

环节动物门
Phylum Annelida
Segmented Worms

Leech



Fireworm



Christmas tree worm

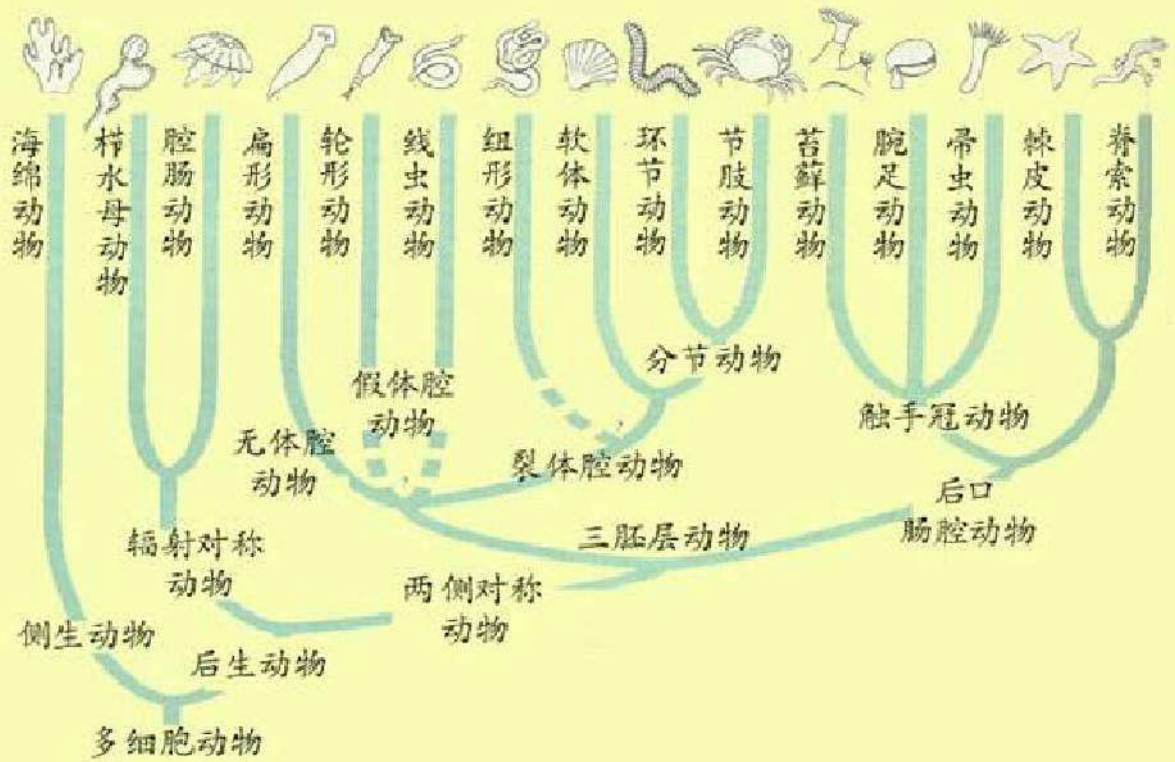


Feather duster worm



- **L. *annelus***, little ring + *ida*, plural
- **Segmentation = Metamerism**
 - Show true segmentation - both internal and external
 - Allows for specialization
- **15 000 extant species** e.g. Earthworm, leeches
- **Marine, freshwater, some terrestrial, some ectoparasitic**

Evolution position



进化地位

- 身体分节、发达的真体腔、闭管式循环系统、原始附肢 等特征，都是动物进化上的大事件
- 对动物体结构和机能的进一步复杂、完善和发展奠定了基础
- 承上启下，高等无脊椎动物的开始

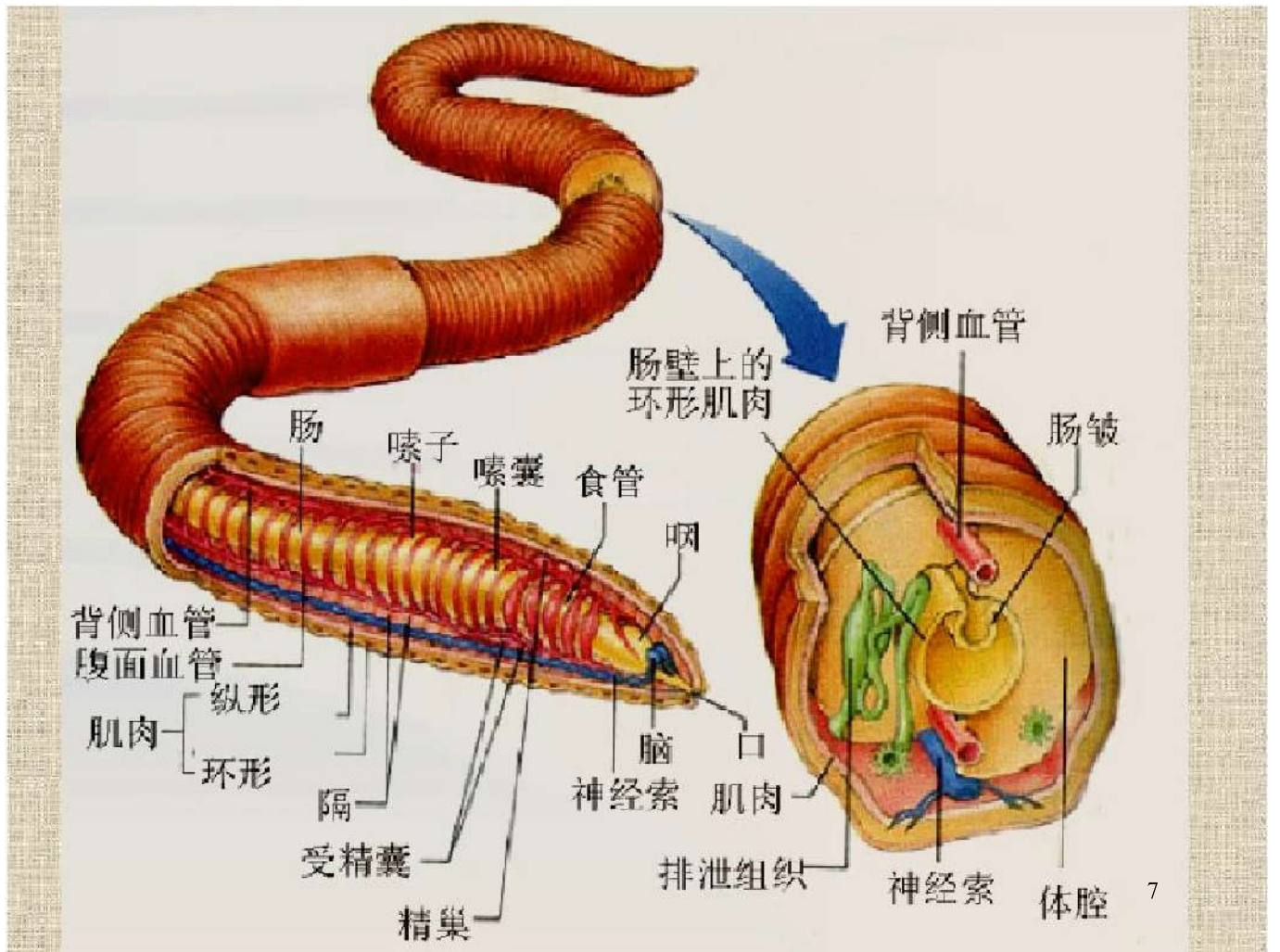
Phylum Annelida

All systems found in Annelids but skeletal

- **Bilateral symmetry & Coelomates**
- **Digestive tube with mouth and anus**
- 1st gizzard (Used to grind food)
- 1st developed central nervous system (Ventral nerve cord connects brain to EACH segment)
- **Closed circulatory system**
- **Have chaetae疣足 (setae刚毛) for locomotion**
- **Have nephridia 后肾管 to eliminate metabolic waste**
- **Reproduce sexually (most are hermaphroditic雌雄同体)**
- **Segmentation is important in the evolution of specialized body tissues**
- **Protostome characteristics: spiral cleavage, trochophore larvae 担轮幼虫**

Metamerism

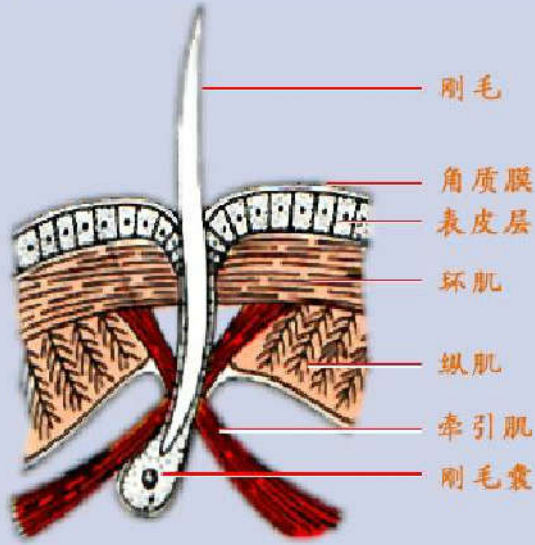
- **Metamerism of body has resulted in each segment having its own locomotory organs excretory, nervous and circulatory structure.**
 - The anterior segments are specialized and contain sensory organs.



