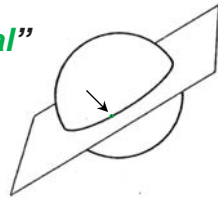


SYMMETRY and BODY AXES

“asymmetry”
(no axes)
e.g. sponge

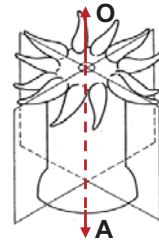


“spherical”
(no axes)
e.g. egg?



infinite planes of symmetry
through single point

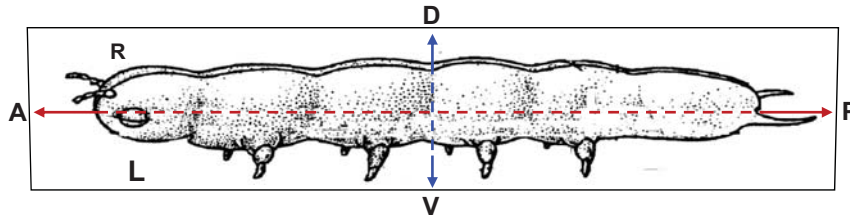
“radial”
(one axis)
e.g. cnidarian



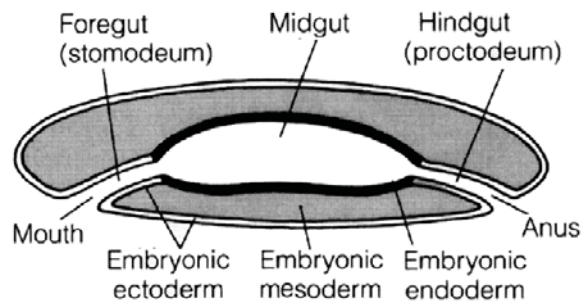
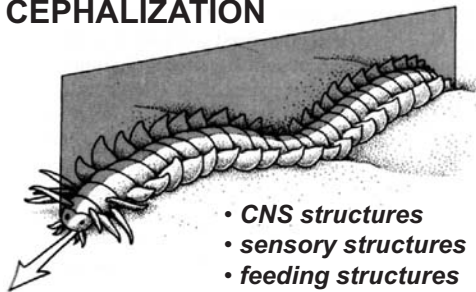
infinite planes of symmetry
through single line

