

Name: _____

Pre-Lab: Animal Diversity

1) Name one coelomate, one pseudocoelomate, and one acoelomate phylum from the lab on animal diversity.

Coelomate:

Pseudocoelomate:

Acoelomate:

2) Name one phylum from the lab on animal diversity that has a complete digestive tract and one with a gastrovascular cavity (same opening for mouth and anus).

Complete:

Gastrovascular cavity:

3) Name one protostome and one deuterostome phylum from the lab on animal diversity.

Protostome:

Deuterostome:

4) Name one phylum lacking symmetry, one with radial symmetry, and one with bilateral symmetry.

No symmetry

Radial symmetry:

Bilateral symmetry:

Animal Diversity I

Note: Today you will study and compare eight animal phyla. If you still have time, you will also be able to start dissecting either a squid or trout: Animal Diversity II. Next week you can finish the dissections. Keep in mind that this material will be on the laboratory practical exam.

You need to bring copies of your textbook for reference, this is extremely important for this lab.

Objectives:

Describe similarities and differences in the anatomy of representative animals.

Discuss how these similarities and differences may indicate phylogenetic relationships.

Discuss the relationship between body form and lifestyle of the organism.

Understand the relationship of cross sections to the whole organism and the terms used to describe anatomical direction.

Introduction

Phylogeny is the evolutionary history of organisms: their lines of descent, the branching of these lines, and thus the relationships between organisms. Much of our understanding of animal phylogeny has come from comparative studies of the anatomy and embryology of present-day animals. Our concepts concerning their ancestral history and relationships have been extended, refined, and sometimes changed as a result of physiological, cellular, or molecular studies.

Just as our understanding of animal phylogeny benefits from a study of anatomy, our understanding of anatomy is enhanced by an understanding of evolutionary principles. The form and function of all features of an organism are determined by: 1) the selection imposed by the organism's environment, and 2) the genetic/morphological/physiological constraints imposed by the general architecture that the organism's lineage has developed over the course of its evolutionary history. Regardless of their particular phylogenetic group, all living animals have the same basic requirements and must perform the same basic functions. Animals may meet these problems in different ways because of differences in size, structure, and environment.

Taxonomists divide the Kingdom Animalia into two subkingdoms: Parazoa which includes sponges and Eumetazoa which includes all other animals (with a couple of controversial exceptions). Parazoa differ from Eumetazoa in that the former lack true tissues and most have an indeterminate form. Taxonomists further divide Eumetazoa on the basis of morphological characteristics such as body symmetry, type of body cavity (known as the coelom), and basic

embryological difference including the number of germ layers and development of the digestive tract. However, results from research using molecular techniques have started to reform the traditional animal phylogeny based on body form. In many ways the phylogenies agree but in many ways they do not.

Before you begin your observations become familiar with the following characteristics:

Symmetry- Radially symmetrical animals have their body parts arranged around a central axis such that any imaginary slice through the central axis would divide the animal into mirror images. These animals have no right/left nor head/tail; they have an oral (mouth) and aboral (away from the mouth) side.

Bilaterally symmetrical animals have right and left halves which are mirror images of each other. Only one imaginary cut would divide the animal into its mirror-image and posterior (tail) ends, and right and left sides.

Animals with no symmetry cannot be divided into mirror-image halves.

Tissue organization- Are cells organized into well –defined tissue layers (structural and functional units)? If so, how many distinctive layers are present? In Metazoan animals, the process of gastrulation during development results in the formation of concentric layers of tissue called germ layers which give rise to the various tissues and organs of the body.

Animals may have up to three layers: ectoderm, mesoderm, and endoderm. Animals with two layers are diploblastic and those with three are triploblastic. Ectoderm, the outermost layer, gives rise to the outer covering of the animal and in some phyla the central nervous system.

Endoderm, the innermost layer, gives rise to the lining of the digestive tract and organs derived from it (e.g., liver). Mesoderm, the layer between the ectoderm and endoderm, forms the muscles and most other organs between the digestive tube and ectoderm.

Coelom (body cavity) – Most triploblastic animals can be assigned to one of three groups depending on characteristics of the body cavity or coelom.

Acoelomate animals have solid, three layered bodies without a body cavity.

Mesodermic tissue completely fills the space between the endoderm (lining of the digestive tract) and the ectoderm (the body wall).