Advantages of metamerism

- **It creates hydrostatic compartments which make possible a variety of advantageous locomotor and supportive functions**
- **It lessens the impact of injury**
- **It permits the modification of certain regions of the body for specialized functions.**

刚毛



多数环节动物，每节都长有刚毛，运动远比纤毛稳固而有力。它是由表皮细胞内陷形成的刚毛囊中的一个细胞分泌而成的。

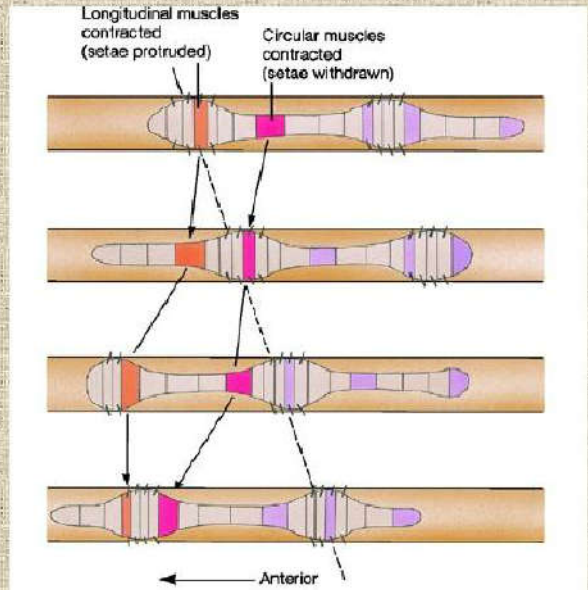


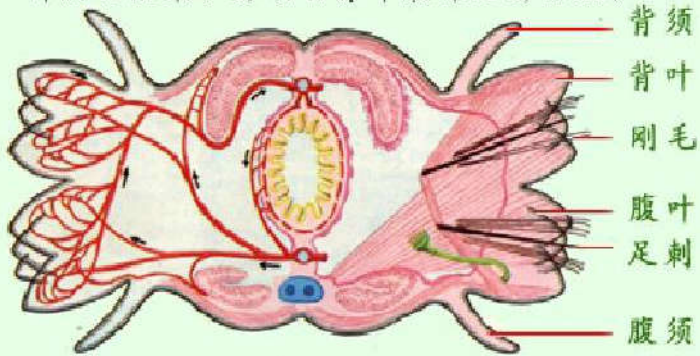
FIGURE 13.12

Earthworm Locomotion. Arrows designate activity in specific segments of the body, and broken lines indicate regions of contact with the substrate. From "A LIFE OF INVERTEBRATES" © 1979 W. D. Russell-Hunter.

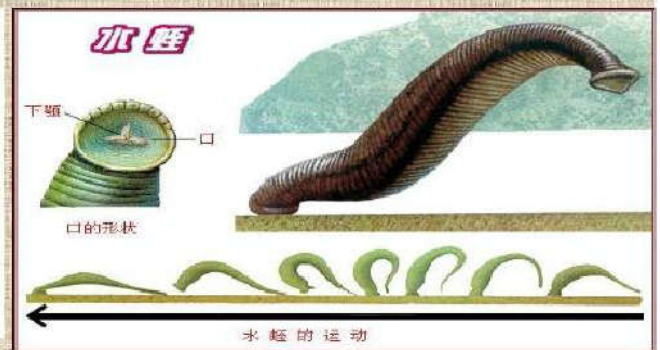
Locomotion of the Annelida

疣足的结构

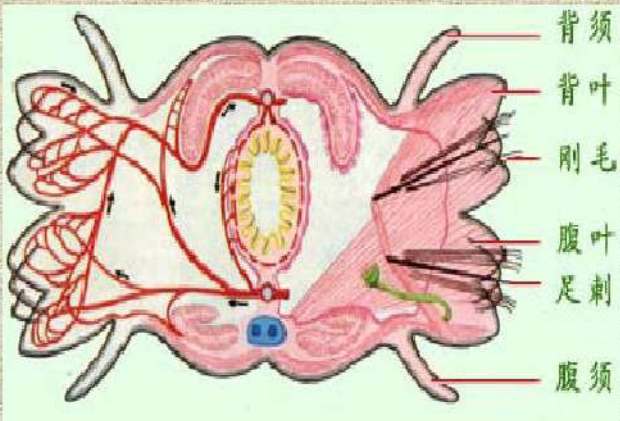
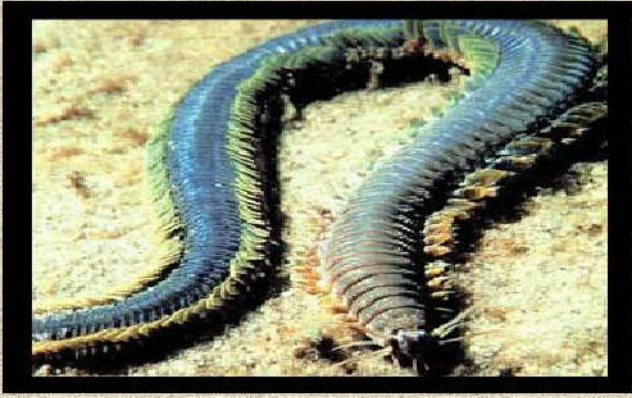
多毛类环节动物体壁向外伸出的扁平的片状突起，每节一对，分为背叶与腹叶，其中有刚毛和足刺伸入以支持，主要用于游泳，作用似船桨，为动物界中最原始的附肢。

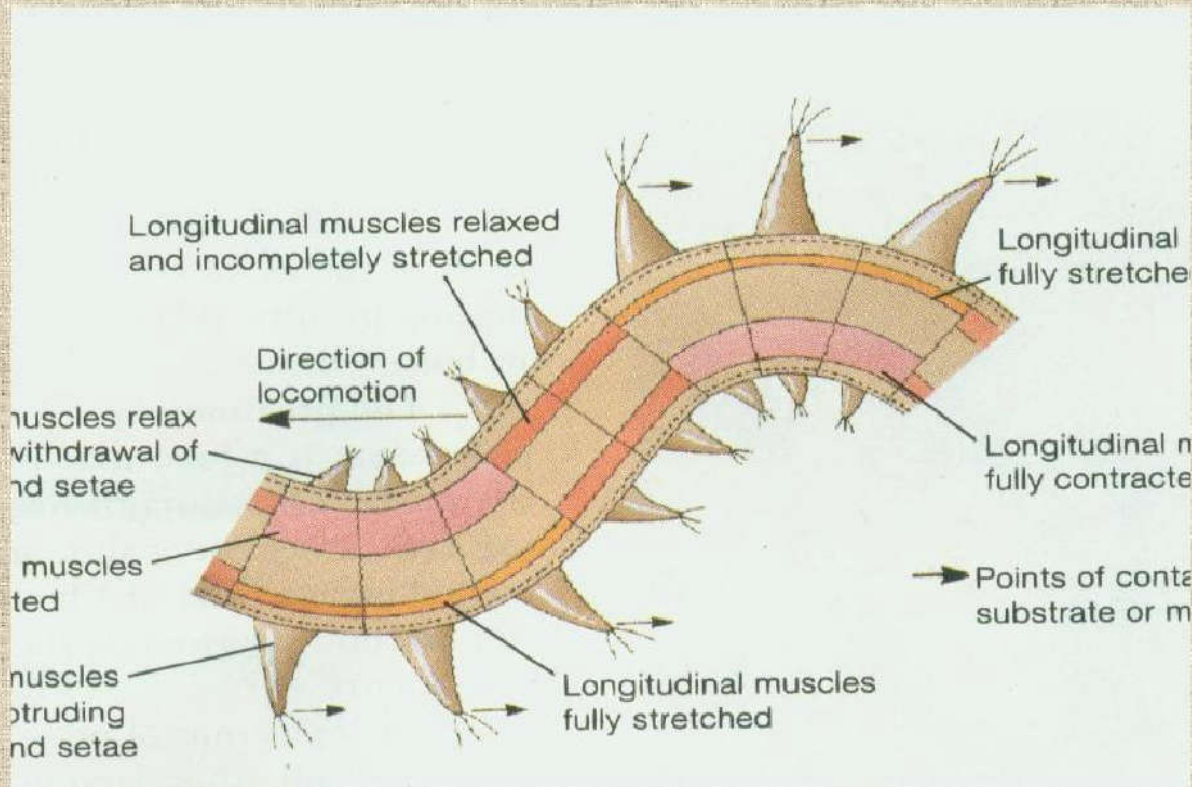


Does Annelida have foot?



