

References (Textbook - pages 543-544, Lab Manual pages 177-179)

Characteristics

1. Annelids have *bilateral symmetry*.
2. They are *triploblastic*.
3. Possess a *tube within a tube* body plan.
4. The body is *segmented* as shown by the rings that encircle the body. This is called *segmentation* or *metamerism*. Each segment is called a *somite*.
5. Annelids are true *coelomates*. The well-developed and fluid filled *coelom* is divided internally by partitions called *septa* and serves as a *hydrostatic skeleton*.
6. The *hydrostatic skeleton* provides structure against which muscles can pull and allows improved movement of individual body segments during locomotion.
7. A thin *cuticle* covers the body of annelids and *setae* are usually present and used for locomotion. *Setae* are *bristles* that anchor the worm and help it move.
8. *Organs* are *well developed* and *organized* in to definite *systems*. *Nervous*, *circulatory*, *excretory*, and *muscular* systems are *segmentally* arranged.
9. The *circulatory system* is a *closed* system.
10. Annelids are *hermaphroditic* and reproduction is *sexual*.
11. *Most* species are *marine*, but some live in *freshwater* and some are *terrestrial*.

Examples

1. Examples include clamworm or sandworm (*Nereis*), lug worm (*Arenicola*), earthworm, and leeches (*Hirudo*).
2. *Leeches* are *blood-sucking* parasites that inhabit *freshwaters*. They have *neither setae* nor *appendages*.

Anatomy and Physiology (*Lumbricus* (earthworm) as representative example)

We will discuss the anatomy and physiology of annelids using the *earthworm* (*Lumbricus*) as an *example*. To help with our discussion, refer to the handout from page 179 of our lab manual and the handout of figures 165 and 167 from another zoology textbook (not our textbook).

Structure and Habits

1. Earthworms *live* in the soil and they *vary* their *depth* depending on the *moisture* and *humus* content. In *winter* they are usually *below* the *frost line*.
2. The *burrow* in *loose soil* by *pushing* soil *aside* and in *compact soil* they *eat* their way through.
3. Their *food* is mainly *decayed organic matter*, bits of leaves and vegetation and animal matter.
4. Their *castings* have *5* times more *nitrogen* (N) , *7* times more *phosphorus* (P) and *11* times more *potassium* (K) than *topsoil* and these elements are *immediately available* to plants as *nutrients*.
5. They inhabit *burrows* covered by grass during the *day* and *emerge* during the *night*. However they leave their tail in their borrow in case they need to make a quick retreat.
6. Earthworms are *bilaterally symmetrical* and *segmented*. Their *ventral side* is *flatter* than the *rounded dorsal* side.
7. The *anterior* end *tapers* to a point and the *posterior* end is more *blunt*.
8. The *body* is covered by a *thin cuticle* and to *survive*, their body must remain *moist*.
9. Most *segments* bear *4 pair* of *bristles* or *setae* (B4).

Digestive System

1. The **mouth** (A2) is at the anterior end just below the lobelike projection called the **prostomium**(A1).
2. In the anterior part of the body the **alimentary canal** (another name for **digestive canal**) is differentiated into the following regions **mouth** and **buccal cavity** (A2), **pharynx** (A4), **esophagus** (A6), **crop** (A9), **gizzard** (A10), and **intestines** (A11).
3. From **segment 19**, the **intestine** continues without modification to the **anus** (C5).
4. Food is taken into the **mouth** by **suction** and **passes** through the **pharynx** to the **esophagus**.
5. In the **esophagus**, **calciferous glands** secrete **CaCO₃** (calcium carbonate) into **food** that tends to neutralize **organic acids** present.
6. Food is then passed to the **crop**, which is a **thin walled storage organ**. What other animal has a crop???
7. From the **crop**, food passes into the **thick walled muscular gizzard** where **food** is thoroughly **ground**. What other animal has a gizzard??
8. The **ground food** is then passed to the **intestine** where **most** of the **digestion** and **absorption** occur.
9. The **dorsal surface** of the **intestine** has an **expanded region** called the **typhlosole** (B2) that **increases** the **area of absorption** and secretion. (Figure 30.7 on page 543 of our textbook shows this feature the best.)
10. **Secretions** contain **digestive enzymes** that break down basic foods that are **absorbed** by the **intestinal wall**.
11. **Undigested material** is **voided** through the **anus** in the form of **castings**.

Excretory System

1. There is a **pair** of coiled tubular **nephridia** (B8) in **each** body **segment** (**somite**).

2. A *ciliated funnel* collects *wastes* from the *coelom* (B3) in an adjacent segment and *transports* wastes to the *segment* that contains the *nephridia*. (draw this on blackboard) – *Chart*
3. *Wastes* are then *passed* to the *outside* via a *nephridiopore*.

Reproductive System

1. Earthworms are *hermaphroditic*.
2. The male organs include the *testes* (somites 10 and 11), *seminal vesicles* (A14), and *vas deferens* (*sperm ducts*) (A7).
3. The female organs are the *ovaries* (somite 13), *oviducts* (A8), and *seminal receptacles* (A13).
4. *Copulation* occurs between worms when they *lie ventral surface to ventral surface* with their *heads* pointing in *opposite directions*.
5. The *clitellum* (C4) a smooth girdle-like area around the worm body, *secretes mucus* that holds the *worms together*.
6. This *mucus* also provides *moisture* through which *sperm swim* from one body to the other where they are *stored* in the *seminal receptacles* (A13).
7. After the worms *separate*, the *clitellum* of each *produces a slime tube* or *cocoon* that is *moved* over the *anterior end* of each worm by *muscular contractions*. (Sort of like taking your tee shirt off).
8. As the *slime tube passes*, *sperm* from *seminal receptacles* received during *copulation* and *eggs* from the *female pores* are *deposited* and *fertilization occurs*.
9. The slime tube or *cocoon protects* worms as they develop into juveniles. There is no larval stage.

Respiratory System

1. There is *no specialized system*. The *moist skin* layer permits *diffusion* of *oxygen* (O₂) and *carbon dioxide* (CO₂).

Circulatory System

1. The main *collection vessel* is the median dorsal vessel called the *dorsal aorta* (A15). It runs *above* the *alimentary canal* from the *pharynx* to the *anus*.
2. Blood *flows forward* or towards the *anterior* end of the worm in the *dorsal aorta*.
3. The main *distribution vessel* is the medial *ventral vessel*.
4. There are *5 pair* of enlarged *transverse vessels* (hearts) (A5).
5. These are often called *aortic arches* and *connect dorsal* and *ventral vessels* and *force blood* through *ventral vessels*.
6. Blood flows through *aortic arches* down to the *ventral vessel* and then *towards* the *posterior* end of the *worm*.

Muscular System

1. The *muscular system* consists of a *circular muscle* (B6) and a *longitudinal muscle* (B7).

Nervous System

1. There is a pair of *cerebral ganglia* called the *brain* (A3) and a solid *ventral nerve cord* (A12,B5).

Final Summary - Segmentation is evidenced by 6 characteristics of Annelids

1. body rings
2. coelom divided by septa
3. setae on most segments
4. ganglia and lateral nerves in each segment
5. nephridia in most segments
6. branch blood vessels in each segment