Coelomate animals have a cavity or space between the ectoderm and endoderm that is completely surrounded by the mesoderm. The mesodermal lining of the coelomic body cavity is known as the peritoneum.

Pseudocoelomate animals have a body cavity that is not completely lined by mesodermal tissue; instead, it is bordered by mesodermal tissue toward the outside of the body and endodermal tissue toward the inside of the body.

Digestive tract (gut) – Openings into the digestive tract- Where does food enter and digestive waste leave the body? How many openings are there? Some animals have only

one opening which serves as both mouth and anus. Others have separate openings for the mouth and anus (complete digestive tract), sometimes referred to as a tube within a tube.

Protostome/deuterostome- Coelomates can be further divided based on the developmental fate of the embryonic blastopore (the opening in the gastrula). Protostome (“first mouth”) - The blastopore develops into the mouth and anus develops as a secondary opening on the end opposite the mouth. Protostomes also exhibit schizocoelous formation of the coelom in which the coelom forms from splits in the mesoderm. Deuterostome (“second mouth”) –The blastopore develops into the anus and the mouth develops as a secondary opening on the end opposite the anus. Deuterostomes also exhibit enterocoelous formation of the coelom in which the coelom forms from outpocketings of the mesoderm.

Cleavage-Pattern of cleavage divisions typically differs between protostomes and deuterostomes (although many exceptions exist).

Spiral cleavage- Most protostomes exhibit spiral cleavage in which cell division results in each tier of cells sitting in the grooves of the adjacent tier of cells.

Radial cleavage- Most deuterostomes undergo radial cleavage in which the tiers of cells sit directly on top of one another.

Where possible also look for:

Type of nervous system- Does the organism have a brain or nerve cord? How many nerve cords and in what location? What types of sensory organs are present? Where and how many?

Circulatory system-Open circulatory system-blood flows through coelomic spaces where it mixes with interstitial fluid and bathes the organs directly.

Closed circulatory system- blood mainly flows through vessels separate from interstitial fluid.

Organs for respiration – Does the organism possess specific organs for the exchange of gases? Where does the exchange occur – skin, gills, lungs?

Organs for excretion- How does the animal get rid of nitrogenous waste?

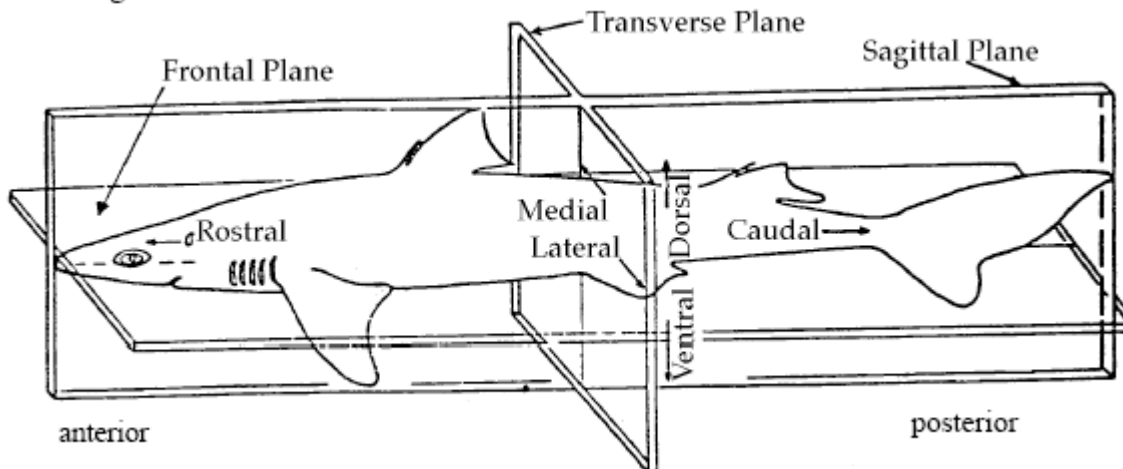
Support system- How does the animal support its body/ Is there a skeleton present- endoskeleton or exoskeleton? If the animal has no true skeleton, does it use a hydrostatic skeleton for support (fluid within and between cells and in body chambers such as the gastrovascular cavity or coelom)?