“bilateral”
(two axes)
e.g. worms

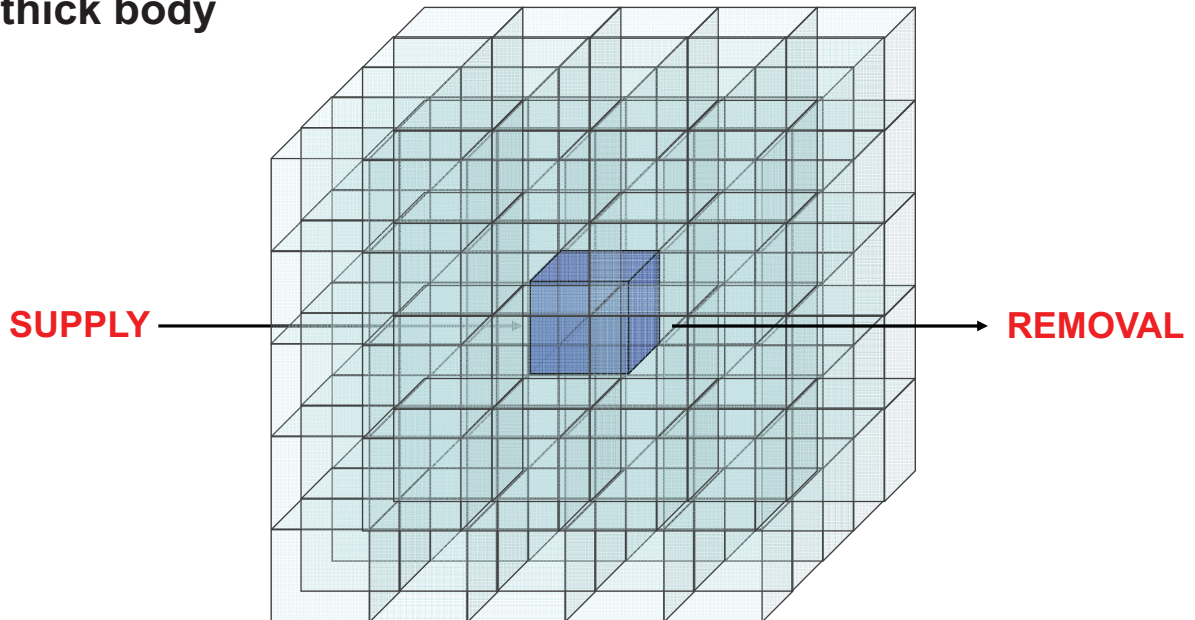
single plane of
symmetry



CEPHALIZATION



Challenges to building a thick body

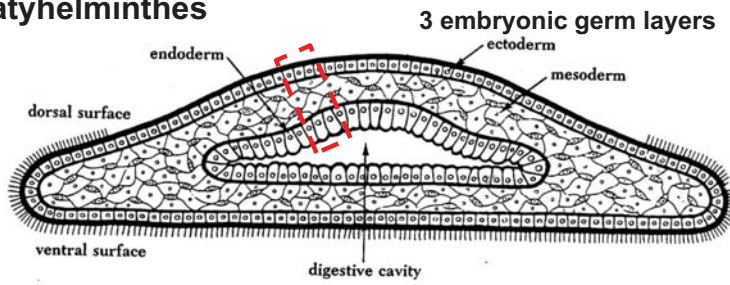


Scaling problem

Solutions?

$$\frac{\text{Surface area} \propto \text{length}^2}{\text{Volume} \propto \text{length}^3}$$

Ph. Platyhelminthes



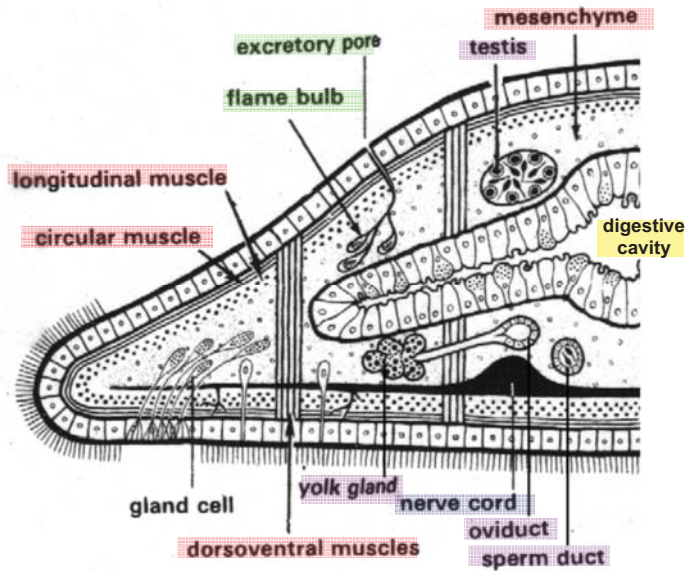
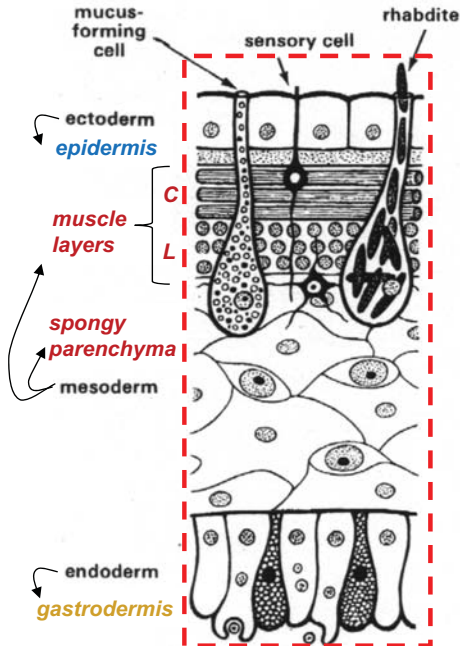
Mesoderm (muscle)