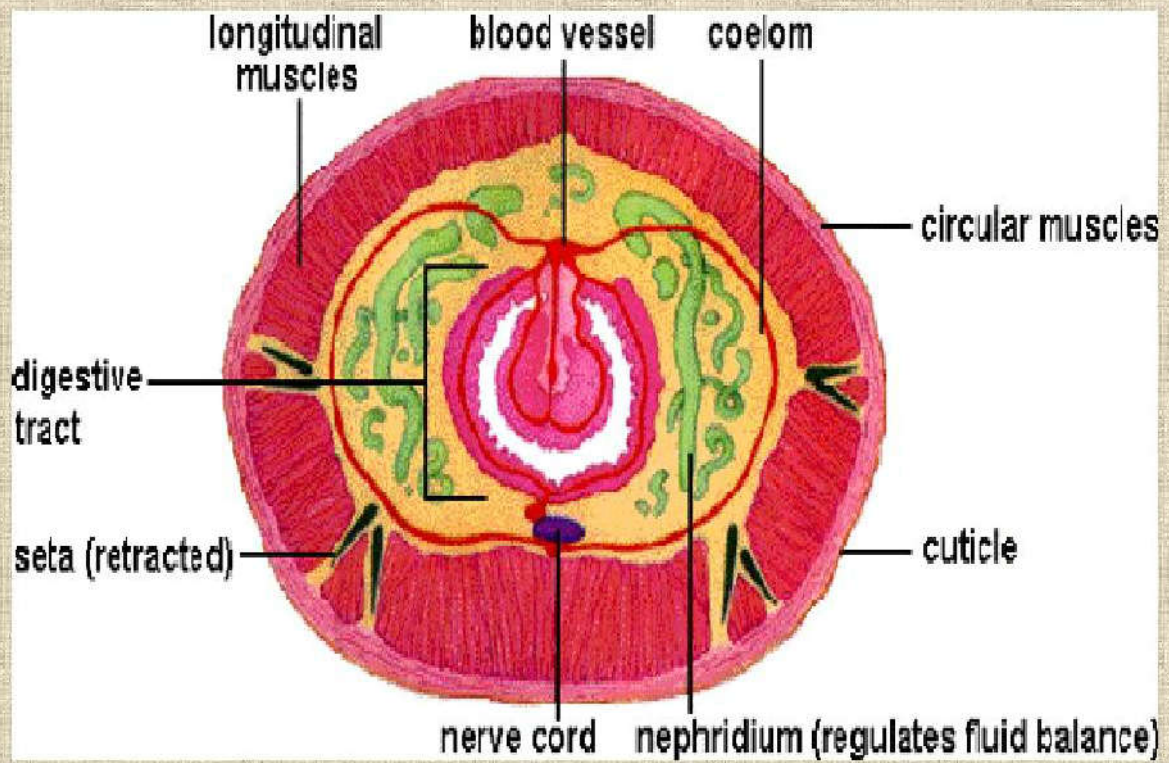
首次出现原始附肢——疣足 (parapodium)





真体腔出现的重要意义

- 体腔间隔在内脏和体壁之间使两者能独立运动；
- 体腔内充满体腔液，具有流体静力骨架的作用；
- 体腔是内脏器官活动的软枕，对器官活动有保证和促进作用；
- 体腔内的液体在器官运动时有润滑作用，同时又是物质交流的媒介；
- 体腔有伸缩性，对机体整体运动，以及为动物从幼体到成体各器官的发展壮大留下余地。

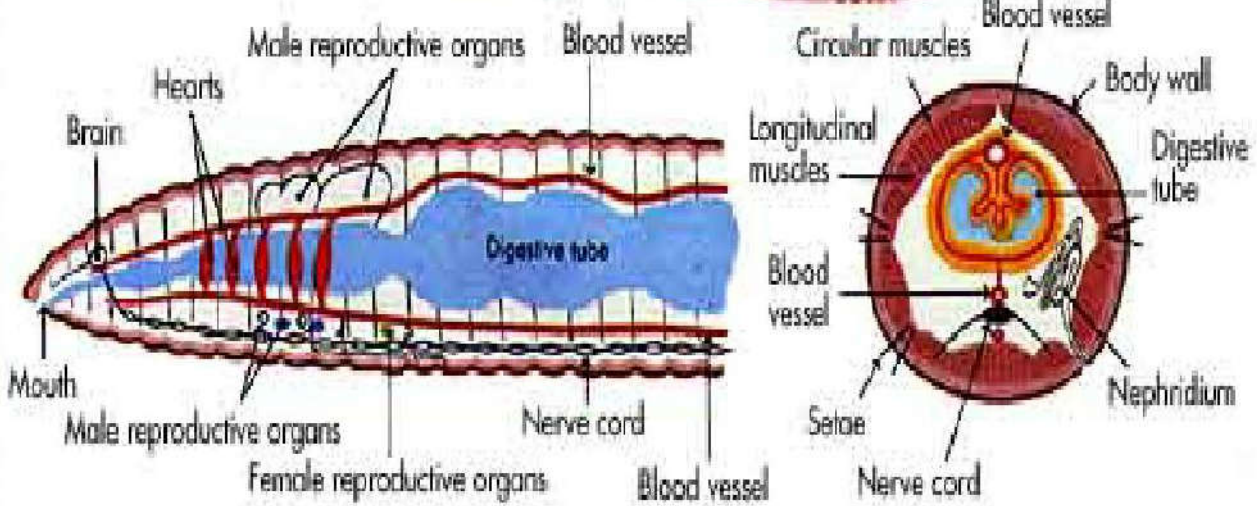


Body cavity of earthworm

closed circulateion system

闭管循环系统有动、静脉和毛细血管的分化，血液自始至终均在密闭的血管中流动（蛭纲除外）。

- **Dorsal aorta (背大动脉), from rear to front**
- **Ventral aorta (腹大动脉), from front to rear**
- **Running vessels serve as a heart**
- **Oxygen is carried in combination with respiratory pigments(呼吸色素), which are usually dissolved in the plasma rather than in blood cells.**
- **Blood may be colorless, green, or red**



