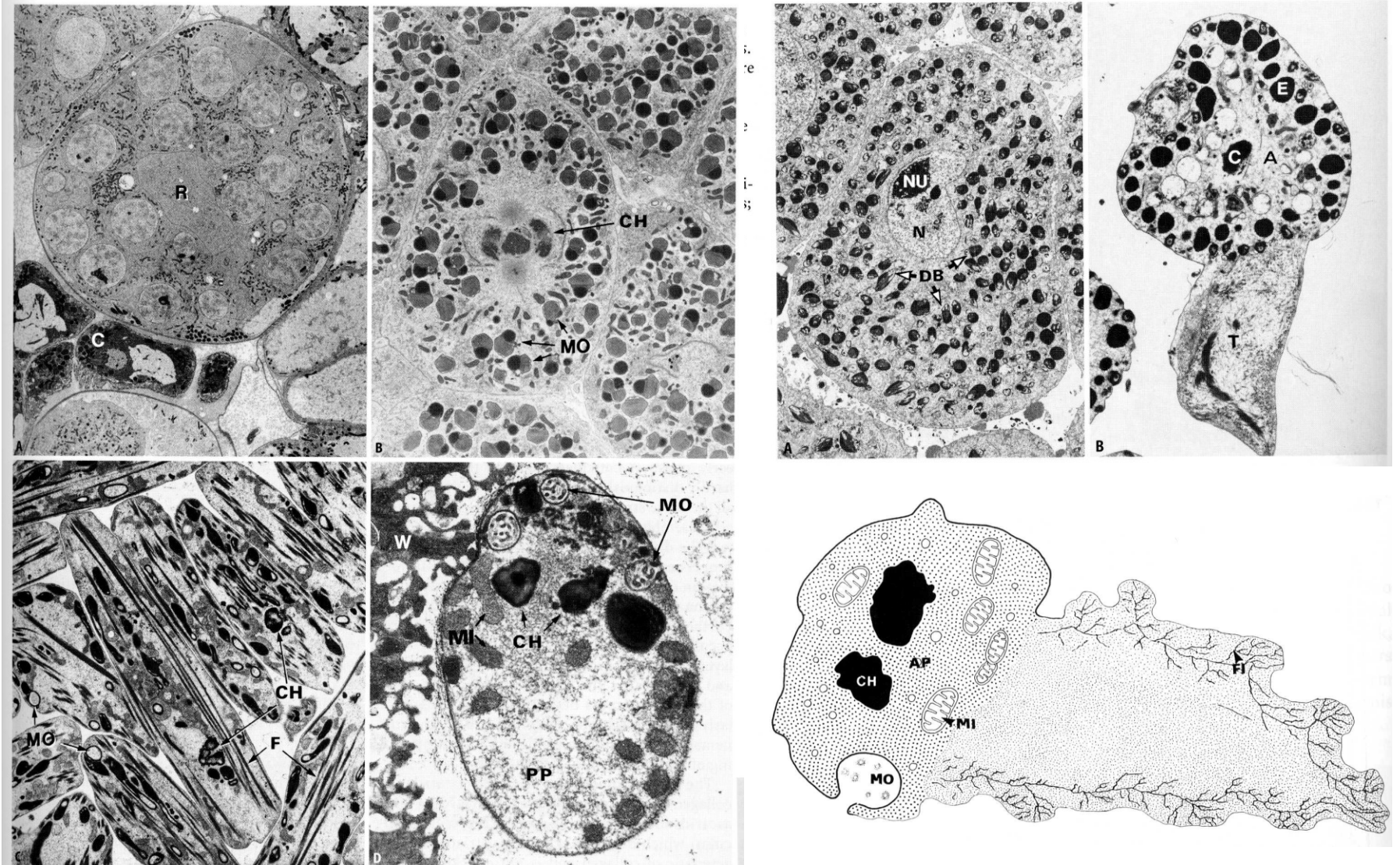


Fig. 5 A-D. Spermatogenesis. A Cross section through the germinal zone of the testis of → *Heterakis spumosa*. x 1.400. C,

