

Name _____

Class: Reptilia “to creep or crawl”

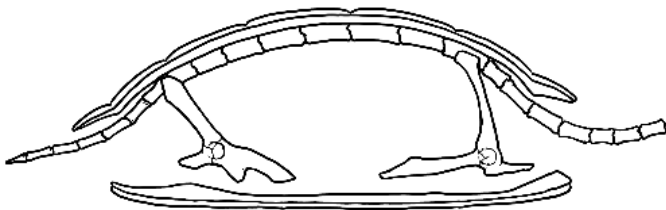
Order: Chelonia “tortoise”

TURTLE DISSECTION LAB

Turtles have had over 200 million years to evolve and have outlived the dinosaurs to become one of the **OLDEST LIVING** families in the animal kingdom. The order **CHELONIA** consists of about 250 species of turtles and tortoises. The term *tortoise* is generally reserved for land dwellers, while *turtle* refers to chelonians that live in water.

INTEGUMENT:

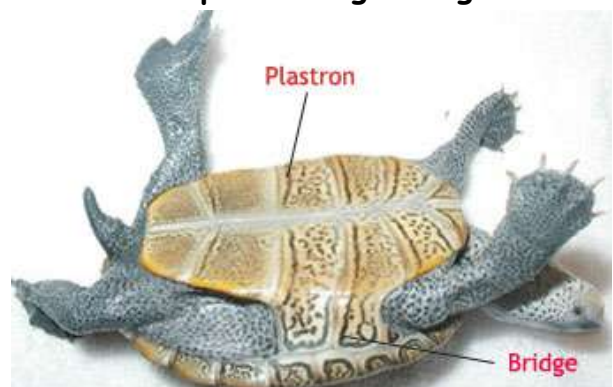
Because amphibians exchange gases through their skin, it must be moist and thin enough to allow rapid diffusion. One of the drawbacks of this kind of skin is the loss of body water through evaporation. The thick, dry, scaly skin of reptiles is an improvement, because it is water tight. The tough skin of a reptile helps to conserve water and protects the animal against infections, injuries, and the wear and tear associated with living on land. Surface cells fill with **KERATIN**, the same protein that forms your fingernails and hair and bird feathers. Lipids and proteins in the skin keep it watertight.



A turtle's protective shell is formed from the fusion of bones from the ribs and vertebrae. The spine and ribs are attached to the shell, so turtles can't really crawl out of their shells like in the cartoons. The bones of the shell are divided into sections called **SCUTES**, and are covered with skin containing a protein called **KERATIN**.

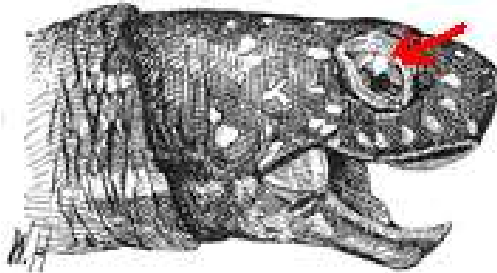
Scutes have nerve endings, so a turtle can feel something touching its shell. The scutes and the bone underneath can grow allowing the turtle to expand and get larger. Turtles can regenerate damaged scutes, and some scutes have rings similar to growth rings on trees that can be used to estimate age.

The **BRIDGE** along the sides connects the **CARAPACE** (dorsal shell) to the **PLASTRON** (ventral shell).



Locate the exit opening below the turtle's tail. Like amphibians, the **CLOACA**, a multipurpose cavity shared by the digestive, reproductive, and excretory systems exits through a **VENT**.

One of the characteristics you saw in **AMPHIBIANS** (frogs) was feet with **NO CLAWS**. Notice the **CLAWED FEET** in reptiles.



Like frogs, turtles have a **NICTITATING MEMBRANE** that acts as a third eyelid to cover and protect the eyeball under water.

The **TYMPANIC MEMBRANE** (eardrum) is directly behind the eyes. Turtles have very poor hearing.

The **EXTERNAL NARES** (nostrils) connect inside to the mouth just like in a frog. Unlike other reptiles, turtles have **NO TEETH**. Instead they have a sharp **BEAK** made of **KERATIN**. The mouth in a turtle is very similar to that seen in frogs. Two **INTERNAL NARES** (connect to **EXTERNAL NARES** outside) which allow the turtle to breathe with its mouth closed.

The **GLOTTIS**, a vertical slit just behind the **TONGUE**, is the opening to the respiratory system. Behind the glottis is the **GULLET** (the opening into the digestive system).

The orientation of the limbs to the body in reptiles and in mammals.

Reptiles
limbs

In



Reptile

have an unusual stance not seen in other animal groups. Their protrude at right angles from their bodies.

all other animals with arms and legs, the shoulders and pelvic bones are **OUTSIDE THE**



Mammal

RIBCAGE.