Habitat- terrestrial or aquatic

Anatomical glossary

- Anterior or rostral: towards the head end.
- Posterior or caudal: towards the tail end.
“Your nose is anterior of your belly button. Your chin is posterior of your nose.”
- Dorsal: toward or near the back.
- Ventral: toward or near the belly.
“Your belly button is ventral of your intestines.”
- Medial: in or near the plane in the middle of the body.
- Proximal: near the base or site of attachment
- Distal : near the tip.
“Your fingernails are on the distal ends of your fingers.”
- Sections through the body are called:
Sagittal: dividing the animal into left and right sides
Frontal: dividing the animal into dorsal and ventral parts.
Transverse: dividing the animal into anterior and posterior parts.

See this figure:



Phylum Porifera

Phylum Porifera (Latin porus, pores; Greek fera, bearing) encompasses the sponges which split early from the main branch of animal evolution and has given rise to no other animal groups. The phylum contains approximately 9,000 species of sponges, all of which are aquatic and most of which are marine. Although adult forms are sessile, the larvae (immature forms) are motile. Sponge bodies consist of two cell layers, an outer epidermal layer and an inner layer of flagellated collar cells, but have no tissues or organs. Between the layers lies an acellular layer called the mesohyl which contains amoeba-like cells (amoebocytes) with various functions such as food storage, digestion, waste elimination, and formation of reproductive cells. Some amoebocytes secrete materials that form an endoskeleton that supports the sponge. These support materials include sponging, a fibrous protein, and spicules, a mineral crystal. Bath sponges, for example, contain fibrous

endoskeletons with no spicules. Sponges generally lack anterior/posterior and left/right symmetry and often grow to fit the space in which they live. Sponges feed by filtering suspended food particles out of the water column (i.e., suspension feeders). Water flows through the numerous pores that perforate the sponge's body into the central opening called the spongocoel and then out of the sponge through a larger opening called the osculum. The central cavity or spongocoel is not a digestive tube or body cavity in the sense of a coelom but is only a channel for water. Moreover, the osculum is not a mouth but an opening used as an outlet for the current of water passing through the sponge. The flagellated collar cells (also called choanocytes) bring water into the sponge through the pores and the collar sieves out food particles such as microscopic algae, bacteria, and organic debris. Most sponges are hermaphrodites and can reproduce both sexually via sperm and eggs and asexually from fragments of a parent sponge.

Examine the section of sponge. Observe the pores for which the phylum is named. Be able to describe how sponges feed.

Examine the spicules. In addition to structure, what other function might these serve the sponge?

What would you hypothesize about the movement of oxygen and waste throughout the sponge body and into and out of the cells?

How would you describe the symmetry of a sponge?

Given that all sponges are filter feeders, why are all aquatic?

Do you see evidence of nervous or circulatory systems?

Do you see evidence of cells organized into tissues or organs?

Phylum Cnidaria

Phylum Cnidaria (Greek Knide, nettle; Latin aria, like) contains approximately 10,000 species, all aquatic and mostly marine. Cnidarians exhibit radial symmetry in two distinct body forms: (1) polyps, a primarily stationary or immobile form (e.g., sea anemones, corals, hydra), and (2) medusa, a free floating, mobile form (e.g., jellies). Some species display both body forms during their life cycle. Cnidarian bodies consist of two tissue layers, the outer epidermis and inner gastrodermis, separated by a gelatinous material, the mesoglea (not to be confused with mesoderm) that helps support the body. The central, sac-like gastrovascular cavity has a single opening which serves as both mouth and anus. Undigested food remains are ejected through the same opening as food is ingested. The water in the gastrovascular cavity also serves as a hydrostatic skeleton. Cells in the two

tissue layers have bundles of microfilaments arranged into contractile fibers (note that true muscle develops from mesoderm, not found in cnidarians). The contractile cells work against the hydroskeleton to perform movement. A non-centralized nerve net coordinates movement of the contractile fibers and simple sensory receptors are distributed around the circumference of the body. Cnidarians use the tentacles around their mouth to capture prey. The tentacles contain specialized cells called cnidocytes which contain organelles called cnidae. Cnidae are capable of everting to entangle or sting a prey item or in defense. The forms of cnidae tipped with a stinging barb or spine are known as nematocysts. Some cnidae can inject poison as well.

Examine hydra whole mount and cross sections.