Schéma spermie

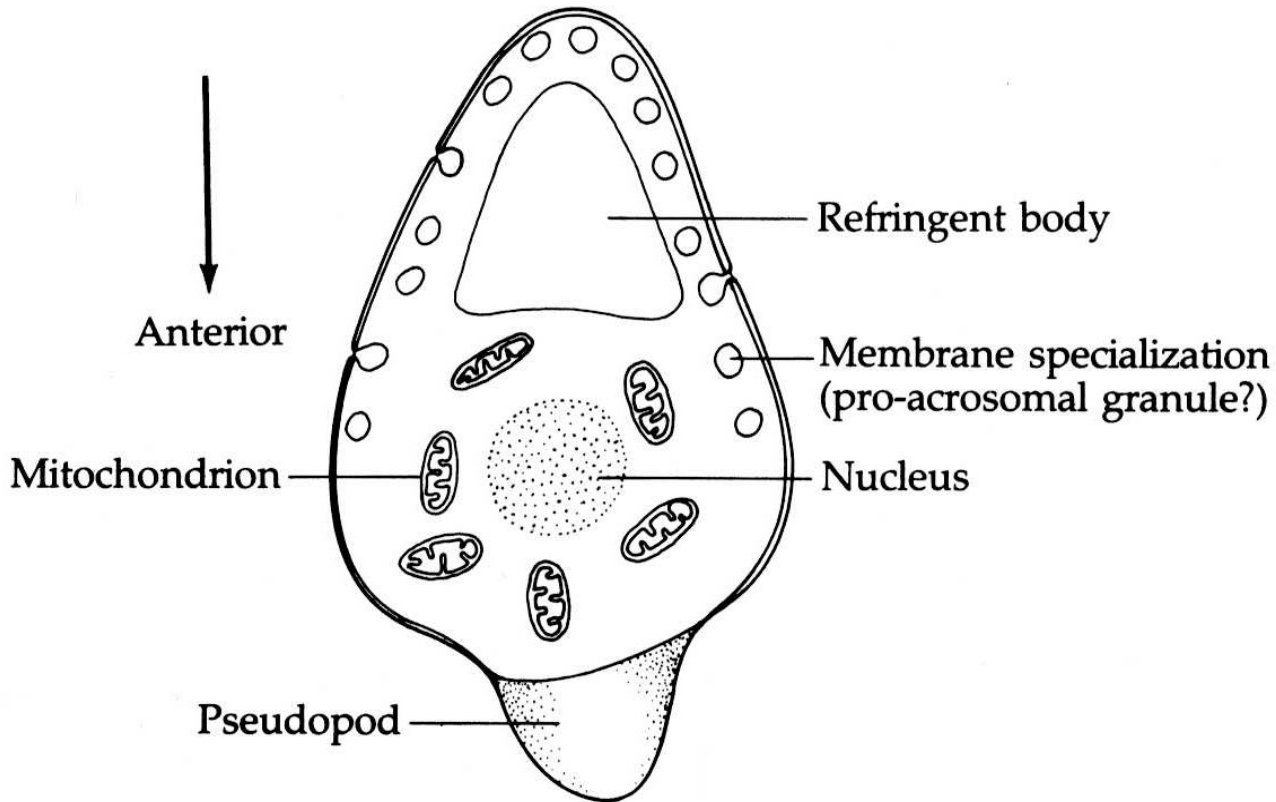
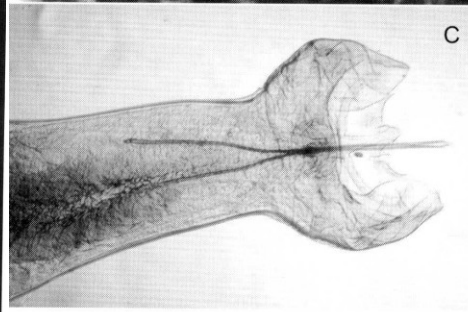
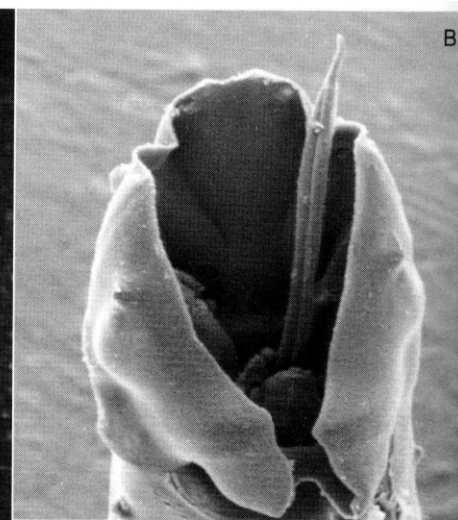
