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Pictures: Modern Biology, HoltThe following is a classification of a species in the earthworm family Lumbricidae. This common species is Lumbricus terrestris also known as the night crawler or dew worm. In this article, we will cover earthworm anatomy and an introduction on dissecting an earthworm.Phylum Class Family Genus Species Annelida Oligochaeta Lumbricidae Lumbricus terrestrisObjectives:In this earthworm dissection guide, you will learn to: Describe the appearance of various organs found in the earthworm. Name the organs that make up various systems of the earthworm.Materials: Safety goggles, dissecting pins, gloves, forceps, lab safety apron, scissors, paper towel, scalpel, water, dissecting probe, preserved earthworm, hand lens, dissection tray.Purpose: In this lab, you will dissect an earthworm in order to observe the external and internal structures of earthworm anatomy, whilst following the all-important lab safety procedures.This guide is perfect for students in colleges or universities.Can you do my homework? Background: Among the most familiar invertebrate animals are the earthworms, members of the phylum Annelida. The word annelida means ringed and refers to a series of rings or segments that make up the bodies of the members of this phylum. Internally, septa, or dividing walls, are located between the segments. External segments are called metameres. There may be more than 100 segments in an adult worm. The clitellum is a swelling of the body found in sexually mature worms and is active in the formation of an egg capsule, or cocoon. This is the earthworm reproductive organ. Eggs are produced in the ovaries and pass out of the body through female genital pores. Sperm are produced in the testes and pass out through tiny male genital pores. During mating, sperm from one worm travel along the sperm grooves to the seminal receptacles of another worm. Fertilization of the eggs takes place outside the body as the cocoon moves forward over the body, picking up the eggs of one worm and the sperm of its mate. The pumping organs of the circulatory system are five aortic arches. Circulatory fluids travel from the arches through the ventral blood vessel to capillary beds in the body. The fluids then collect in the dorsal blood vessel and reenter the aortic arches. The earthworm takes in a mixture of soil and organic matter through its mouth, which is the beginning of the digestive tract. The mixture enters the pharynx, which is located in segments 16. The esophagus, in segments 613, acts as a passageway between the pharynx esophagus and the crop. The crop stores food temporarily. The mixture that the earthworm ingests is ground up in the gizzard. In the intestine, which extends over two-thirds of the body length, digestion and absorption take place. Soil particles and undigested organic matter pass out of the worm through the rectum and anus. The nervous system consists of the ventral nerve cord, which travels the length of the worm on the ventral side, and a series of ganglia, which are masses of tissue containing many nerve cells. The nerve collar surrounds the pharynx esophagusand consists of ganglia above and below the pharynx. Nervous impulses are responsible for movement and responses to stimuli. Each segment contains an enlargement, or ganglion, along the ventral nerve cord. Excretory functions are carried on by nephridia, which are found in pairs in each body segment. They appear as tiny white fibers on the dorsal body wall. The earthworm has no gills or lungs. Gases are exchanged between the circulatory system and the environment through the moist skin. External Earthworm AnatomyWhat is the external anatomy of an earthworm?The external body of an earthworm is well adapted for living in the soil, similar to the external structure of other insects. The front or head of the worm is called the anterior. The very first section of the anterior contains the mouth and prostomium. The prostomium is a kind of lip which is located on the front of the mouth. Earthworms lose moisture and breathe via their skin. They have light-sensitive cells across their external structure, which are scattered around the skin. These cells give earthworms the ability to detect changes in lighting, and these cells are also sensitive to chemicals and touch. The body is separated in segments which resemble rings. Each segment has a number of bristly hairs attached to it, which helps the earthworm to move around. On mature earthworms, you will find a saddle or glandular ring called a clitellum. When an earthworm has mated, the clitellum will secrete a sack of eggs. The final segment of an earthworm contains the anus which is where waste is secreted.Dissection Guide: 1. Put on safety goggles, gloves, and a lab apron.2. Place earthworm in the dissecting tray & rinse off the excess preservative. Identify the dorsal side, which is the worms rounded top, and the ventral side, which is its flattened bottom. Turn the worm ventral side up, as shown in the earthworm anatomy diagram below.3. Use a hand lens as you observe all parts of the worm, externally and internally. Locate the conspicuous clitellum, a saddle-like swelling on the dorsal surface. The clitellum produces a mucus sheath used to surround the worms during mating and is responsible for making the cocoon within which fertilized eggs are deposited. The anterior of the animal is more cylindrical than the flattened posterior and is the closest to the clitellum. The ventral surface of the earthworm is usually a lighter colour than the dorsal surface. The mouth is located on the ventral surface of the first segment while the anus is found at the end of the last segment. Find the anterior end by locating the prostomium (lip), which is a fleshy lobe that extends over the mouth. The other end of the worms body is the posterior end, where the anus is located. 