Sketch the longitudinal cross section and label the gastrodermis, epidermis, mesoglea, mouth, anus, tentacles, and gastrovascular cavity.

Why is radial symmetry adaptive for a sessile animal in an aquatic habitat?

Name a disadvantage of having one opening into the digestive cavity.

Examine the slide of the hydra nematocyst.

How does the hydra use the nematocyst?

Examine the slides of Obelia, a colonial cnidarian with both polyp and medusa stages.

Compare the slides to the diagram provided. Sketch and label feeding polyps, reproductive polyps, and medusa buds.

How does the medusa stage fit into the lifecycle of Obelia?

Which stages are haploid and which are diploid? Label the feeding polyps, reproductive polyps, and medusa buds as such.

Of what advantage is the colonial life adopted by Obelia?

If an animal is stationary what is the purpose of having a motile phase at some point in the life cycle?

Why is it advantageous to have sensory cell encircling the bell of the medusa?

Phylum Platyhelminthes

Phylum Platyhelminthes (Latin platy, flat; Greek helmis, worm) includes about 20,000 species. A dorsoventrally flattened body (i.e., thin between dorsal and ventral surfaces) characterizes these species. Like other bilaterally symmetrical animals, flatworms have three layers of tissue but have no body cavity or coelom. Most Platyhelminthes have a digestive tract with one opening; although the parasitic cestodes or tapeworms lack a digestive tract. Flatworms lack organs specialized for gas exchange and circulation, and most nitrogenous waste diffuses directly out of the cells into the surrounding water. However, they do possess specialized cells, called flame cells that primarily help the organism maintain osmotic balance. Free-living flatworms such as planaria are in the minority, comprising less than $\frac{1}{4}$ of the species, compared to parasitic forms such as flukes and tapeworms. Flatworms live in marine, freshwater and terrestrial habitats and range in size from microscopic to over 20 meters long in some tapeworms!

Examine the Planaria slide whole mount.

Examine the body for a number of digestive openings (the stained planaria shows the digestive system). Observe the pharynx and mouth. The pharynx lies in a pharyngeal chamber inside the mouth. The proximal end of the pharynx opens into the dark-colored branched intestine. How do planaria rid themselves of solid waste?

Which end is the head? What led you to that conclusion?

Two auricles containing a variety of sensory cells (e.g., touch and chemical receptors) project from either side of the head or anterior end (blunt end.) Two pigmented eyespots, sensitive to light intensity and direction but unable to form images, lie between the auricles. The pigment cups contain the photosensitive end of retinal cells which extend from the brains. Two cerebral ganglia (the brain) lied beneath the eye spots, and two ventral nerve cords extend posteriorly from the brain. Transverse nerves connect the two nerve cords forming a ladder like nervous system.

How might bilateral symmetry be an advantage to a motile organism? What is cephalization? Under what circumstances would it be useful? Under what circumstances would it not be useful?

Look at planaria in cross section. The slide shows sections through three different regions of the body. Do you see a body cavity or coelom? What word describes this condition? (The pharyngeal chamber and spaces in the gut are not a coelom – recall that the coelom is a space surrounded by mesoderm between the body wall (ectoderm) and lining of the digestive tract (endoderm)).

How many tissue layers can be detected?

What provides support for the body?

Diagram the flatworm as seen in a cross section at the level of the pharynx. Label the epidermis, muscle derived from the mesoderm, the lining of the digestive tract derived from endoderm, and the pharynx.

How do flame cells relate to the ability of flatworms to live in freshwater and terrestrial habitats?

Examine the tapeworm slide.

Adult tapeworms live in the intestine of numerous animals including humans. The scolex at the anterior end of the worm allows the animal to anchor itself to the intestinal wall to avoid being swept out by digestive movements. Posterior to the scolex is a chain of reproductive structure called proglottids each containing male and female reproductive organs. Mature proglottids loaded with thousands of eggs detach from the worm and leave the host's body with the feces. Tapeworms lack a digestive system and must absorb nutrients across their body surface directly from their hosts.

Sketch the tapeworm proglottid and label the uterus, ovary, testes, and genital pore.

Compare tapeworm and planaria anatomy in relation to their lifestyles (especially consider the proglottids, anterior structures, and lack of a digestive tract in tapeworms).

How does the flat body shape help with gas exchange and circulation in an animal without organs specialized for such functions?