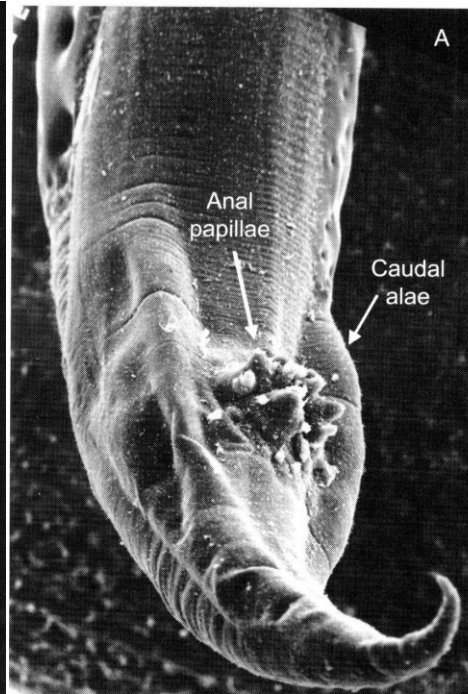
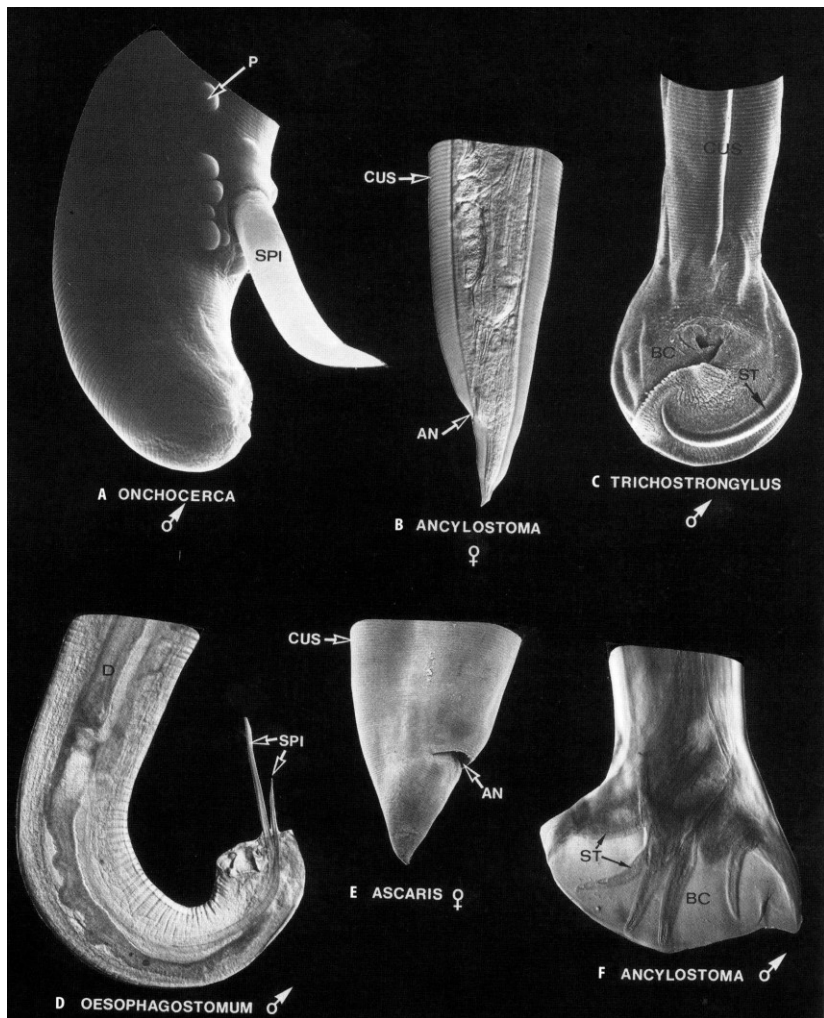
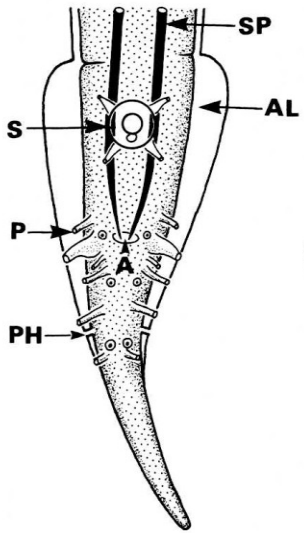