Excretory

Nervous

Reproductive

Digestive



Muscle

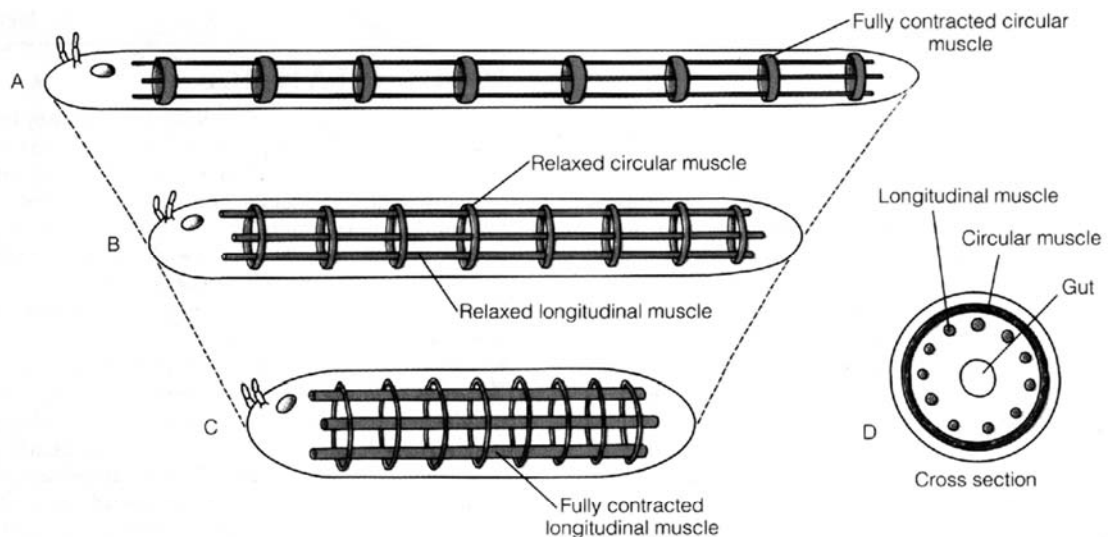
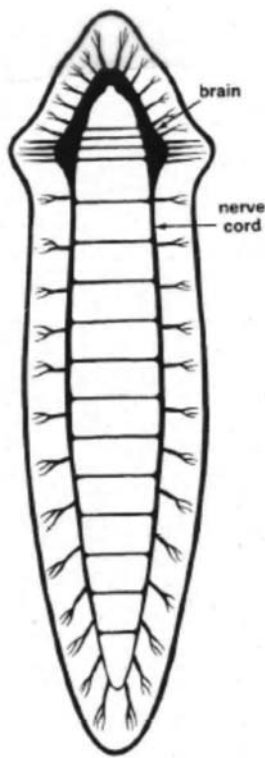


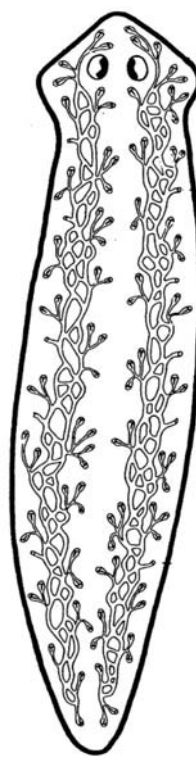
FIGURE 9-5 Bilateria: body-wall musculature. The basic arrangement of body-wall muscles in soft-bodied bilateral animals, as shown in B and the cross section (D), is an outer circular and an inner longitudinal musculature. These two layers have antagonistic actions: Contraction of the circular musculature causes elongation of the body (A), whereas contraction of the longitudinal musculature causes shortening (C). Longitudinal muscles alone allow the animal to bend and turn. The circular body wall muscles typically are positioned outside of the longitudinal muscles because the effectiveness of their action (elongation or peristalsis) depends on compression of the bodily tissues, including the longitudinal musculature.