- **feeding and digestive system**

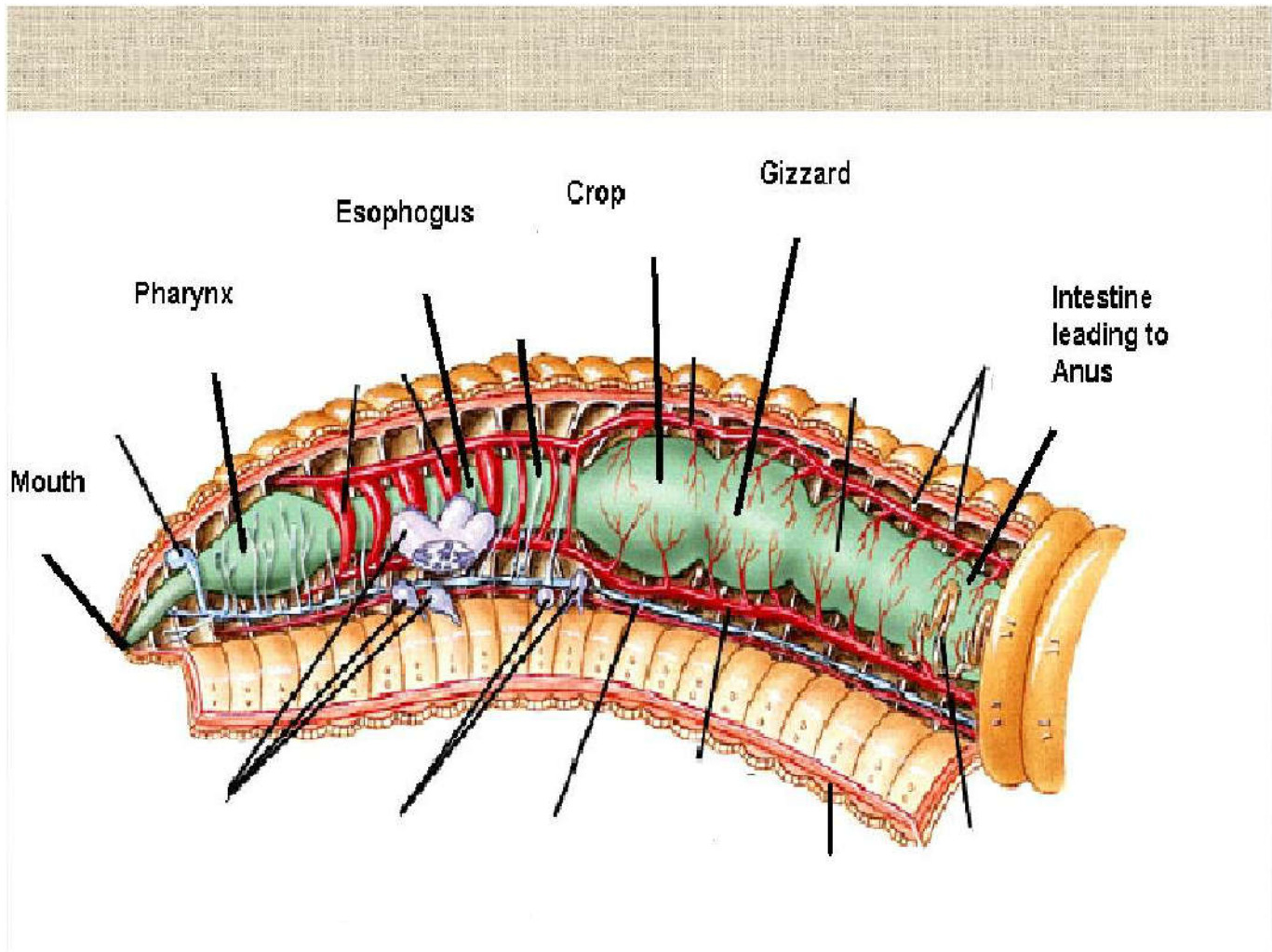
- **Complete digestive tract, some specialization**

- **crop and gizzard**

- 盲囊，盲道，以增加消化面积，并分泌消化酶

- 消化道有中胚层形成的肌肉层

- 食性与环节动物的生活方式关系密切。



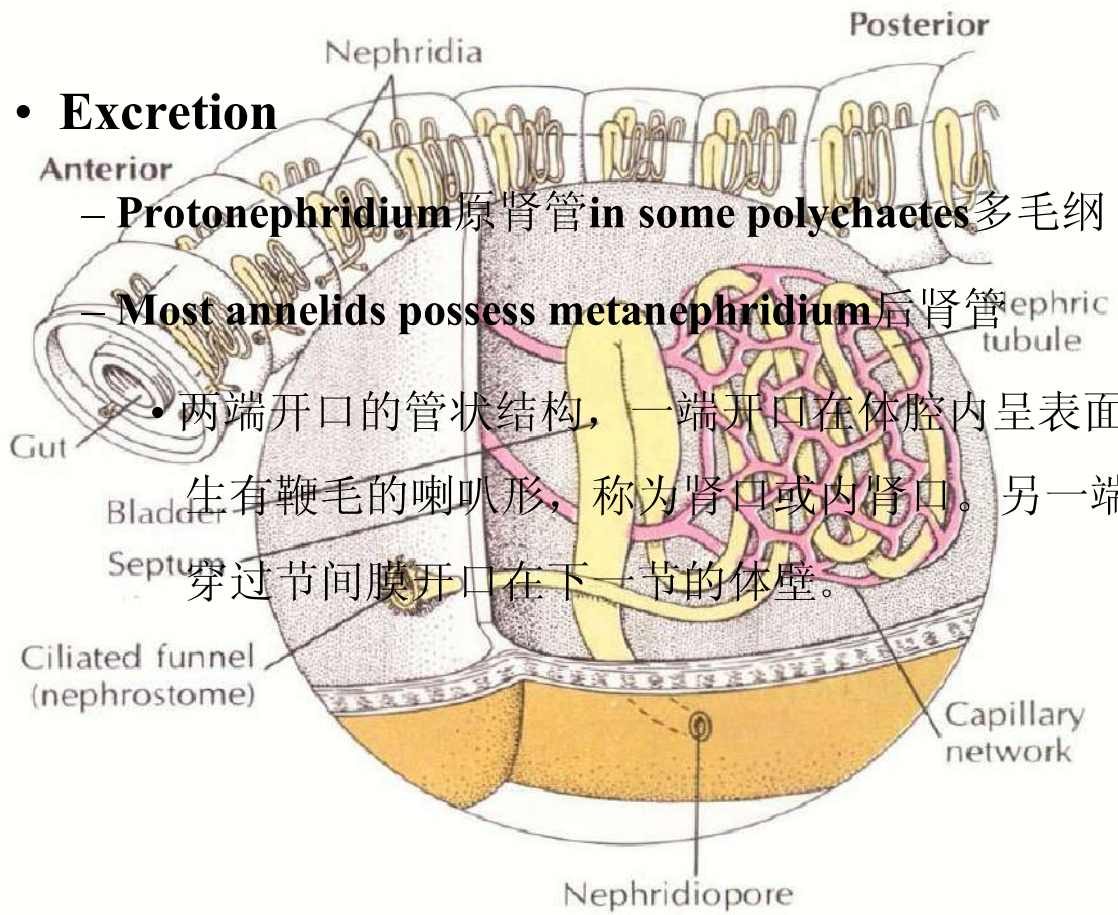
- Some polychaetes are predator, other are herbivores. They use their paired jaws to prey and tear food.
- Some are deposit-feeding which extract organic matter from the sediments, the organic matter is digested, and the inorganic particles are passed through the intestine and released.

• **Excretion**

– **Protonephridium** 原肾管 in some polychaetes 多毛纲

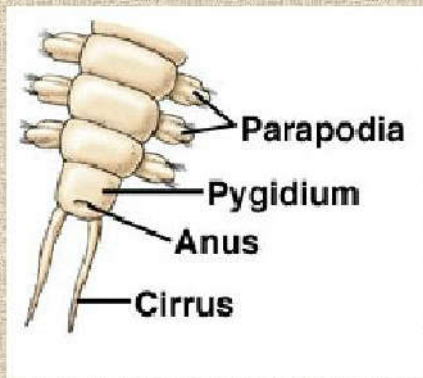
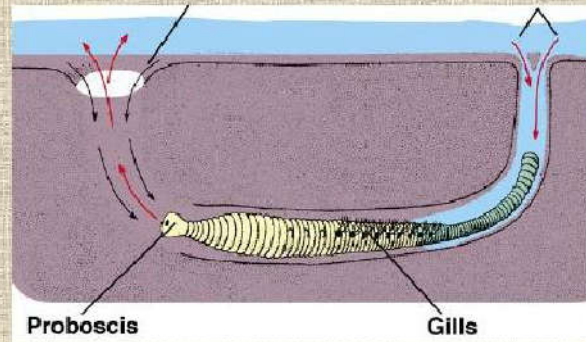
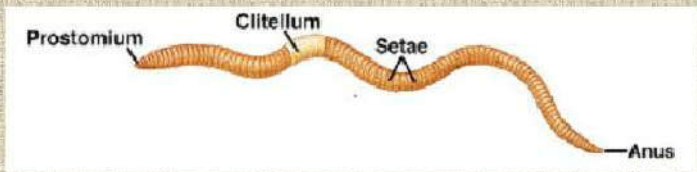
– **Most annelids possess metanephridium** 后肾管