FIGURE 15-12
A generalized diagram of a nematode sperm.

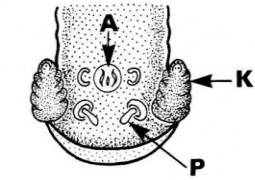
Morfologie zadního konce těla samce



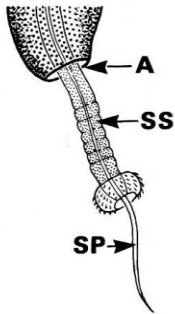
Morfologie zadního konce těla samce



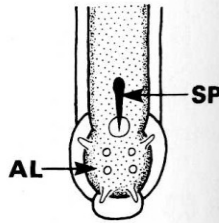
A *HETERAKIS*



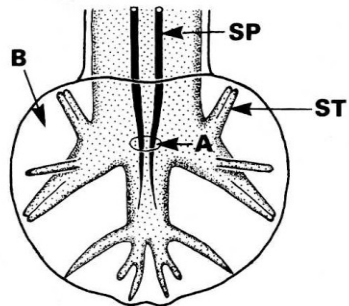
B *TRICHINELLA*



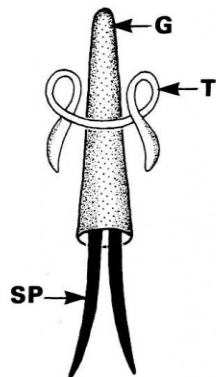
C *TRICHURIS*



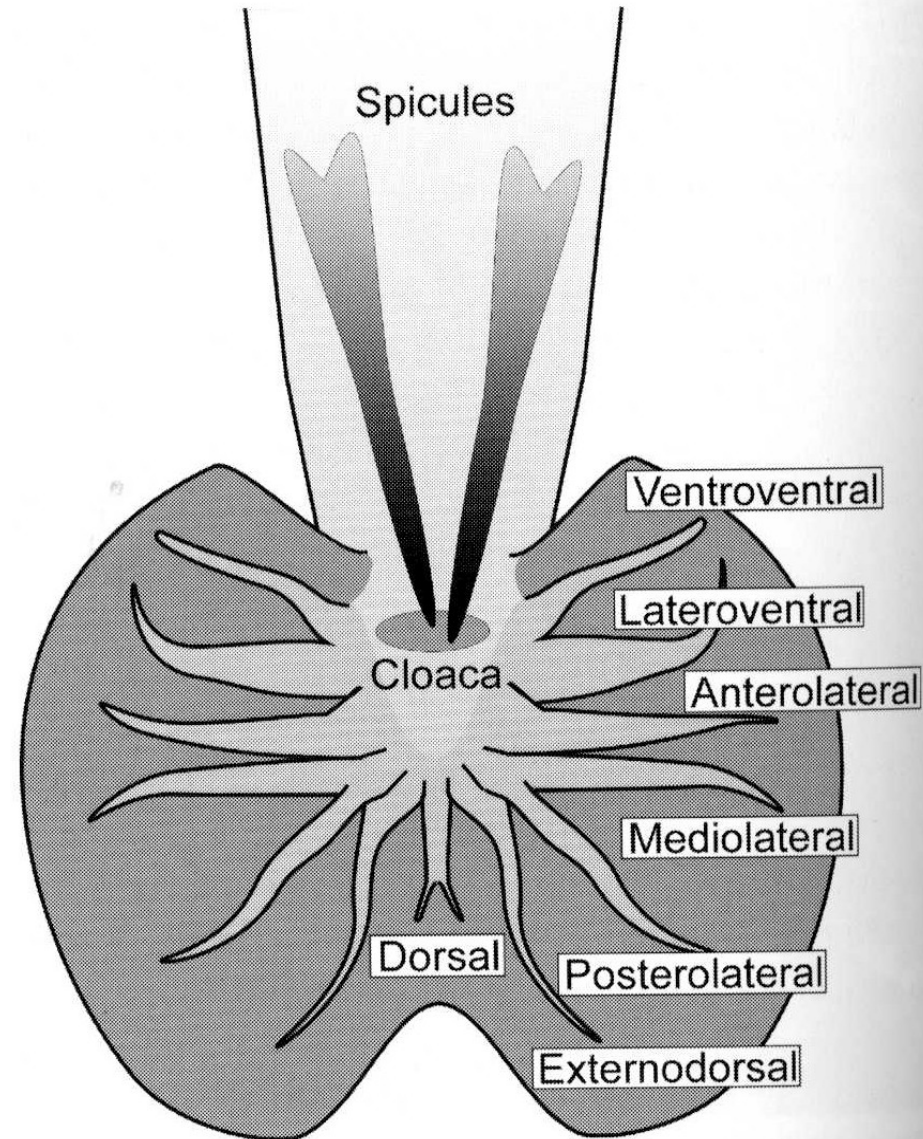
D *ENTEROBIUS*



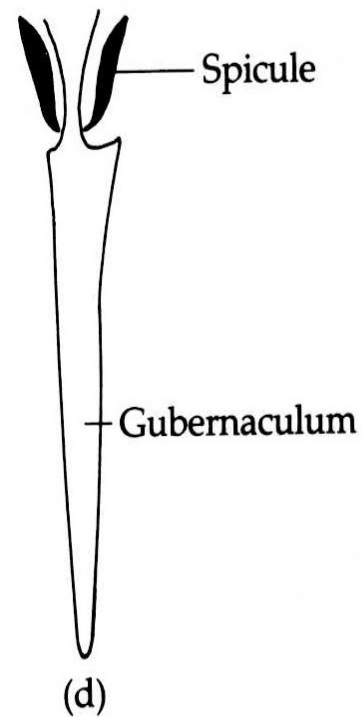
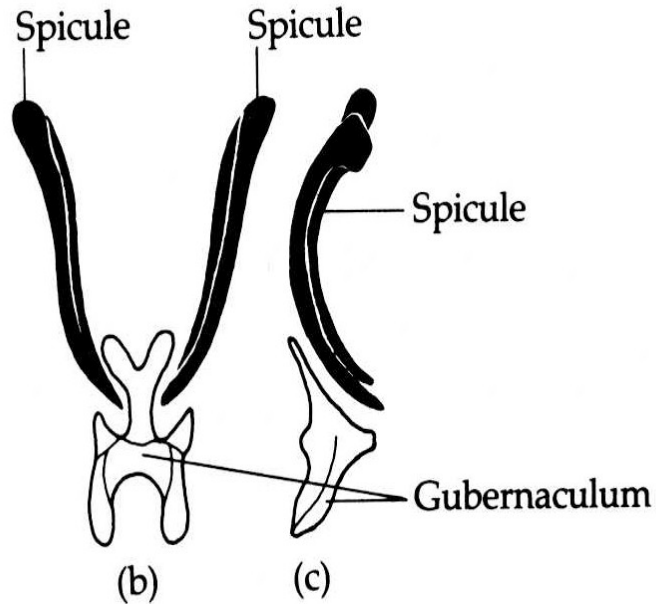
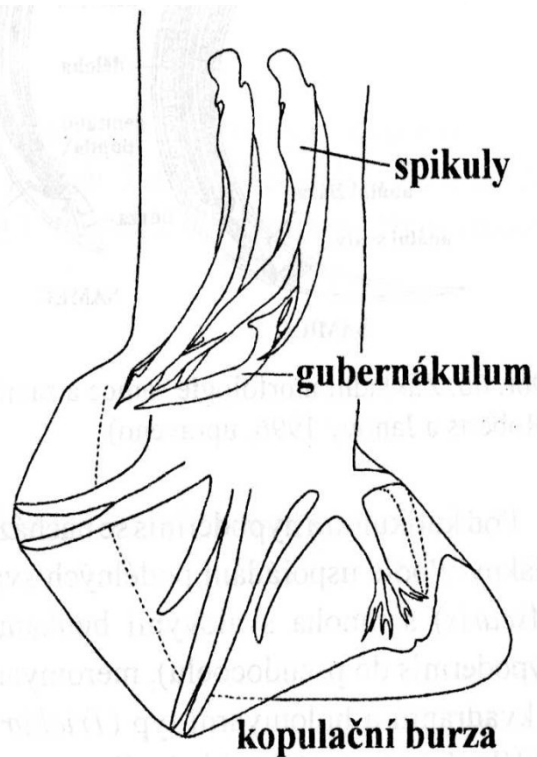
E *OESOPHAGOSTOMUM*