Phylum Nematoda

Phylum Nematoda (Greek *nema*, thread,; *eidos*, form) contains about 90,000 identified species but may contain up to a million; indeed, nematodes may be the most abundant animals on earth. They live in virtually all habitats, including moist soils, beach sand, salt flats, ocean, hot springs, and lakes, and exhibit a great diversity of lifestyles. Although some of our most familiar parasites are nematodes (e.g., dog and cat heartworm, hookworm, roundworm, pinworm) most species are harmless or beneficial. These worms range from 0.1mm to 9m (a parasite in sperm whales) in length. These animals exhibit bilateral symmetry with three germ layers. Nematodes have a complete digestive tract with two openings but no circulatory system or organs for excretion of gas exchange. Their nervous system consists of a ring of nervous tissue around the anterior end of the worm with one dorsal and one ventral nerve cord extending posteriorly from the ring.

Examine the slides of the longitudinal sections of male and female *Ascaris*.

Identify the digestive tract. How is food taken in and undigested wastes expelled? What are the advantages of a complete digestive tract (i.e., a gut with two openings)?

Look at the cross section of male and female *Ascaris*.

Note that the body wall is made up from the outside inward of the cuticle (noncellular), epidermis (cellular), and muscle fibers. The muscle derived from the mesoderm lies at the outer boundary of the body cavity. Locate the intestine (derived from endoderm).

Can you detect muscle tissue adjacent to the endodermal layer? What do we call a body space that is lined by mesoderm laterally and endoderm medially?

Most of the body cavity is filled with reproductive organs. Identify male and female reproductive organs.

Identify the nerve cords. How many are there and where are they located?

Sketch a cross section of a male *Ascaris* and label cuticle, epidermis, muscle fibers, intestine, body cavity (give specific name), testis, dorsal and ventral nerve cords.

Phylum Nemertina

Phylum Nemertina (Greek Nemertes, a sea nymph) contains about 900 identified species ranging from less than 0.5mm to 30m in length, one of the longest invertebrates known. Their common name of ribbon worms refers to their flat bodies and often vibrant color patterns. They are characterized by a long anterior proboscis used to capture prey, explore their environment, and defend themselves. They can rapidly evert their proboscis which may extend up to three times their body length. Nemertines possess a blood vascular system through which blood pumps and a digestive tract with two separate openings, one for the mouth and one for the anus. Some species may promote gas exchange through a vascularized foregut but most occurs through the epidermis. Like flatworms, these species also possess flame cells that regulate ions and water and perhaps dissolved waste. Their nervous system resembles that of flatworms with cerebral ganglia and longitudinal nerve cords with connecting nerves. They also possess numerous anterior sensory organs for chemical, tactile, auditory, and light reception. Nemertines possess three body layers but their categorization as to the status of a coelom remains somewhat controversial. However, molecular data and ultrastructural evidence strongly suggest that they indeed possess a coelom but one that has undergone significant modification into the blood vascular system, gonadal sacs, and cavity that houses the proboscis.

Examine the slides of *Cerebratalus* embryonic development.

Identify the type of cleavage. Sketch the 8-cell stage. Is this animal a protostome or deuterostome?

Identify the blastula and gastrula. Sketch the gastrula and label the blastopore and archenteron. Will the blastopore become the anus or mouth? What does the archenteron become?

Phylum Annelida

Phylum Annelida (Latin *annellus*, little rings) contains approximately 15,000 species including marine, freshwater, terrestrial members and both free-living and parasitic species. Earthworm and leeches are the most familiar examples and a quick examination of their bodies illustrates why they are referred to as segmented worms. However, the most speciose group of annelids is the polychaete class, most of which are marine. The outer body segments coincide with internal compartments containing serially repeated nervous, muscle, and excretory systems. Body segments are filled with a fluid that serves as a hydrostatic skeleton against which the muscles contract to allow movement. In contrast to the relatively unspecialized nematode digestive tract, the earthworm digestive tract is divided into several different organs. At the anterior end are the mouth and pharynx, a muscular organ used to draw food into the mouth. The esophagus, a passageway between the pharynx and the crop (a temporary storage organ for food), follows. From the crop, food passes to the gizzard which grinds the food into smaller pieces. The intestine follows posteriorly and runs the remainder of the worm. Enzymatic digestion occurs in the intestine followed by absorption of nutrient molecules. Undigested material is expelled through the anus. A pair of cerebral ganglia (brain) lies anterior to the pharynx and connects to a ventral nerve cord with segmented ganglia. The closed circulatory system consists of dorsal and ventral blood vessels connected by segmental pairs of vessels some of which around the esophagus are muscular and pump blood. The excretory system consists of segmentally repeated pairs of metanephridia that remove nitrogenous waste from the blood and coelomic fluid. Individual earthworms possess both male and female reproductive organs (i.e., hermaphroditic). Mating worms lay head to tail side by side and transfer sperm to each other. On each worm the clitellum, a specialized swollen section of segments, produces a mucous cocoon that surrounds the eggs and transferred sperm. The cocoon then slides off each worm's head depositing the mass in the soil. The embryos develop inside the protective cocoon.