• 两端开口的管状结构，一端开口在体腔内呈表面生有鞭毛的喇叭形，称为肾口或内肾口。另一端穿过节间膜开口在下一节的体壁。



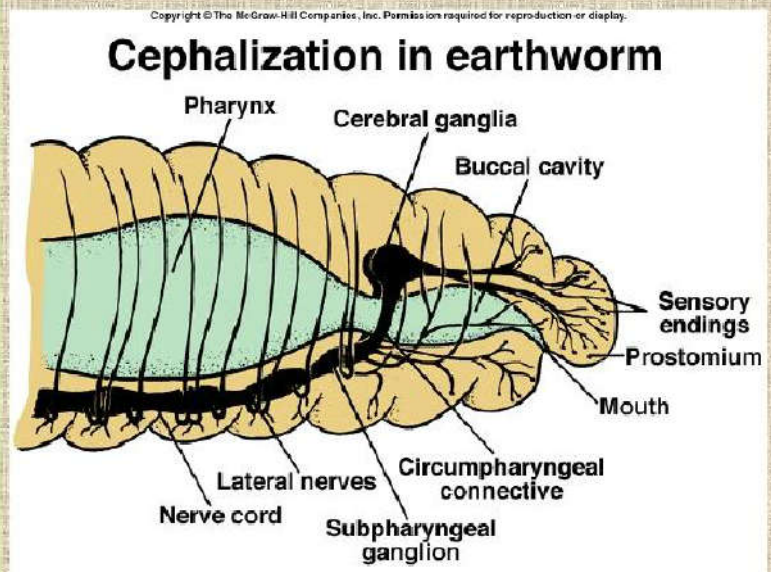
Respiration

- across body surfaces
- some have gills
- some use parapodia



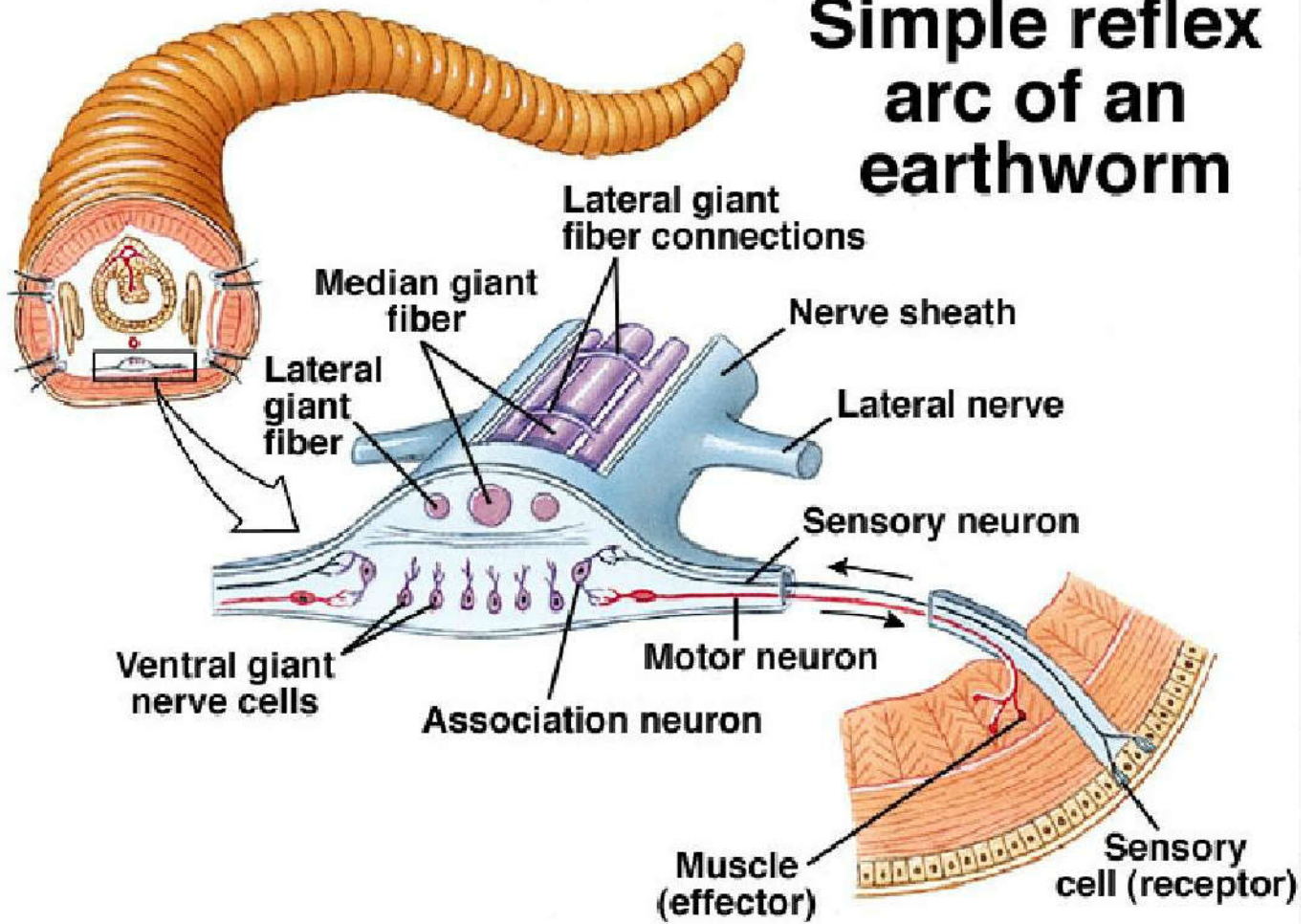
Nervous system

- ladder shaped
- pair of cerebral ganglia
- double ventral nerve cords
- pair of ganglia in each segment
- several sensory structures
 - taste buds
 - tactile organs 触觉器官
 - eyes in some
 - Statocyst 平衡囊



Segmental ganglia 神经节 are responsible for coordinating swimming and crawling in isolated segments. (head is not necessary for coordinated movements)

Simple reflex arc of an earthworm



Reproduction and development

– Reproduction usually sexual

- Sexual forms dioecious and monocious
- Protostome development
- Spiral cleavage
- larva – trochophore 担轮幼虫; Some have direct development
- asexual reproduction
 - a) budding in some
 - b) fragmentation (auto and otherwise)
 - c) regeneration highly developed