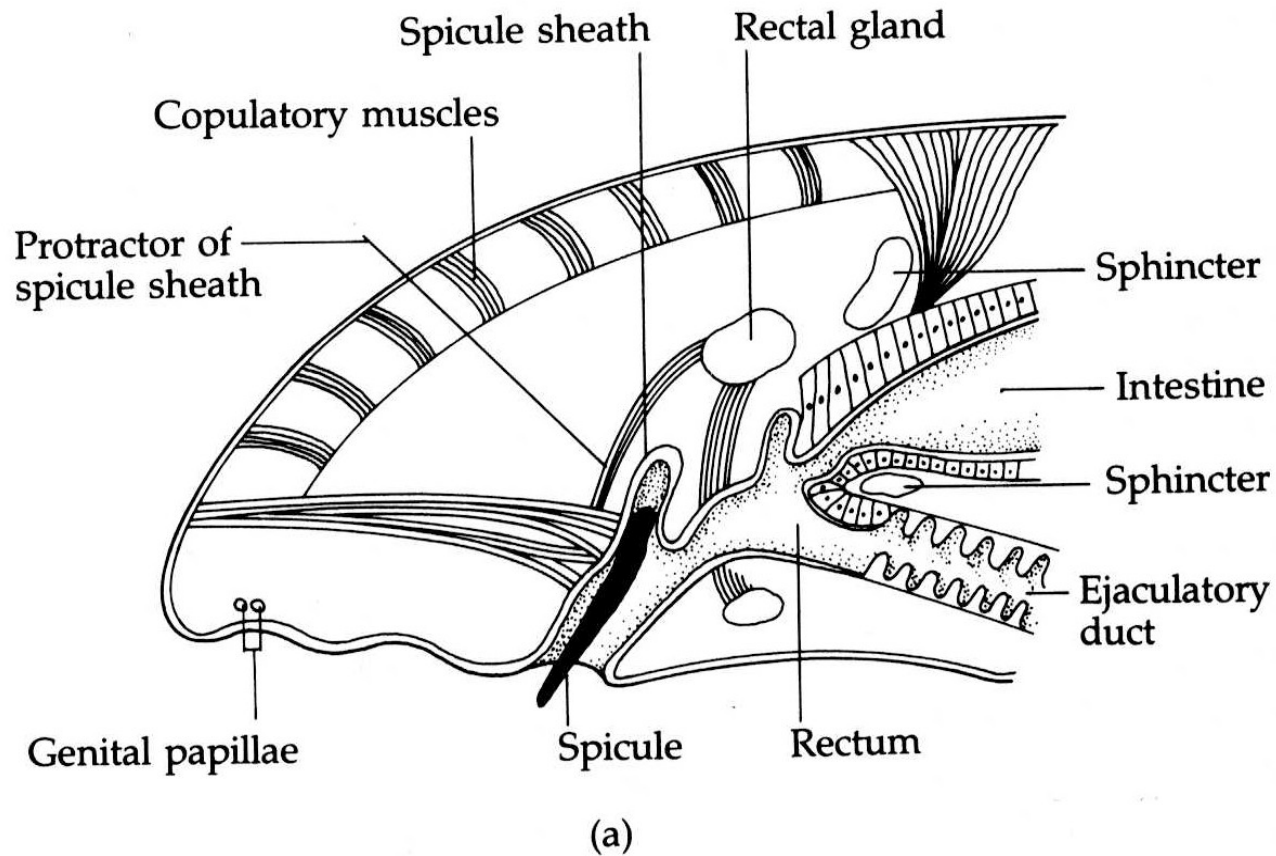
F



Spikuly a gubernakum



Funkce spikul a gubernakula



Nematoda - vývoj

- Životní cykly **přímé** x **nepřímé**
- Často alternativní střídání generací
- Sexuální generace x partenogenetické
- Geohelminti x biohelminti
- Většina prodělává čtvero svlékání (L1, L2, L3 a L4)

- **Geohelminti** – vajíčko – larva (2 svlékání) –
invazní larva L3 – do DH proniká: 1) perorálně (kontaminace potravy, vody)