In turtles the skeleton is modified so the LIMB GIRDLES (shoulders and pelvis) are located inside the RIBCAGE,.

This allows the turtle to pull its limbs inside its shell.

Reptiles are **ECTOTHERMIC**, commonly called "cold blooded". They don't make their own body heat. They maintain their body temperature (**THERMOREGULATION**) by absorbing heat from their environment. When it gets too warm they find a cool, shady spot. When they get too cool, they warm themselves by basking in the sun. *ECTOTHERMS require very little energy because their metabolism is so low.*

ADVANTAGES OF BEING ECTOTHERMIC: Because their metabolism is so slow, ectotherms can survive on about 1/10 the amount of food needed by the same size endotherm (warm blooded organism).

DISADVANTAGES OF BEING ECTOTHERMIC:

- 1). Ectotherms can run or swim at **MAXIMUM SPEED FOR ONLY SHORT PERIODS** of time. (Their metabolism can't provide enough energy to keep them going longer.)
- 2). Ectotherms **CAN'T LIVE IN VERY COLD CLIMATES**
They survive in moderate climates only by becoming dormant (**HIBERNATING**) during the coldest months.

Because their body temperature is dependant on the temperature of their environment, reptiles are abundant in the warmer regions of the world, a few live in colder parts of the temperate zone, but none live in the Arctic or Antarctic regions.

What sex is it?

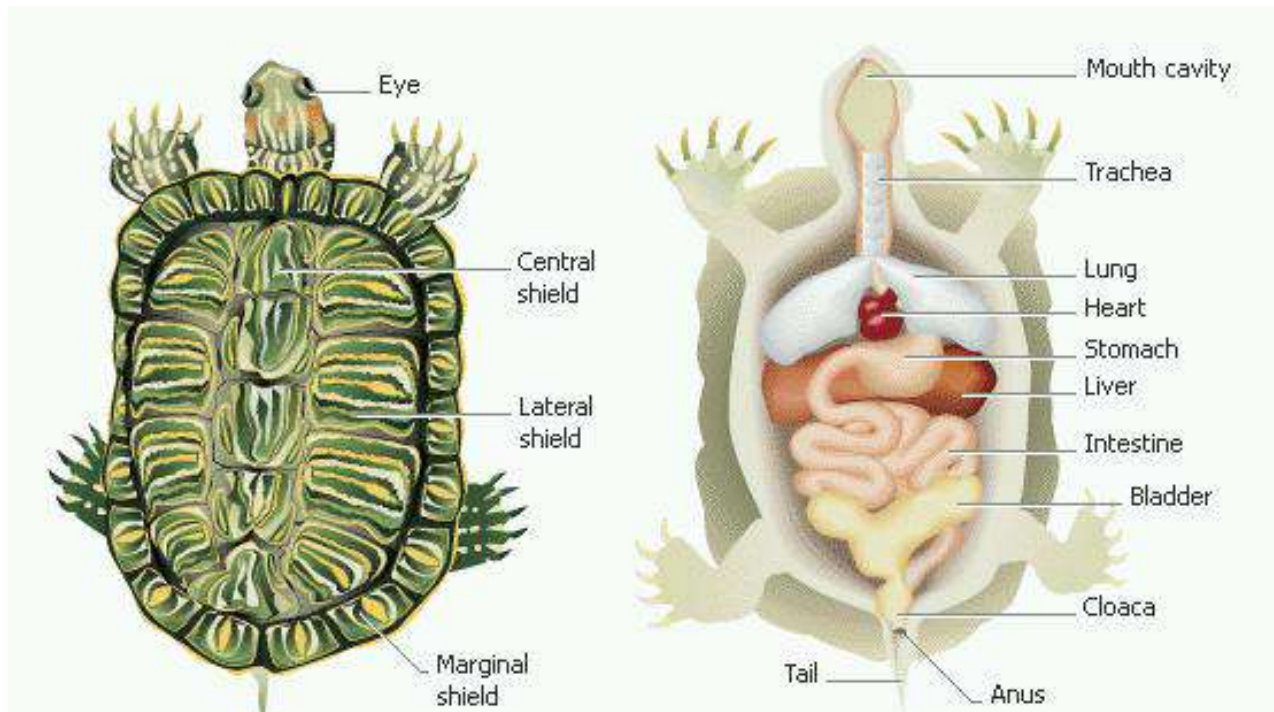
Male turtles have longer front claws and a longer tail. The vent in males is farther back from the edge of their shell than in females. Their plastron is slightly concave to allow for males to climb on top of females during mating. The plastron in a female is slightly convex to allow more room for eggs inside.