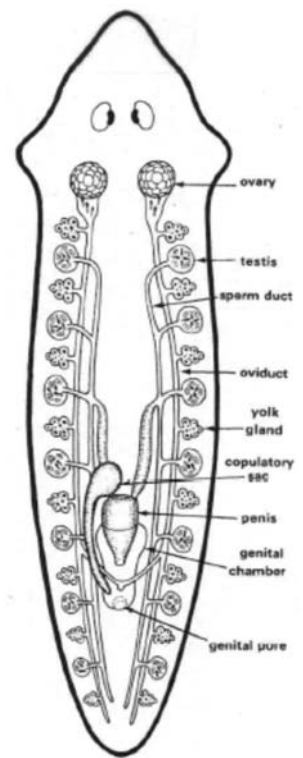
Digestive



Nervous

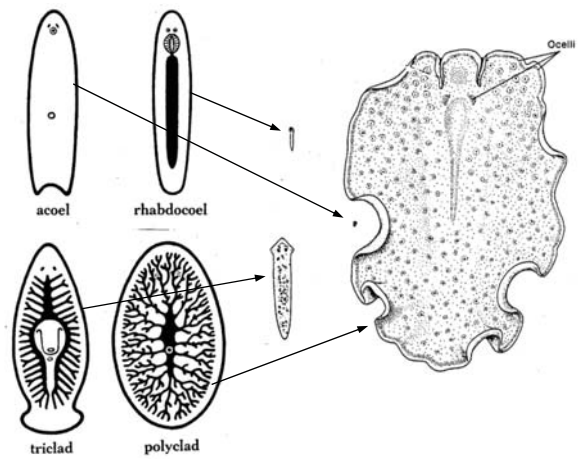
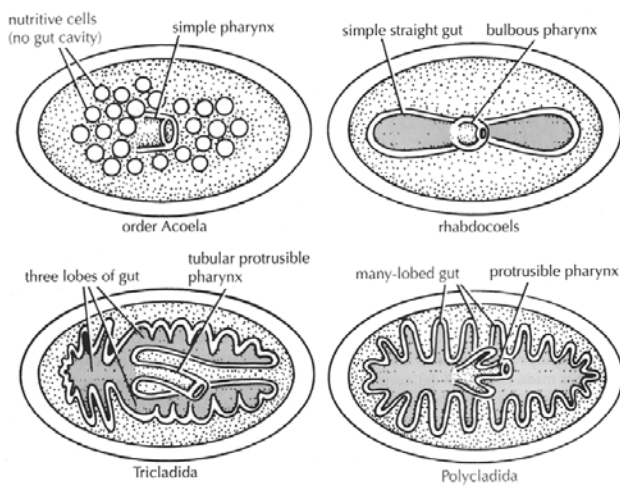


Excretory

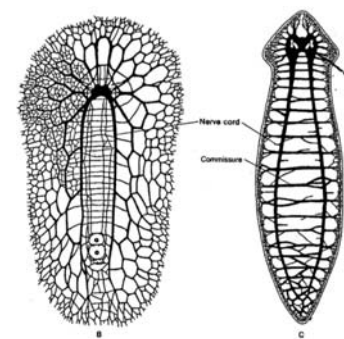
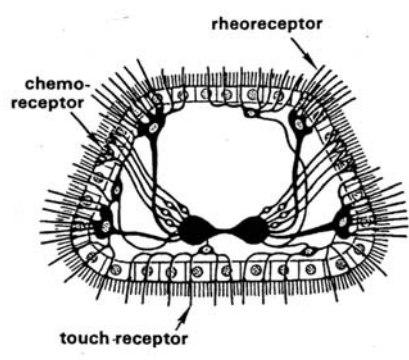