Observe the living earthworms under the stereoscope. Note the segmentation, mouth, anus, clitellum (a structure specialized for reproduction), and setae (small bristles on each segment used for locomotion).

Examine the cross section posterior to the clitellum. Sketch and label the intestine, two muscle layers (one inside the skin and one on the surface of the intestine), coelom, ventral nerve cord, dorsal and ventral blood vessels, epidermis, and metanephridia. Which parts are derived from the endoderm, mesoderm, and ectoderm? Label these.

Gas exchange must take place across thin wet surfaces. How do you think gas exchange occurs?

Examine the composite cross sectional slide of the earthworm. Locate the brain and pharynx.

Examine the slide of the leech whole mount. Note the segmentation.

What structures adapt it to a parasitic (external blood sucker) life style?

Locate the mouth and anus.

Examine the cross section of the leech. Identify the ectoderm, mesoderm, endoderm, and coelom. What does the coelom look like?

Phylum Echinodermata

The phylum Echinodermata (Greek echin, spiny, Greek derma, skin) includes about 7,000 species. All live in marine habitat, and as adults all exhibit a radial, five-part appearance. Some sources refer to them as radially symmetrical while other sources cite certain anatomical features that render them not truly radially symmetrical. However, this radial appearance (symmetrical or not) is believed to be secondarily derived from a bilateral ancestor-the larvae of echinoderms are in fact bilateral. This phylum includes sea stars, sand dollars, sea urchins, and sea cucumbers. Echinoderms possess many unique adaptations. For example, they locomote by means of a water vascular system, a network of canals connected to the outside by pores through the epidermis. By using specialized contractile organs, echinoderms vary the water pressure in certain portions of the water vascular system causing hundreds of tube feet that project through the body wall to extend or retract; this allows the echinoderm to move, capture food, or cling to surfaces. Many sea stars represent important predators of clams and mussels and have an unusual way of feeding on them-the sea star wraps its tube feet around the shell and pulls constantly with them until it fatigues the muscles that hold the shells together. This causes a small opening in the shell (less than 1mm) that allows the sea star to evert its stomach and insert it into the shell where it digests the mollusk's soft body parts. Sea urchins and sand dollars have no arms; all are spherical or disk shaped. The body surface consists of

epidermis covering an endoskeleton composed of calcareous ossicles, and all urchins and sand dollars are covered with movable spines. The digestive tract of most echinoderms have an oral surface or mouth which faces the ventral side of the animal (i.e., toward the seafloor or substrate) and an aboral surface with an anus that opens in the opposite direction. Echinoderms achieve circulation through hemal and perihemal coelomic systems, an array of canals and rings derived from the coelomic space. Nitrogenous waste diffuses from the coelom through the tube feet which, in some species, also serve respiratory functions. The nervous system consists of a nerve ring encircling the esophagus (in the central disc of the body) with nerve nets extending into the body. Echinoderms also have sensory receptors for light, chemical, touch, and balance. Many echinoderms can regenerate missing body parts.

Examine the pictures or samples of echinoderms.

Note the radial appearance and five-part body plan. Understand why despite this they are included in phylogenies with bilateral rather than radial animals.

Do you see any evidence of a head or anterior end and a tail or posterior end?

Examine the cross section of a sea star arm.

Identify the coelom, tube feet, radial canal (part of the water vascular system), and gonads.

Examine the slides of sea star cleavage, blastula, and gastrula.

Identify the type of cleavage. Sketch the 8-cell stage. Is this animal a protostome or deuterostome?