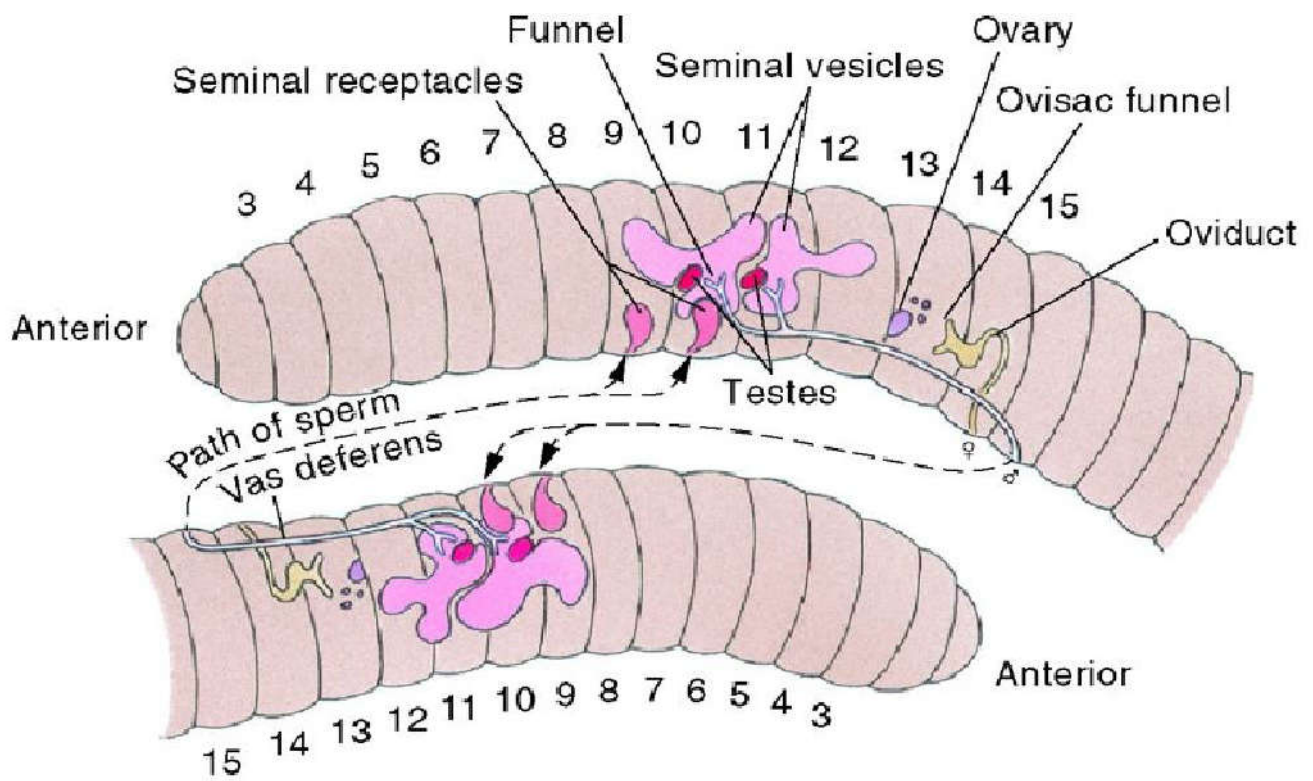
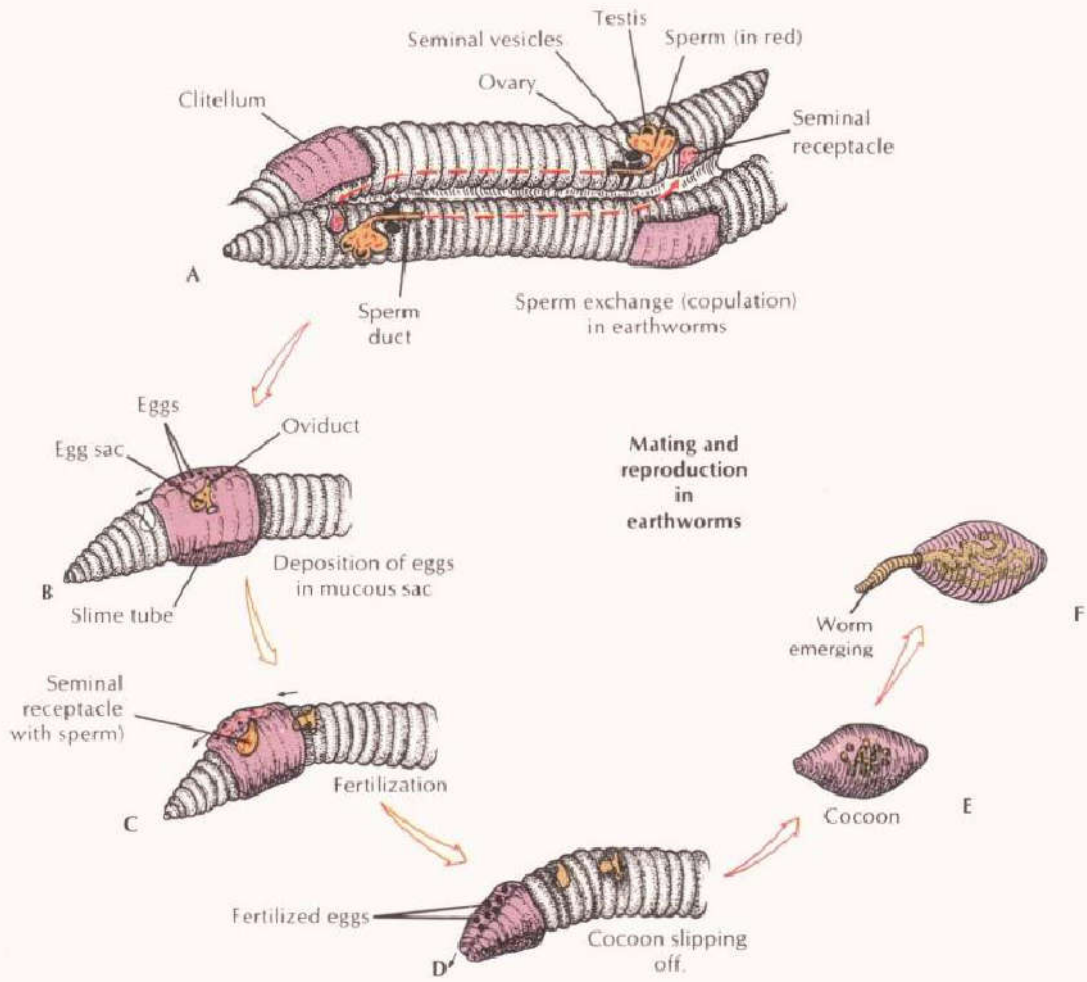


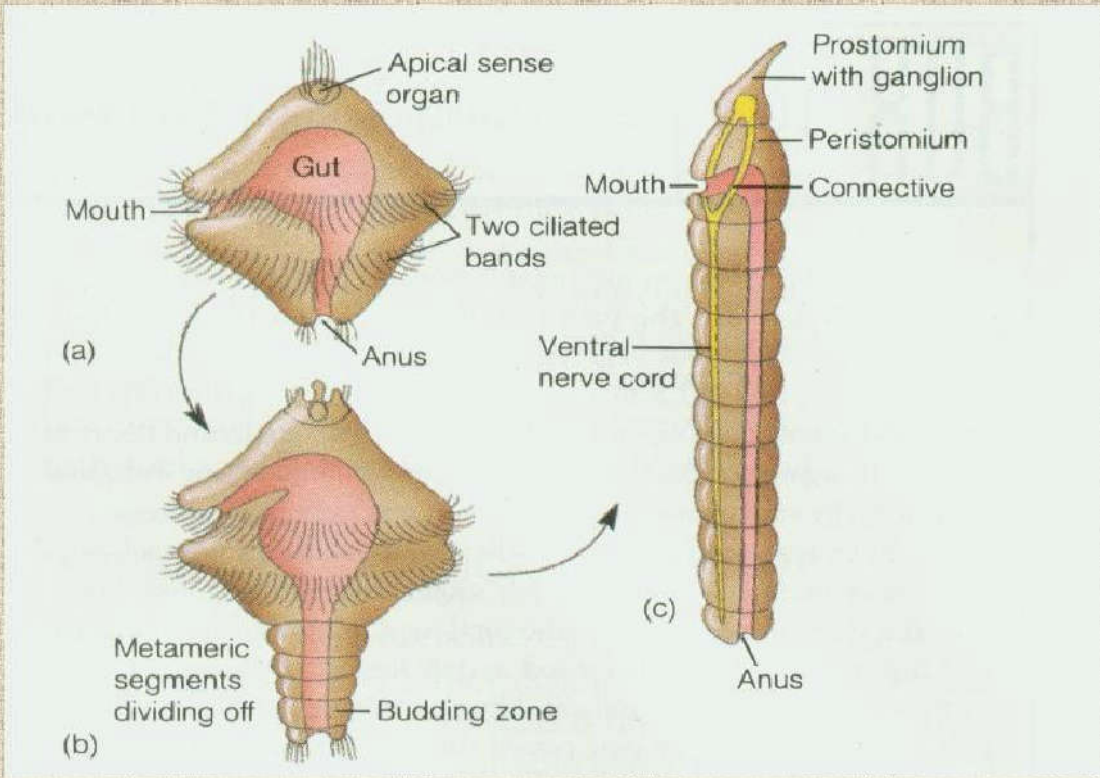
FIGURE 13.15

Earthworm Reproduction. Mating earthworms, showing arrangements of reproductive structures and the path sperm take during sperm exchange (shown by arrows).

Mating of earthworms







环节动物的主要类群

环节动物门的分纲

| 类群 | 生活环境 | 运动器官 | 已知种类数 | 发育 | 生殖环带 |
|--------------------|----------|----------|--------|----------------|------|
| 多毛纲 Polychaeta | 海洋 | 疣足, 刚毛多 | 17000种 | 间接发育 有担轮幼虫期 | 无 |
| 寡毛纲 Oligochaeta | 陆地 淡水 | 无疣足, 刚毛少 | 6700种 | 直接发育 | 有 |
| 蛭纲 Hirudinea | 淡水 湿地 | 无疣足和刚毛 | 500种 | 直接发育 半寄生 | 有 |



Class Polychaeta

- **Make up 2/3 of phylum**
 - 10,000 + species
 - 1mm to 3 m long
- **well-differentiated head**
 - ;
- **parapodia**
- **most primitive annelids;**
ancestral to other two
classes
- **almost all are marine,**
few freshwater species



