<u>STARFISH LAB</u> PHYLUM: Echinodermata "spiny skin" CLASS: Asteroidea "star-like"

<u>ECHINODERMS</u> are spiny skinned invertebrates that include sea stars (starfish). sea urchins, sand dollars, and sea cucumbers. Starfish are MARINE (ocean dwelling) animals, not found in South Dakota. They feed on shellfish and can be a problem for the oyster industry.

Which way is up?

There is NO HEAD/BRAIN (NO CEPHALIZATION) in a starfish; therefore, no anterior or posterior. The surface where the mouth is located is the ORAL (VENTRAL) and the opposite surface is the ABORAL (DORSAL).



This is the only RADIALLY SYMMETRICAL animal you will dissect this semester. Starfish typically have 5 arms, but there may be up to 24. Starfish with 5 arms (rays) are said to have PENTARADIAL symmetry.

Although adult sea stars have radial symmetry, they develop from winged BIPINNARIA LARVA with BILATERAL symmetry.



<u>INTEGUMENT</u> Examine the ABORAL surface more closely. The large SPINES on the skin's surface give this organism its PHYLUM name ECHINODERMATA (spiny skin). They are for protection. Think how much fun it would be to bite into one of these!

The spines connect below the skin to a network of calcium plates called OSSICLES that make up the ENDOSKELETON. The smaller white specks in between the SPINES are tiny pinchers with claws on stalks called PEDICELLARIA (pl. PEDICELLARIAE). Because starfish "breathe" through their skin, keeping the surface free of algae and other small organisms is important. These pinchers keep the starfish's skin clean and prevent "critters" from growing on it. In some species these can be venomous.

RESPIRATORY/EXCRETORY

Echinoderms have NO actual excretory or respiratory organs. GASES and NITROGEN WASTE are exchanged between the fluid in the coelom cavity and the water outside through soft, hollow, thin-walled tubes that project from the surface called SKIN GILLS and through the thin walls of the tube feet. The many surface extensions provide increased surface area for gas exchange.

OTHER ABORAL STRUCTURES TO FIND:

The small white disc located at the junction of two of the arms (BIVIUM) is the MADREPORITE. It is the opening for water entering the WATER VASCULAR SYSTEM. The 3 arms farthest from the madreporite are called the TRIVIUM. The ANUS is located in the center of the star on the ABORAL surface. Small pigmented EYESPOTS, which can sense light and dark, appear at the end of each ARM (RAY).

EXAMINE THE ORAL SURFACE:

The TUBE FEET are located in the AMBULACRAL GROOVE which runs from the tip of each arm to the mouth. In many species, muscles in the tube feet can create suction when the foot is pressed against a surface that allows the starfish to crawl along a surface or grab onto and open bivalve shells. The TUBE FEET are controlled by water pressure moving in the WATER VASCULAR SYSTEM.

LOCOMOTION & FOOD CAPTURE



The WATER VASCULAR SYSTEM is unique to ECHINODERMS. It is a system of tubes that use hydraulic (water) pressure to operate suction cupped TUBE FEET.

Water enters the system through small pores in the MADREPORITE, a sieve-like opening on the ABORAL surface. Water then passes down the STONE CANAL (so called because it contains CALCIUM CARBONATE) to the RING CANAL, which encircles the MOUTH. A RADIAL CANAL (also called AMBULACRAL CANAL) extends from the ring canal into each arm and is protected by the AMBULACRAL RIDGE. The upper end of each tube foot is expanded to form a bulb-like sac called an AMPULLA (pl. AMPULLAE) Contraction of muscles in the ampullae and along the tube feet contract to control water entering and leaving the tube feet. In this way a starfish uses water pressure to extend and withdraw its tube feet which it uses for locomotion and to grab onto prey.

CIRCULATORY: (OPEN)

Starfish have NO HEART or BLOOD VESSELS. BLOOD (HEMOLYMPH) in the coelom (HEMOCOEL) bathes the organs and distributes nutrients and oxygen.

DIGESTIVE:

The sea star's mouth is connected by a short ESOPHAGUS to the CARDIAC STOMACH, which is turned inside out through the mouth during feeding. The cardiac stomach transfers food to the PYLORIC STOMACH, which connects to a pair of DIGESTIVE GLANDS in each arm. The two stomachs and the digestive glands use digestive enzymes to break down food. Nutrients are absorbed through the walls of the DIGESTIVE GLANDS into the COELOM and undigested food is passed out of the body through the ANUS on the ABORAL surface. THERE IS NO INTESTINE IN A STARFISH!

<u>REPRODUCTIVE</u>: (SEXUAL and ASEXUAL)

Most Echinoderms have SEPARATE SEXES and their reproductive organs (GONADS) can be seen extending into the arms. EXTERNAL FERTILIZATION occurs when eggs and sperm are shed into the water. Starfish show INDIRECT development, hatching as an immature bilaterally symmetrical winged BIPINNARIA LARVA.