4. Locate the clitellum (the reproductive organ), which extends from segment 33 to segment 37. Look for the worms setae, which are the minute bristle-like spines located on every segment except the first and last one. Run your fingers over the ventral surface of the earthworms body. You should be able to feel bristle-like setae used for locomotion5. Refer again to the diagram of the ventral view of the worm to locate and identify the external parts of its reproductive system. Find the pair of sperm grooves that extend from the clitellum to about segment 15, where one pair of male genital pores is located. Look also for one pair of female genital pores on segment 14. There is another pair of male genital pores on about segment 26. Try to find the two pairs of openings of the seminal receptacles on segment 10. Note: These openings are not easy to see.Internal Earthworm AnatomyWhat is the internal anatomy of an earthworm?At the very front of an earthworm, you will find the pharynx. Earthworms push the pharynx from inside their mouths to grab hold of things. They pull food into their mouths and then soak it in saliva. As earthworms dont have teeth, they have to use strong muscles called a gizzard, along with sand and soil, to grind up the food they are eating. Once the food has been fully ground up, it travels to the intestines where it is further broken down so that it can be absorbed. The majority of earthworms have five aortic arches which are like hearts and these move around their bodies. A large blood vessel runs across the top of the earthworm and this is called the dorsal blood vessel. This vessel contracts and pumps blood around to the aortic arches. There is a further blood vessel on the lower side of the earthworm which is called the ventral blood vessel. An earthworm has a very simple nervous system. A ventral nerve cord which runs the entire length of its body connects to the cerebral ganglion, which is an earthworms brain. Each segment is connected to the cord so that they can sense light and touch, and can move. Each segment is also wrapped in circular muscles, which contract to help the earthworm move.Continued: Dissection ProcedureHint: Position your preserved earthworm dorsal side up and pin it down through the first segment and then again further back behind the clitellum. Cut a slit in the dorsal surface near the posterior pin. Using fine scissors extend the cut forward to the first segment. Be careful not to cut too deep as to affect the internal organs. Starting at the first segment, cut the septa (thin membranes) that internally divide the segments, so the skin can be laid flat. Use additional pins to hold the integument open and expose the internal organs. Continue to lay the skin back until you have uncovered a centimeter or so of the intestine. 6. Turn the worm dorsal side up. Using a scalpel and scissors, make a shallow incision in the dorsal side of the clitellum at segment 33. CAUTION: Scalpels and scissors are very sharp. Report any cuts to your teacher. Using the forceps and scalpel, spread the incision open, little by little. Separate each septum from the central tube using a dissecting needle, and pin down each loosened bit of skin. Continue the incision forward to segment 1.7. Use the diagram below to locate and identify the five pairs of aortic arches, or hearts. Then find the dorsal blood vessel. Look for smaller blood vessels that branch from the dorsal blood vessel. Digestive System The earthworm is an example of a foraging herbivorous annelid, obtaining food by eating its way through the soil and extracting nutrients from the soil as it passes through the digestive tract.Hint: Starting at the anterior end, locate the muscular pharynx (food ingestion). This is followed by a tube-like esophagus which terminates in a crop (the wider organ) which serves as a storage stomach. Posterior to the crop you will find the gizzard. Gently press on the crop and gizzard to test their firmness. While the crop is soft and thin, the gizzard is muscular (soil is ground up and churned within the gizzard). The gizzard is followed by a long intestine in which both digestion and absorption occur. Undigested material is voided through the anus.8. Locate the digestive tract, which lies below the dorsal blood vessel. Refer to the diagram above to locate the pharynx, esophagus, crop, gizzard, and intestine. 9. To find organs of the nervous system, push aside the digestive and circulatory system organs. Use the diagram below to locate the ventral nerve cord. Trace the nerve cord forward to the nerve collar, which circles the pharynx. Find one pair of ganglia under the pharynx and another pair of ganglia above the pharynx. The ganglia above the pharynx serve as the brain of the earthworm. 