REMOVE your PLASTRON: Be careful! This is a difficult and time consuming procedure! It will give you an appreciation for the armor that protects the turtle from most predators and which partially accounts for the long lives that turtles live. **DO NOT USE YOUR SCALPEL TO PRY OPEN THE SHELL . . .** it will break. Use your steak knife to disconnect the skin around the legs to separate it from the shell.

Reptiles are **EUCOELOMATES**. The space you see surrounding the internal organs is "true coelom" (body cavity lined on both sides by mesoderm).

The yellowish structures are stored **FAT**. Turtles do not store fat in the same way as frogs do. Fat stores are reservoirs for food used during **HIBERNATION**.

The **MESENTERY** (fan-like membrane) connects the internal organs just like in a frog.



DIGESTIVE Just like in a frog, food moves from PHARYNX (back of throat) down the GULLET into the ESOPHAGUS to the STOMACH. Acid secreted by the walls of the stomach and the stomach muscles work to break down food. The PYLORIC SPHINCTER muscle at the end of the stomach controls the passing of digested food into the SMALL INTESTINE. The upper portion of the SMALL INTESTINE closest to the stomach is the DUODENUM. The next coiled section is the ILEUM. A fan-like membrane called the MESENTERY holds the folds of the small intestine together. The SMALL INTESTINE receives bile from the LIVER and pancreatic enzymes (including trypsin) from the PANCREAS. Digestion is completed here and nutrients are absorbed through the VILLI (small fingerlike extensions) lining the small intestine. The lower end of the small intestine leads into the LARGE INTESTINE (also called the COLON), where undigested waste is collected and passed into the CLOACA, a multipurpose cavity. Digestive waste, nitrogen waste from the kidneys (urine), as well as eggs and sperm all pass through the CLOACA on their way out of the body through the VENT. The main functions of the lobed LIVER are to MAKE BILE, STORE GLYCOGEN and VITAMINS, and PROCESS TOXINS including NITROGEN WASTE for the kidneys to remove.

THE GALL BLADDER, a greenish colored sac found in the liver, stores BILE made by the LIVER. The PANCREAS is an elongated organ located in the first loop of intestine between the beginning of the small intestine and stomach. It secretes TRYPSIN that is used in the small intestine to break down proteins.

ENDOCRINE

Hormones secreted by the THYROID gland control heart rate, growth, nutrient utilization, and reproduction. The PANCREAS makes INSULIN which causes cells to take up glucose from the blood and store it as glycogen and GLUCAGON which causes cells to release stored glucose into the bloodstream.

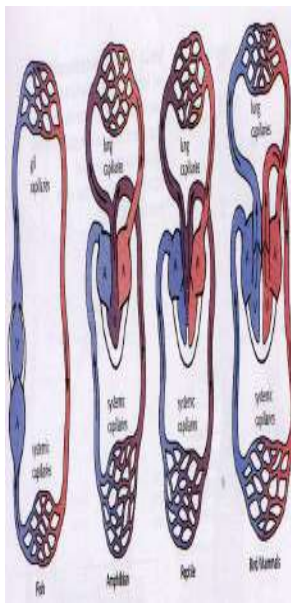
RESPIRATION:

Turtles use LUNGS for respiration. Air enters the GLOTTIS, moves down the TRACHEA (a tube lined with cartilage rings which help to hold the airway open) which splits into two BRONCHI that carry air into the lungs. Unlike a frog whose lungs were simple sacs, the lungs in a turtle have many small individual air sacs called ALVEOLI (*sing.* ALVEOLUS) to increase surface area for greater gas exchange. Some sea turtles can exchange gases through the skin of their cloaca.

CIRCULATORY

Like amphibians, the circulatory system in reptiles consists of a CLOSED TWO LOOP SYSTEM and a THREE CHAMBER HEART surrounded by a PERICARDIAL MEMBRANE. Locate the RIGHT ATRIUM, LEFT ATRIUM, and VENTRICLE. The SINUS VENOSUS and CONUS ARTERIOSUS ARE SMALLER THAN IN AMPHIBIANS. In fact the SINUS VENOSUS is even absent in some species. The CONUS ARTERIOSUS forms the base of the 3 large arteries leaving the heart.

The PULMONARY CIRCULATION carries deoxygenated blood from the heart to the lungs, then returns oxygenated blood to the heart. The SYSTEMIC CIRCULATION carries oxygenated blood from the heart to the muscles and body organs and brings deoxygenated blood back to the heart. Blood going to the kidneys (RENAL circulation), to the liver (HEPATIC circulation), and blood that supplies the heart itself (CORONARY circulation) are special parts of the SYSTEMIC loop. Remember adding a second loop has the advantages of FASTER BLOOD FLOW to the body organs and MORE EFFICIENT delivery of oxygen.