2) perkutánně – aktivně přes pokožku

Velký význam paratenických hostitelů

- **Biohelminti** – alespoň jeden mezihostitel zde se vyvíjí L3
Mezihostitelé – kroužkovci, korýši, měkkýši, hmyz apod.

Význam paratenických, postcyklických, paradefinitivních a dalších typů fakultativních hostitelů

Schéma vývoje a růstu nematodů

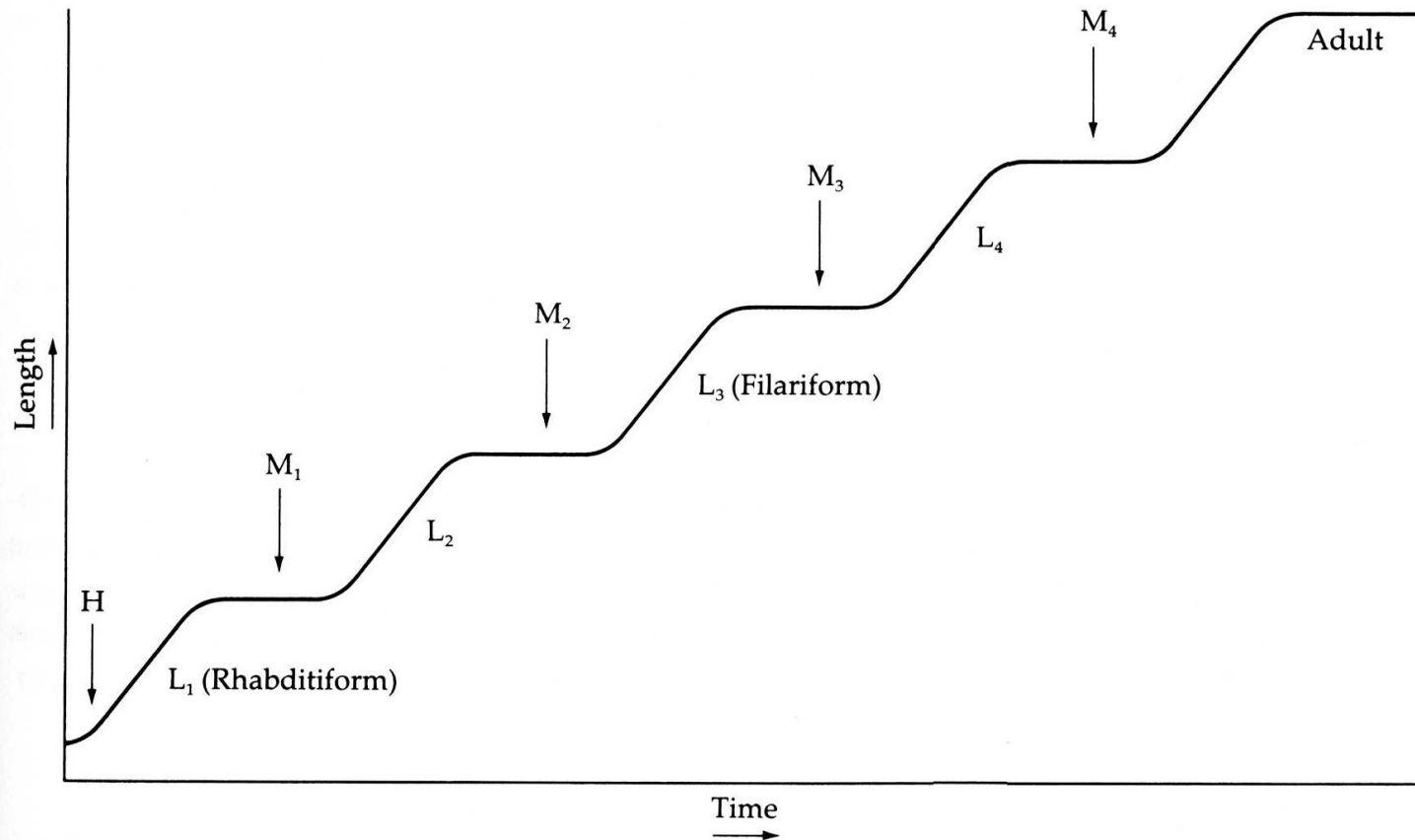
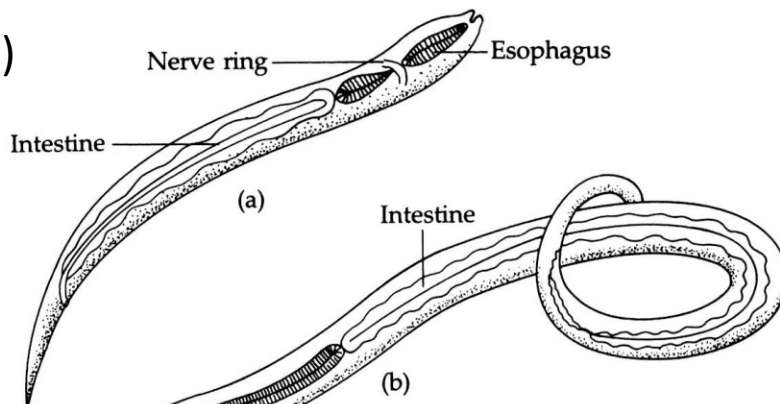