AUTOTOMY/REGENERATION:

Starfish are relatively simple animals that show a remarkable power of regeneration. Any piece of the starfish containing a part of the ring canal can regenerate the lost portion of the body. Like Planaria, these organisms can use their powers of regeneration for ASEXUAL REPRODUCTION. Starfish can use this ability as a defense mechanism by automatically shedding an arm (AUTOTOMY) at its base if grabbed by a predator and growing it back later (REGENERATION)

NERVOUS:

The nervous system in a starfish is primitive. Since they have no head (NO CEPHAPLIZATION), they also have no brain or cerebral ganglia. The nervous system consists of a NERVE RING connecting MULTIPLE GANGLIA that encircles the mouth and a RADIAL NERVE that runs from the nerve ring along the length of each arm inside the AMBULACRAL RIDGE. If the radial nerve is cut in one arm, the tube feet in that arm lose coordination. If the nerve



ring is cut, the feet in all arms lose coordination and the starfish can't move. Sea stars also have a NERVE NET near the body surface that controls the movements of the spines, pedicellariae, and skin gills. The end of each arm has an eyespot that can sense light. Touch and chemical sensitive cells are scattered over the surface of the sea star's body.

NAME _____

STARFISH LAB QUESTIONS

	LATIN meaning			
KINGDOM				
PHYLUM				
CLASS				
1. Use the words in the wo	ord bank below to ide	ntify on w	hich surface is	each of the following located?
	Mouth	ORAL	BOTH	
	Mouth			Skin gills
	Anus			Ambulacral groove
	Madreporite			Pedicellariae
	Spines			Tube feet
3. Describe the skeleton in	n a starfish			
4.What do the typhlosole a starfish have in common? All of these	in an earthworm, the	ridges on	the gills in a c	lam, and the skin (dermal) gills in
5. Echinoderms are the on A. invertebrate pro B. vertebrate proto C. invertebrate deu D. vertebrate deut	ly itostomes ostomes iterostomes erostomes			
6. In earthworms and man How do starfish absorb nu	y other organisms the trients if they don't h	e function nave an int	of the intesting estine?	e is to absorb nutrients.

7. Put these parts of the water vascular system in the correct sequence.



8. Which 2 structures are found INSIDE THE AMBULACRAL RIDGE?

9. COMPARE		
Looks like ?	A COR	and the second sec
What is it called?		
Which PHYLUM has this kind of larva?		

10. Use words in the word bank below to identify the correct part of the stomach.

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CARDIAC STOM	ACH PYLORIC STOMACH
 	Extruded out through mouth during feeding
 	Stays inside the starfish during feeding
 	Connects to the anus
 	Connects to the digestive glands
 	Connects to the mouth

11. MATCH DESCRIPTION WITH THE CORRECT ORGANISM

Fill in ALL that apply. There may be more than one answer on a line.

EARTHWORMS	STARFISH	CLAMS	NONE OF THESE
		Uses sexual reprodu	uction
		Uses asexual reproc	duction
		Have separate sexe	S
		Are hermaphrodites	
		Internal fertilizatio	n
		External fertilizatio	on
		Direct development	
		Indirect developmer	nt
12. Tell how a NERVE RING	is DIFFERENT fr	om a RING CANAL.	
Nerve ring			
Ring canal			
Circle ALL that apply to S	TARFISH:		
Invertebrate protostomes	Invertel	orate deuterostomes	Vertebrate deuterostomes
blastopore → mouth (Determinate spiral cle	avage)	blastopore → anus (indeterminate radial cle	avage)
NO CEPHALIZATIO	N	CEPHALIZATION	
EXOSKELETO	Ν	ENDOSKELETON	
OPEN CIRCULATION		CLOSED CIRCULATI	ION
HERMAPHRODITES		SEPARATE SEXES	
ASEXUAL REPRODUCTIO	N SE	XUAL REPRODUCTION	(Careful!)
INDIRECT DEVELOPA	NENT	DIRECT DEVELOPMENT	
EXTERNAL FERTILIZ	ZATION	INTERNAL FERTILI	ZATION

NAME THE BODY ORGAN:

General term for reproductive organs
Makes eggs
Makes sperm
Makes bile and absorbs nutrients
Opening for water entering the water vascular system
Connects stone canal with radial canals
Connects madreporite and ring canal
Muscular bulb that controls water entering tube feet
Keeps surface free of foreign objects
Skin extensions that exchange gases with water
Gives Echinoderms their name and provides protection
Groove on underside of arms that holds the tube feet
Ridge inside each arm that contains the radial canal and radial nerve
Calcium carbonate plates that make up the skeleton
Senses light at the ends of a starfish's arms
Two body parts that excrete nitrogen waste & help with osmoregulation and
Found in the ambulacral groove; help in locomotion, grabbing food, & prying open bivalve shells
Part of the nervous system that encircles the starfish's mouth and connects the radial nerves together
Part of the water vascular system that encircles the starfish's mouth and connects the radial canals together