10. The worms excretory organs are tiny nephridia. There are two in every segment. Use the preceding diagram to locate some nephridia.11. Use the diagram below to locate and identify a pair of ovaries in segment 13. Look for two pairs of tiny testes in segments 10 and 11. To find these organs, you will again have to push aside some parts already dissected.12. Dispose of your materials according to the directions from your teacher in your college or university.13. Clean up your work area and wash your hands before leaving the lab.Earthworm worksheetEarthworm factsBACK Examine your earthworm and determine the dorsal and ventral sides. Locate the clitellum which is on the anterior end of the worm. Locate the mouth of the worm on the far anterior end of the worm The openings toward the anterior of the worm are the sperm ducts The openings near the clitellum are the genital setae. Locate the dark line that runs down the dorsal side of the worm, this is the dorsal blood vessel. The ventral blood vessel can be seen on the underside of the worm, though it is usually not as dark. Locate the worm's anus on the far posterior end of the worm Note the swelling of the earthworm near its anterior side, this is the clitellum. Label the earthworm pictured: A = _____ B = _____ C = _____ D = _____ Internal Anatomy 1. Place the specimen in the dissecting pan DORSAL side up. 2. Locate the clitellum and insert the tip of the scissors about 3 cm posterior (behind the clitellum). 3. Cut carefully all the way up to the head. Try to keep the scissors pointed up, and only cut through the skin. 4. Spread the skin of the worm out, use a needle to gently tear the septa (little thread like structures that hold the skin to organs below it) 5. Place pins in the skin to hold it apart, angle the pins out so that they are not in your way. Reproductive System The first structures you probably see are the seminal vesicles. They are cream colored and located toward the anterior of the worm. These are used for producing sperm. Use tweezers to remove these white structures from over the top of the digestive system that lies underneath it. Circulatory system The dorsal blood vessel (X) appears as a dark brownish-red vessel running along the intestine. The heart or aortic arches (Y) can be found over the esophagus (just posterior to the pharynx). Carefully tease away the tissues to expose the arches of the heart, the run across the worm.How many aortic arches can you count? _____ The ventral blood vessel (Z) is opposite the dorsal blood vessel, and cannot be seen at this time because the digestive system covers it. Label the diagram (use the letters next to the bold words above) Does the earthworm have a closed or open circulatory system? _____ Digestive System The digestive system starts at the mouth. You will trace the organs all the way to the anus and identify each on the worm. Find the mouth opening, the first part after the mouth is the pharynx, you will see stringy things attached to either side of the pharynx (pharyngeal muscles) . The esophagus leads from the pharynx but you probably wont be able to see it, since it lies underneath the heart . You will find a two structures close to the clitellum. First in the order is the crop , followed by the gizzard . The gizzard leads to the intestine which is as long as the worm and ends at the anus . *Use your scissors to cut open the crop and the gizzard. Which one has the harder exterior? _____ Place in the correct order (number) ____ Anus ____ Crop ____ Mouth ____ Gizzard ____ Esophagus ____ Intestine ____ Pharynx Nervous System Locate the brain at the far anterior region of the worm. It is very tiny and whitish colored. If you can't find it, it is probably because it was destroyed when you cut the worm. You CAN locate the ventral nerve cord by removing the intestines and searching for a white string-like structure that runs the length of the worm and attaches to the brain. Remove the intestines and locate the ventral nerve cord. Lab Analysis (Answer True of False; most of the answers can be found in this worksheet) 1. ____ The brain attaches to the ventral nerve cord. 2. ____ The dorsal side of the worm is lighter than the ventral side.. 3. ____ The clitellum is located toward the anterior end of the worm. 4. ____ The esophagus lies beneath the pharynx 5. ____ Earthworms are hermaphrodites. 6. ____ The ventral nerve cord and the ventral blood vessel are connected. 7. ____ The pale string-like structure running the length of the ventral side of the worm is the blood vessel. 8. ____ An earthworm has fourteen aortic arches. 9. ____ The dorsal blood vessel can be seen from the worm's exterior. 10. ____ Serminal vesicles are part of the worm's digestive system. 11. Label these structures on the image: pharynx, esophagus, crop, gizzard, aortic arches, brain, dorsal blood vessel, seminal vesicles, clitellum Other Resources on Invertebrates Observation of a Live Earthworm- examine an annelid, observe its behavior Label the Anatomy of an Earthworm- image of an earthworm, label its parts Squid Dissection- describes procedure for dissecting a squid and identifying structures

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