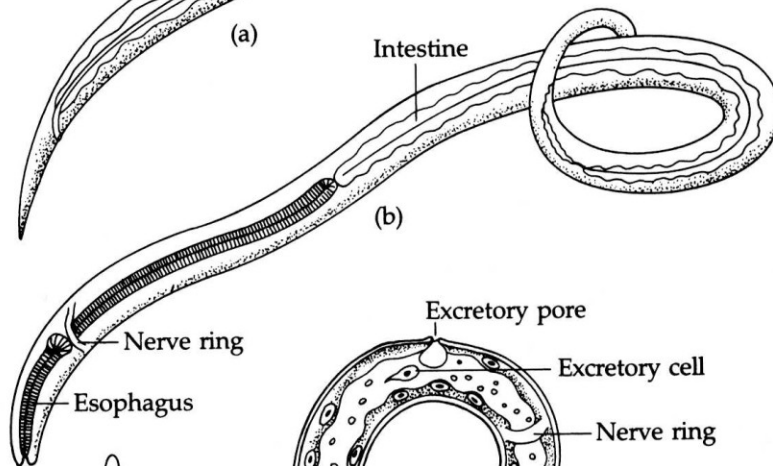
FIGURE 15-14
Nematode growth pattern.
H, hatch; M, molt; L, larva.

Larvální stádia nematodů

Rhabditiformní (L1)



Filariformní (L3)