Identify the blastula and gastrula. Sketch the gastrula and label the blastopore and archenteron. Will the blastopore become the anus or mouth? What does the archenteron become?

Phylum Chordata

Your textbook includes two subphyla of invertebrate chordates (animals without a vertebral column) and one subphylum of vertebrate chordates within the phylum Chordata (your textbook is a lumpers). In contrast, the Five Kingdoms book splits the two groups of invertebrate chordates into their own separate phyla (Phylum Urochordata and Phylum Cephalochordata) and likewise places the vertebrate chordates into a separate phylum (Phylum Craniata, animals having a brain encased in a skull or cranium). The Urochordata includes tunicates and sea squirts, and all are marine. The Cephalochordata include lancelets or Amphioxus, and all live in aquatic habitats. The vertebrates or craniata comprise the largest group of chordates with about 45,000 species. This group includes animals most familiar to humans-fish, birds, amphibians, reptiles, and mammals. All chordates, vertebrate or invertebrate, share common characteristics: a single dorsal hollow nerve cord, a notochord, gill structures and a post-anal tail.

For this part of today's lab, you will view images of cross sections of the human body. These images came from a project in which human bodies were preserved, frozen, cross sectioned in more than 150 locations along the body, and photographed. The images for this lab exercise were selected from this enormous undertaking. Note that all sections are viewed from below, looking toward the head. This corresponds to the way radiologists view sections of the body but not to the usual anatomical view of looking down toward the feet. Also, the left side of the body usually appears on the right of the photograph and vice versa.

On the outline of the human body (to be provided during lab for inclusion in your write up), identify the approximate location of the selected cross sections. Where appropriate identify the images as male or female. Use figures from the Photographic Atlas for reference.

Using these images, identify and provide evidence for the following:

Type of body symmetry	Organs of excretion
Layers of embryonic tissue	Type of support system
Presence of coelom	Position and complexity of nervous system
Number of Digestive tract openings	
Open or closed circulatory system	
Organs of respiration	

Write-up: as the case with the plant diversity labs, your answers are for you to review as you learn and study this material. Your TA will require a check off, prior to the start of the practical exam. Hand-drawn and labeled drawings are fine. All drawings must indicate size.

PART ONE:

There are 5 organisms. You need to have at least two drawings of each, one of the whole animal, and one (or more, see below) cross section drawing of that animal, with features labeled:

1) *Hydra*

Whole body (name of organism, phylum, scale)

Longitudinal cross section

Name of organism, phylum, scale, label the gastrodermis, epidermis, mesoglea, mouth, anus, tentacles, and gastrovascular cavity

2) *Planaria*

Whole body (name of organism, phylum, scale)

Cross section at the level of pharynx

Name of organism, phylum, scale, label the epidermis, muscle derived from the mesoderm, the lining of the digestive tract derived from endoderm, and the pharynx.

3) *Ascaris*

Whole body (name of organism, phylum, scale)

Cross section of male

Name of organism, phylum, scale, label cuticle, epidermis, muscle fibers, intestine, body cavity (give specific name), testis, dorsal and ventral nerve cords

Cross section of female

Name of organism, phylum, scale, label cuticle, epidermis, muscle fibers, intestine, body cavity (give specific name), ovaries, uterus, dorsal and ventral nerve cords.

4) Earthworm

Whole body (name of organism, phylum, scale)

Cross section posterior to clitellum

Name of organism, phylum, and scale. Label the intestine, two muscle layers (one inside the skin and one on the surface of the intestine), coelom, ventral nerve cord, dorsal and ventral blood vessels, epidermis, and metanephridia. Label parts derived from the endoderm, mesoderm, and ectoderm

5) Sea star

Arm (name of organism, phylum, and scale)

Cross section

Name of organism, phylum, and scale. Identify the coelom, tube feet, radial canal (part of the water vascular system), and gonads.

PART TWO:

Draw 8-cell stage and gastrula of embryo development for:

Cerebratalus

Sea star

For each drawing, provide the name of the organism, the phylum, and an indication of scale. Label each according to the type of cleavage pattern exemplified and whether it is a protostome or deuterostome.

On the gastrula drawings, label the blastopore and indicate whether it will become a mouth or anus.