Reproductive

Digestive

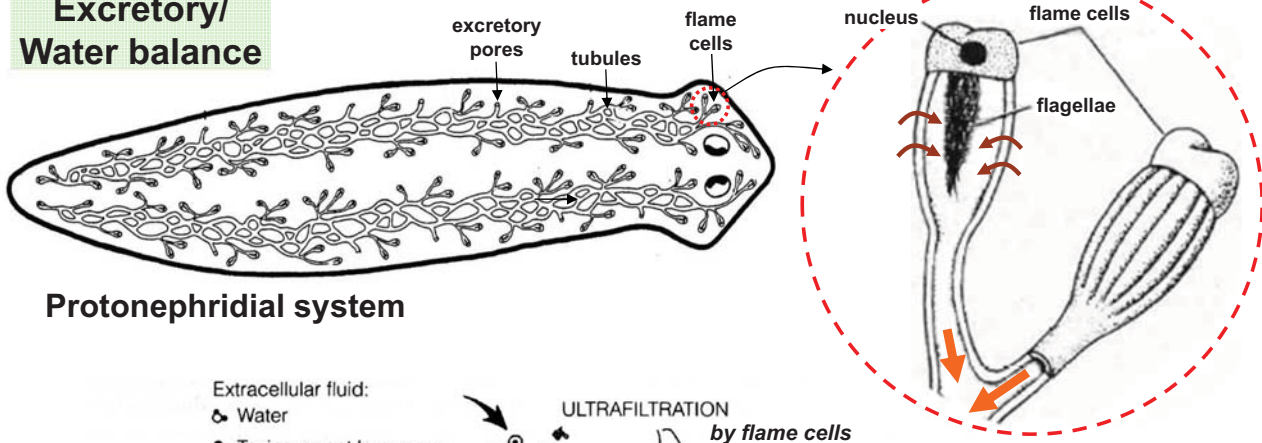


Nervous

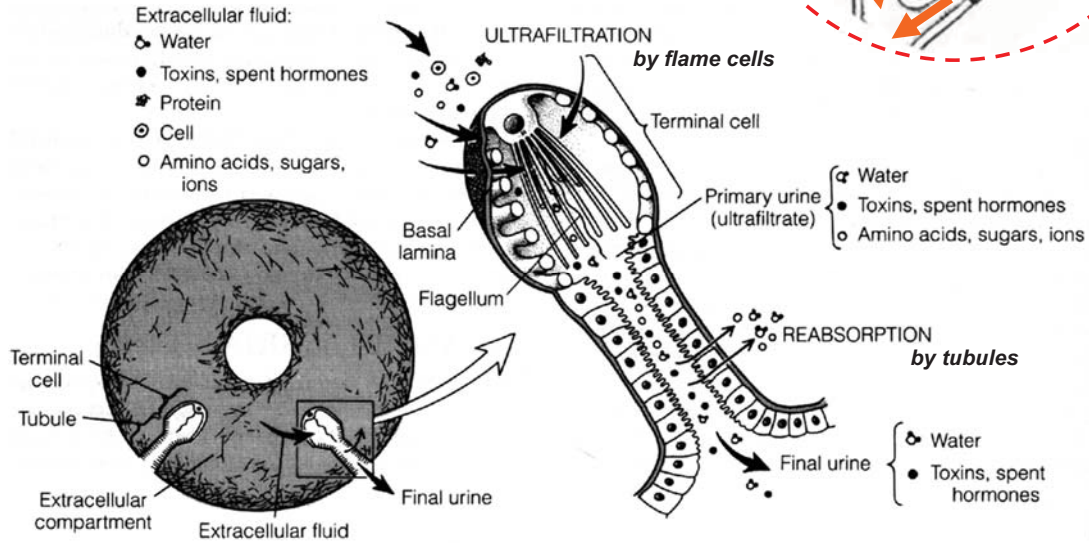


The netlike arrangement of peripheral nerves is clear in polyclads (B, ventral nervous system) and triclads (C), but in triclads a regular series of transverse commissures imparts a segmental pattern on the nervous system.