多毛类头的分化

- **differentiated head**

- **Tentacles**

- **first segment**

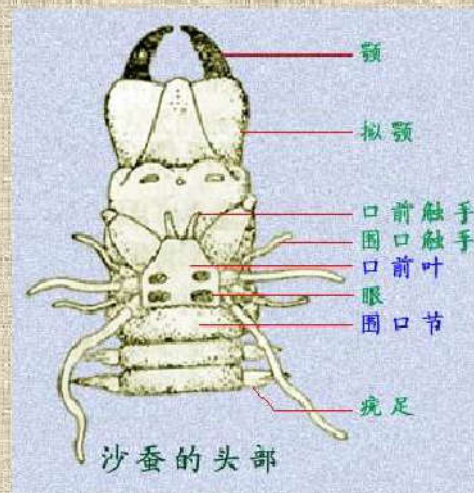
- **Prostomium** 口前叶

- **Peristomium** 围口叶

- **Mouth**

- **Palps**

- **eyes**

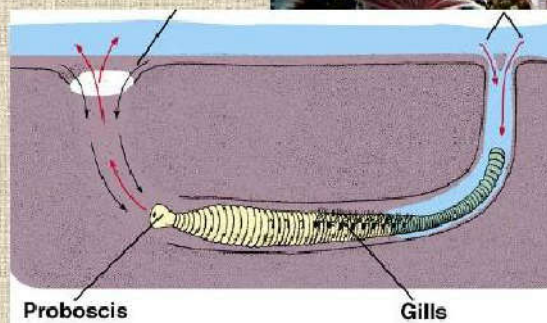


Polychaet Ecological Types

- free living- all are predators



- tube dwelling- all are filter feeders
 - secrete their own tube
 - burrow into substrate



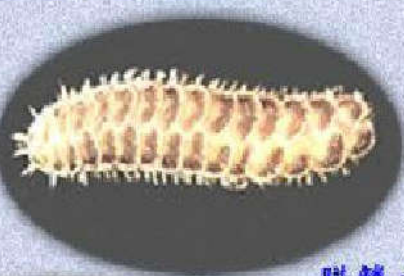
自由生活的多毛类 (游走类)



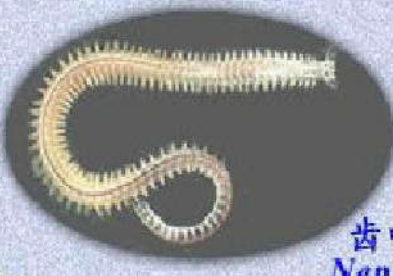
神须虫 *Mysta* sp.



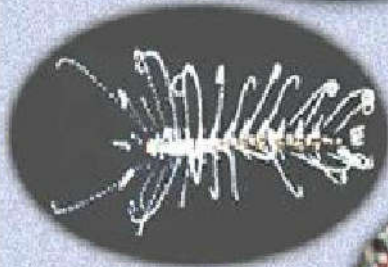
沙蚕 *Nereis* sp.



腊鳞虫
Lagisca sp.



齿吻沙蚕
Nephtys sp.



裂虫 *Syllis* sp.



鳞沙蚕
Aphrodita sp.



仙虫
Amphinome sp.

在海底泥沙表面爬行或钻穴生活，常捕捉小动物为食；头部具眼点和触手，疣足发达。



管栖生活的多毛类 (隐居类)

常生活于泥质或石灰质栖管中，过滤取食，身体前端常形成羽状触手冠，体表常生有发达的鳃。



龙介虫 *Serpula* sp.

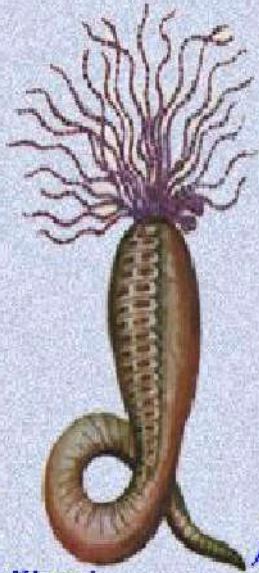


纓鳃虫 *Sabella* sp.

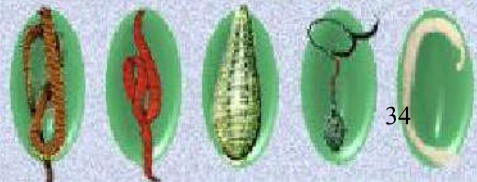
巢沙蚕 *Diapatra* sp.



巴西沙蚕 *Arenicola brasiliensis*

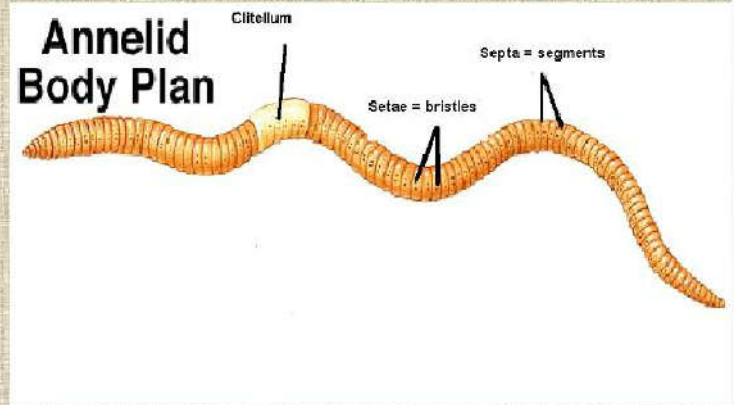


扁蚕虫 *Loimia medusa*



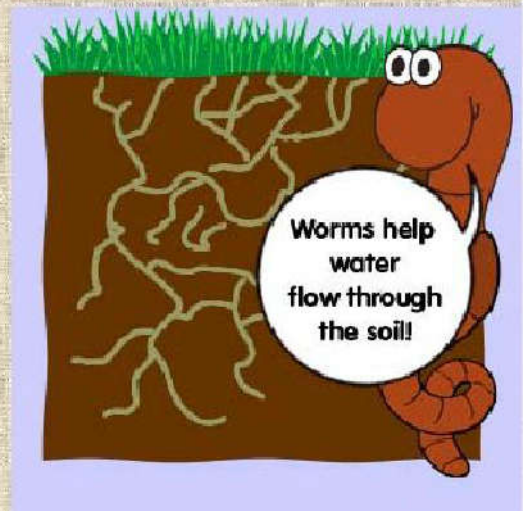
Class - Oligochaeta

- Terrestrial or Freshwater
 - 3,000 species
- setae few in numbered
- No distinct head
- Clitellum 环带- present at all times
 - Used in copulation 交配
 - Cocoon 蚓茧 production

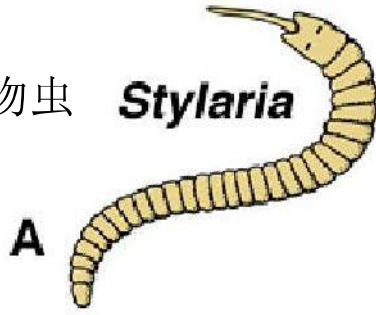


*Can you believe:
it is estimated that nearly 40 tons of soil per acre
per year pass through earthworm bodies.*

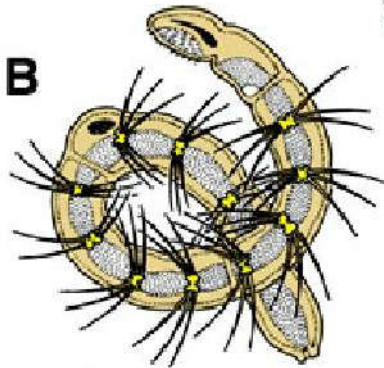
- Earthworms eat their way through the soil, extracting nutrients as the soil moves through the alimentary canal
 - Which helps till the earth, making earthworms valuable to farmers