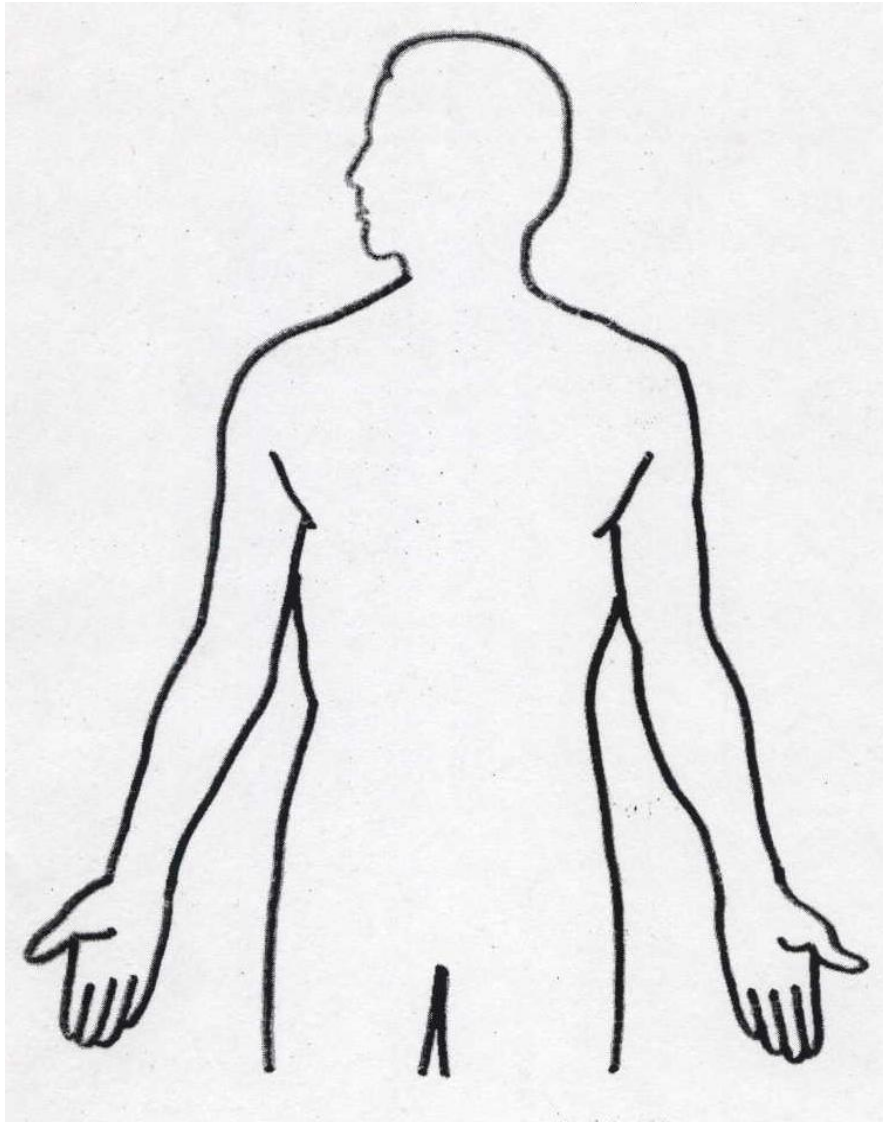
PART THREE:

Indicate on the human outline where each of the cross sections are located. State what aspects of the cross section helped you to make those conclusions for each one. Indicate whether the cross section is from a male or female. Turn in the labeled human outline page with your write up.

PART FOUR:

Brief answers to the following questions (asked already in the manual):

- a) Compare and contrast the manner in which sponges and anemones acquire oxygen and rid themselves of carbon dioxide and the way they acquire food and rid themselves of food wastes.
- b) Name two organisms that you saw in lab that have one opening into the digestive tract and two organisms with a separate mouth and anus. What is the disadvantage of a single opening over a complete digestive tract?
- c) Jellies have sensory organs encircling the bell of the medusa. Why would it be advantageous for jellies to have this?
- d) Compare tapeworm and planarian anatomy in relation to their lifestyles (especially consider the proglottids, anterior structures, and lack of a digestive tract in tapeworms).
- e) Platyhelminthes derive their name from their flat body shape. How does the flat body shape help with gas exchange and circulation in an animal without organs specialized for such functions?
- f) Compare and contrast how earthworms and humans accomplish gas exchange.



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