**Excretory/
Water balance**

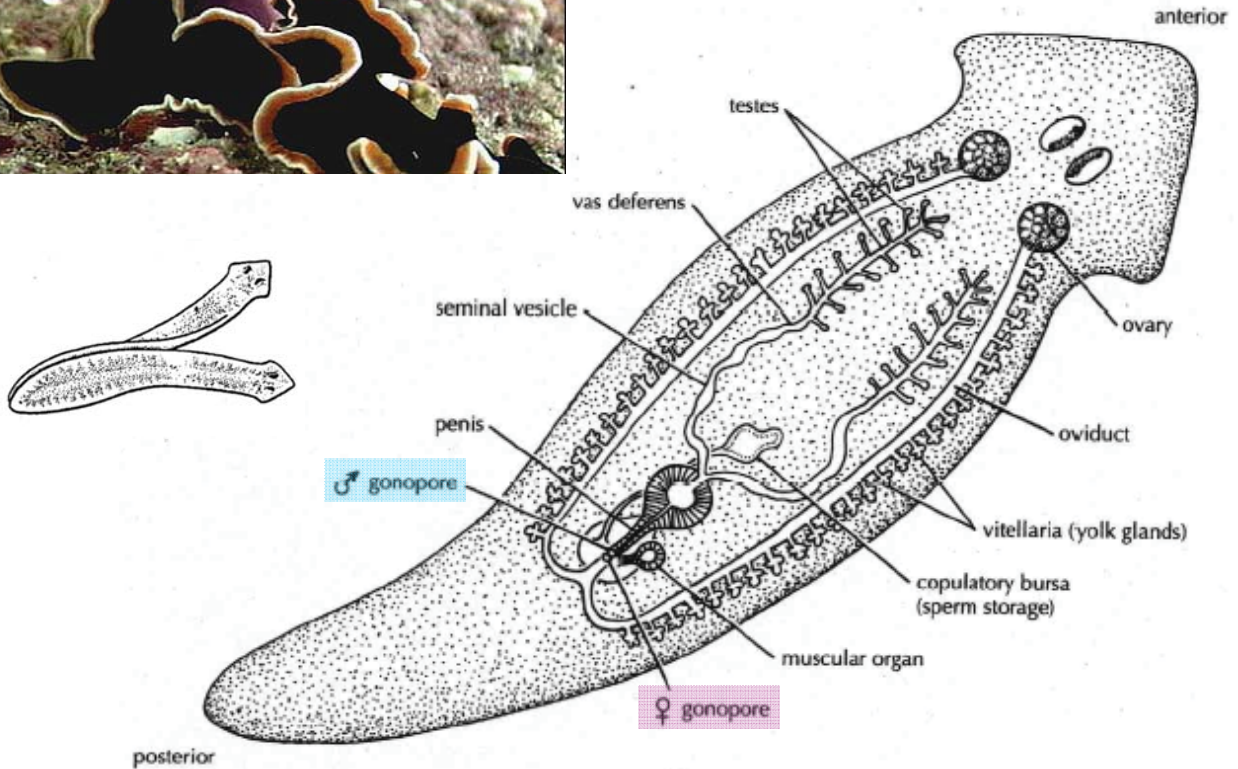


Protonephridial system

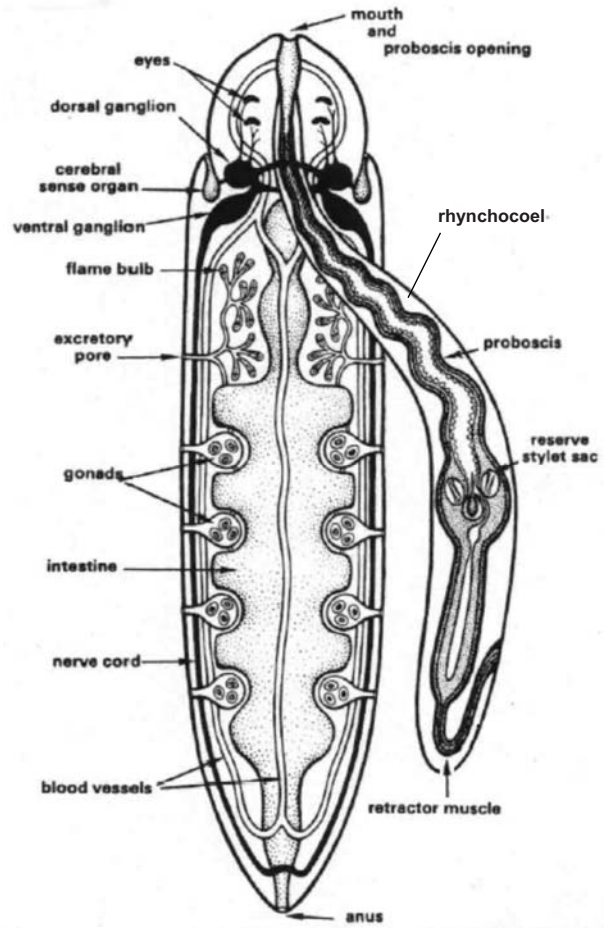
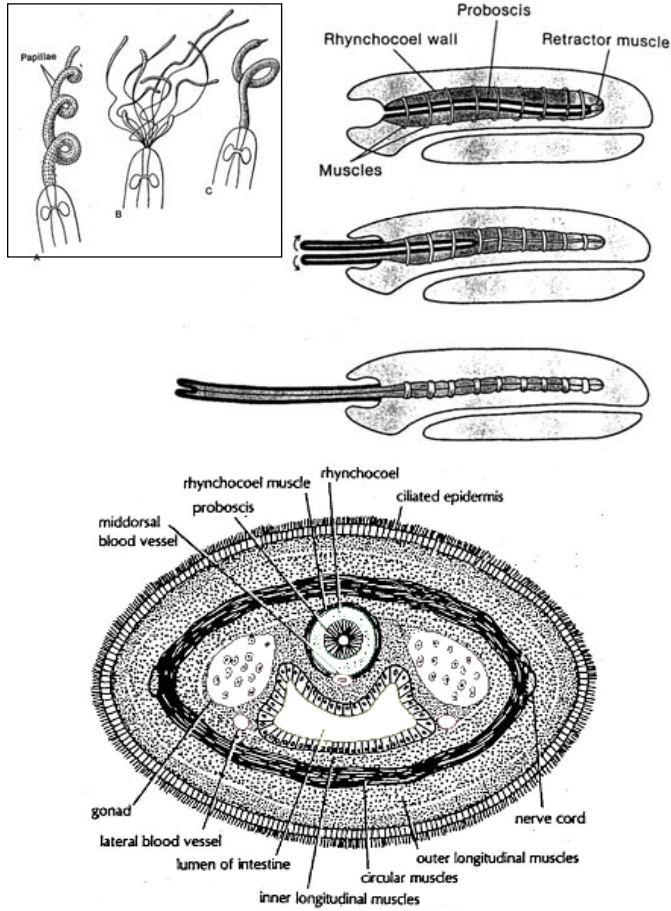


http://www.pbs.org/kcet/shapeoflife/episodes/hunt_explo2.html
<http://www.youtube.com/watch?v=5fx-YgcP8Gg> (0:43)