Mikrofilarie

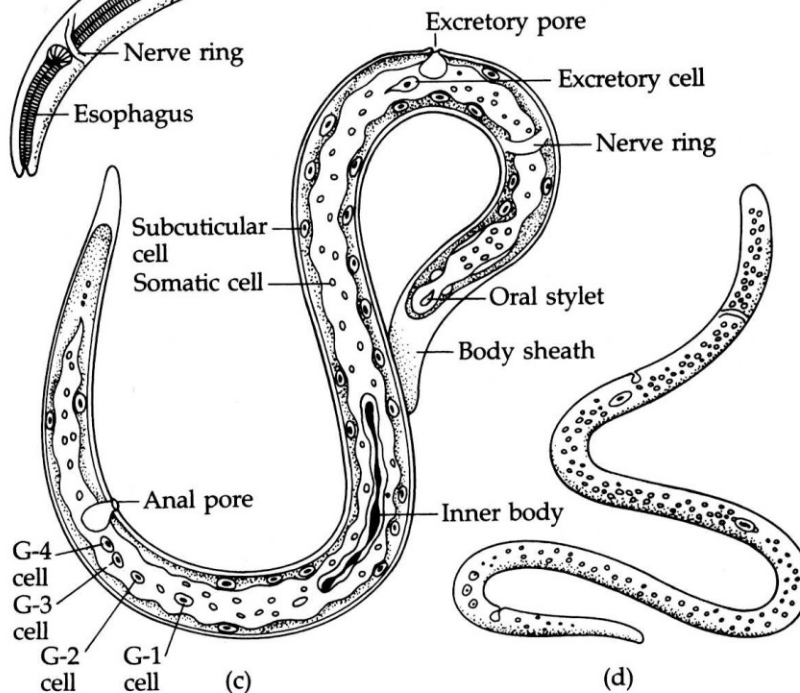
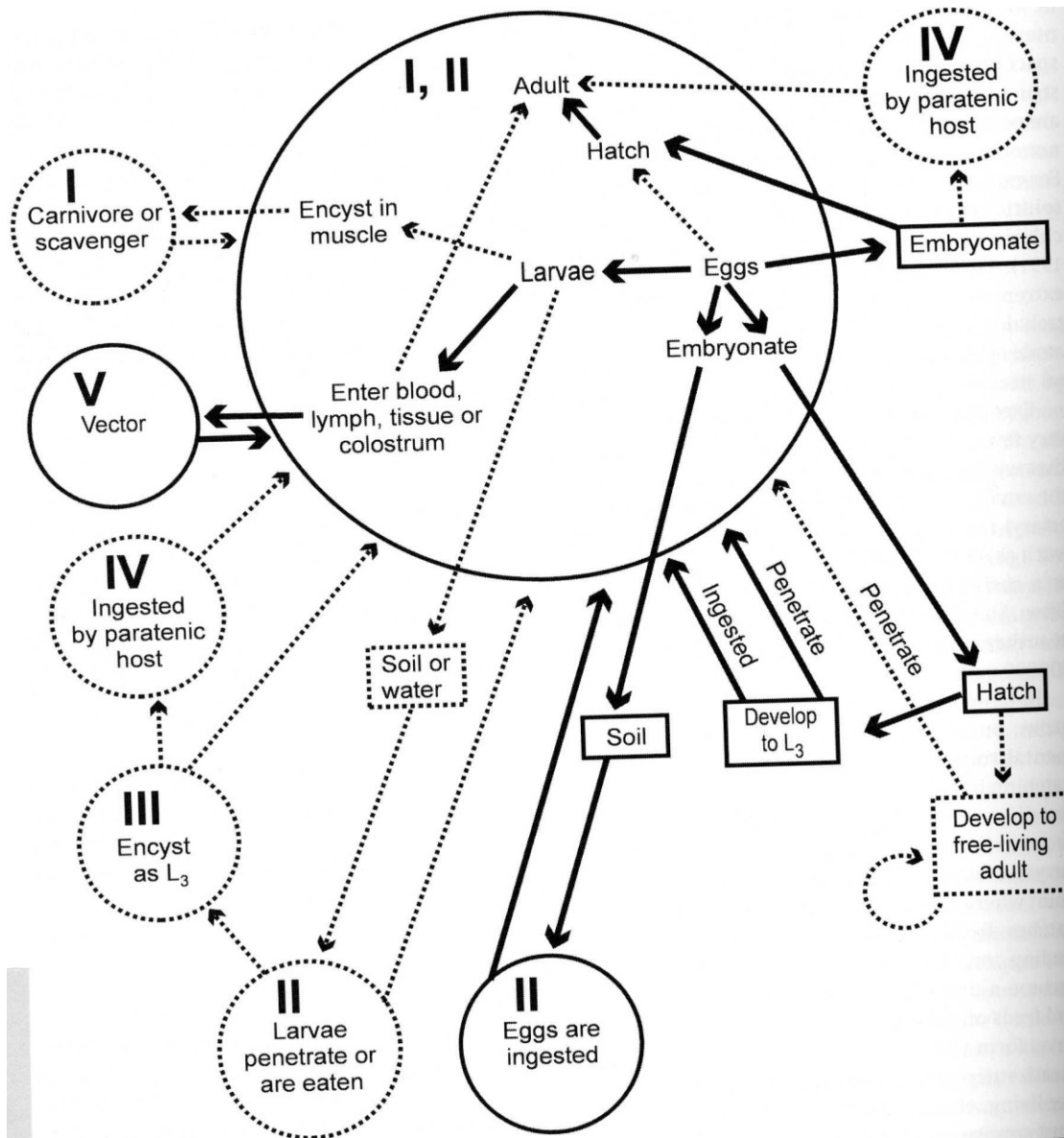


FIGURE 15-15
Nematode larvae.
(a) Rhabditiform larva. (b) Filariform larva. (c) Sheathed filariform larva of *Wuchereria*. (d) Unsheathed microfilaria of *Onchocerca*.

Typy vývojových cyklů nematodů



Vývojové cykly vybraných zástupců

- **Přímé vývojové cykly**

- **Trichinella spiralis** – zjednodušení cyklu – DH plní zároveň roli meziphostitele
- **Ascaris lumbricoides** – složitá migrace larev L3 – nahrazuje část cyklu v chybějícím meziphostiteli
- **Strongyloides stercoralis** – existence dvou fází VC – parazitická generace (endogenní, partenogenetická) x volně žijící (exogenní, gonochoristická)

- **Nepřímé vývojové cykly**

- **Wuchereria bancrofti** – krevsající členovec jako MZ a vektor (L3)
- **Dracunculus medinensis** – vodní prostředí – MZ – buchanka (Copepoda)
– perorální nákaza Mz – do DH opět perorálně

Děkuji za pozornost

Nematoda - fylogeneze