尖头杆吻虫 *Stylaria*

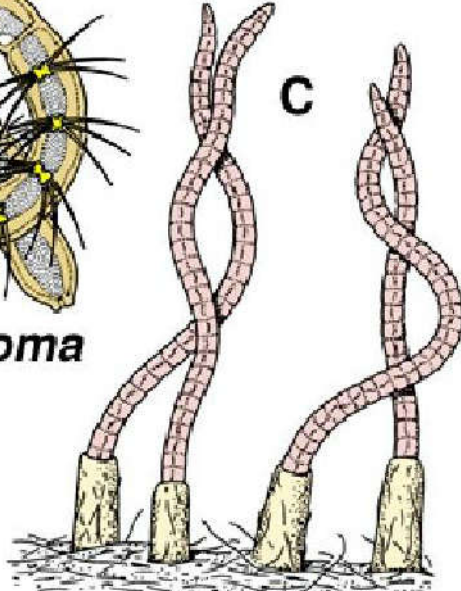


Some freshwater oligochaetes

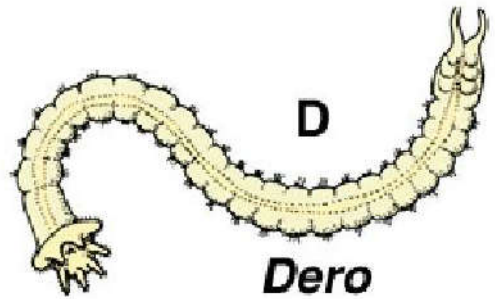


Aeolosoma

颚体虫

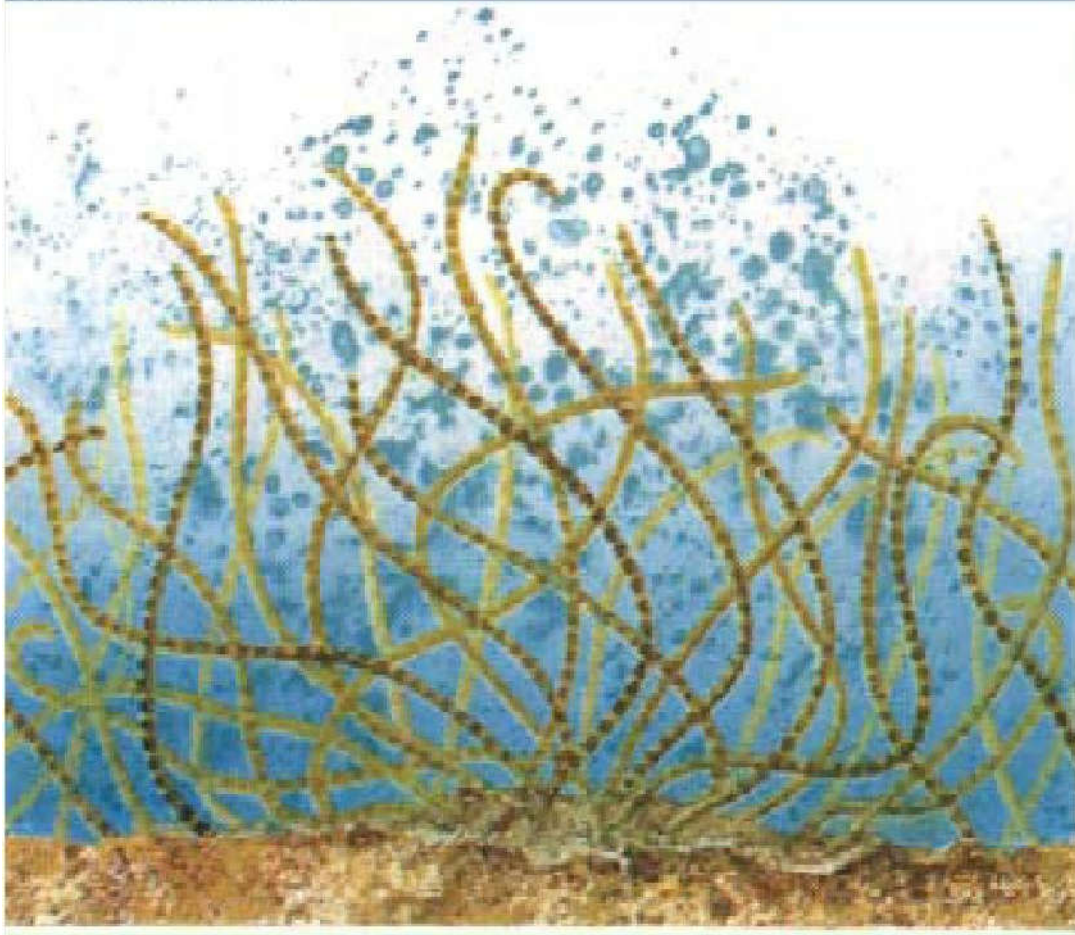


Tubifex 颤蚓



Dero

水生蚯蚓



水蚯蚓为一类在淡水水域底栖生物，生活于底泥内营造的栖管中，在有机质丰富的水域常形成高密度，为水环境有机污染的指标生物。³⁸

Class - Hirudinea

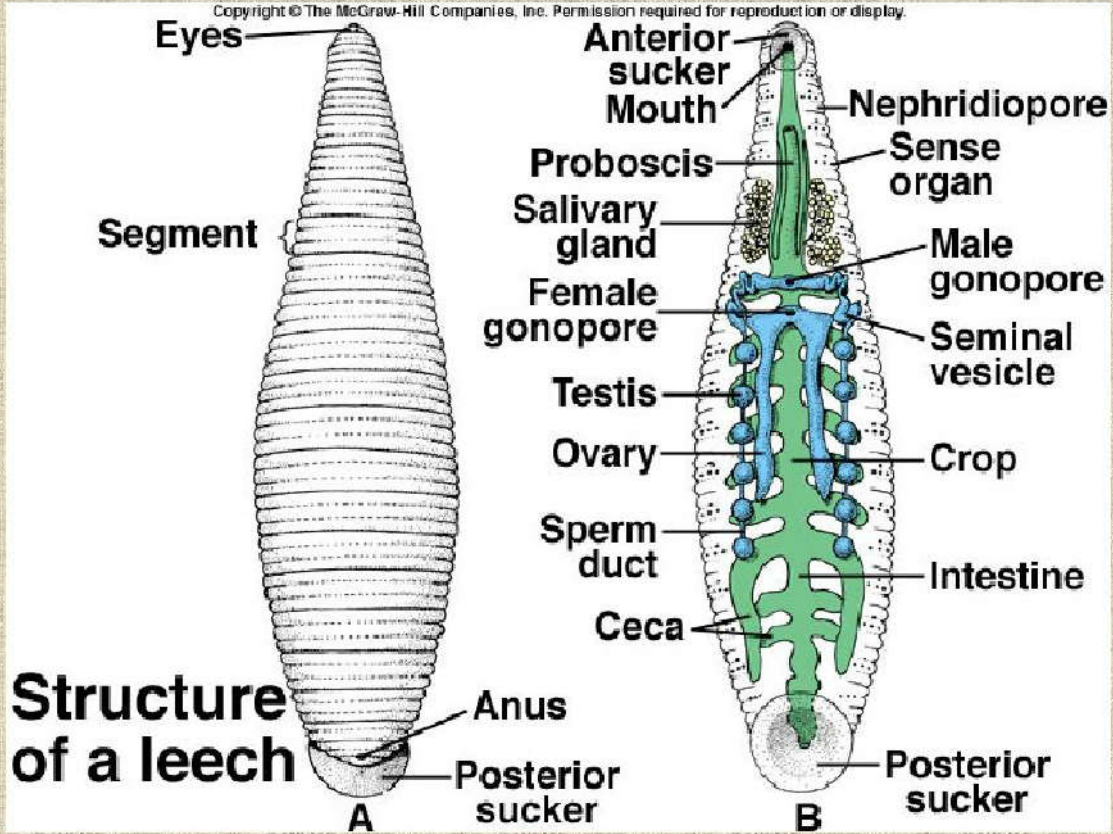
- Freshwater or terrestrial, 500 species
- Have suckers 吸盘
- Segmentation fixed (34 segments)
- Clitellum 环带 only during season
- Digestive tract
 - large crop
 - Anticoagulant (Produce in saliva called HIRUDIN 蛭素)
- Medically important





- **coelom filled with tissue in most**
- **no setae**
- **½ of species ectoparasitic** 外寄生;
Leeches – parasites ☹️ ☺️.





Leeches Used in Medicine



Successful reattachment of severed ear, as blood continued to flow and carry nutrients to the damaged region

Evolutionary relationship

- **The origin of this diverse phylum occurred at least as early as Precambrian times, more than 600 million years ago.**
- **As many zoologists believe, the annelids evolved from ancient flatworm stock.**

- 软体动物、环节动物和原始节肢动物的早期发育十分相似，三门的共同祖先被认为是某些扁平的蠕虫。
- 多数环节动物起源理论认为多毛类是最早的分节蠕虫；寡毛类是适应与蠕动和穴居的动物，水蛭可能是寡毛类发展而来的。

Summary and homework

| | | |
|---------------------------|---------------------------|-------------------------|
| PHYLUM | CLOSEST RELATIVE | SYMMETRY |
| | | |
| TISSUE LAYERS | BODY CAVITY | DIGESTIVE SYSTEM |
| | | |
| CIRCULATORY SYSTEM | RESPIRATORY SYSTEM | EXCRETORY SYSTEM |
| | | |
| NERVOUS SYSTEM | SKELETAL SYSTEM | LOCOMOTION |
| | | |
| SEGMENTATION | APPENDAGES | HABITAT |
| | | |