<http://www.youtube.com/watch?v=S0c3NyupRuY&NR=1> (0:35)

“Penis-fencing”

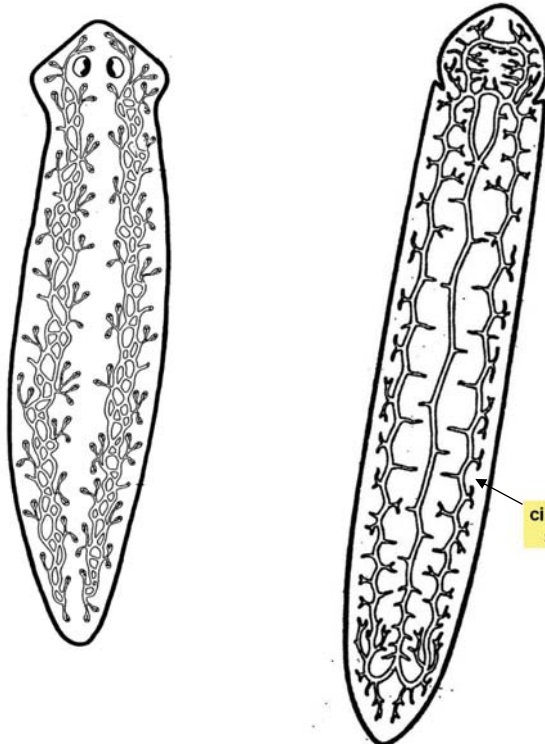


Ph. Nemertea: internal anatomy



Excretory systems

Excretion in platyhelminths
protonephridial system



Excretion in nemerteans
protonephridial system
coupled to circulatory system