Low oxygen blood returning from the body enters the SINUS VENOSUS. From there it enters the RIGHT ATRIUM. At the same time high oxygen blood returning from the lungs enters the LEFT ATRIUM. When the atria contract, both kinds of blood are sent to the VENTRICLE. The turtle heart is different from that seen in frogs. In most reptiles a PARTIAL SEPTUM appears to separate the ventricle to further prevent mixing to the HIGH and LOW oxygen blood that shares this pumping chamber. (In Crocodilians this septum divider is complete making crocodilians the only reptiles with a 4 chamber heart.) When the ventricle contracts, both kinds of blood pass through the CONUS ARTERIOSUS, which has a valve to prevent mixing of high and low oxygen blood. Large arteries then carry the high oxygen blood out to the body organs and muscles and low oxygen blood is sent to the lungs to pick up oxygen.

The reptile circulatory system has a flexibility that amphibians, birds, and mammals do not. Pumping blood through the lungs requires energy. Under some circumstances it is advantageous for a reptile to divert blood away from the lungs to conserve energy.

There are times when a reptile may want to save energy by bypassing the lungs

1. when it is inactive (may go a long time without breathing)
2. when holding breath underwater

3. when they want to warm up fast

By constricting the blood flow to the pulmonary arteries, a reptile can redirect blood to the body and bypass (SKIP) the lungs to save energy. Bypassing the lungs can also help a reptile raise its body temperature quickly because warm blood from the skin can be directed to the organs deep inside.

NERVOUS

Turtles are vertebrates with a DORSAL SPINAL CORD surrounded by bone which is actually fused to become part of the carapace shell. The brain of a reptile is about the same size as that of an amphibian of the same size and includes the same parts you have seen previously: medulla oblongata, cerebellum, optic lobes, cerebrum, and olfactory lobes. However, the CEREBRUM is much larger. Turtles have highly developed senses of SMELL and SIGHT, but they don't hear well.

EXCRETORY

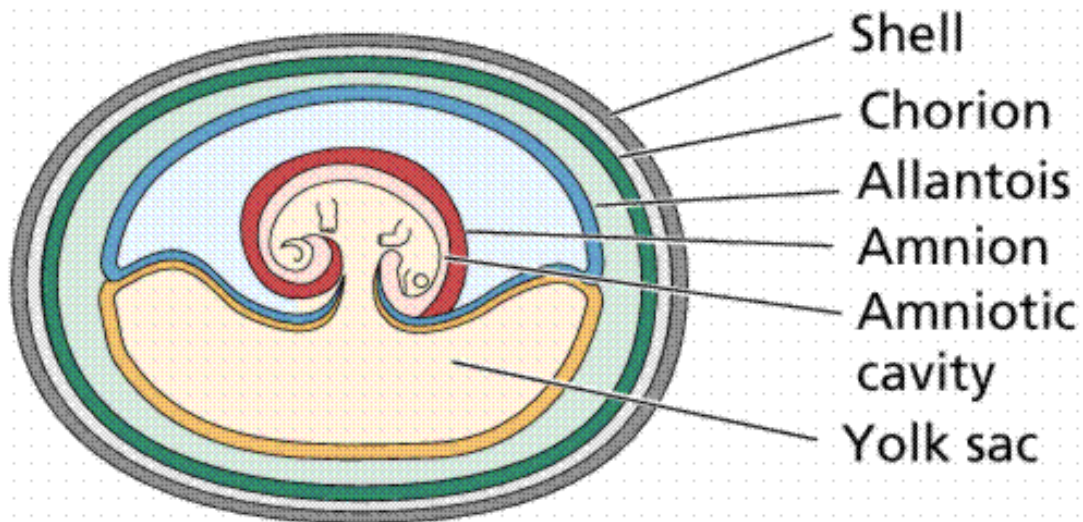
The excretory system of reptiles helps them to conserve body water. Snakes, lizards, and other land dwelling reptiles excrete nitrogen waste in the form of URIC ACID. Uric acid is much less toxic (poisonous) than ammonia or urea, so it requires little water for dilution. Reptiles lose only small amounts of water in their urine. The KIDNEYS, which lie on either side of the spine against the dorsal body wall, are the primary excretory organs. The kidneys filter NITROGEN WASTES (URIC ACID) from the blood, and dilute it with water to make URINE. Urine flows from the kidneys through urinary ducts to the CLOACA. The URINARY BLADDER stores urine until it is released through the VENT. The kidneys also REGULATE THE ION/WATER BALANCE in the blood and tissues.

REPRODUCTION

A female turtle has paired OVARIES that produce the eggs, which pass through the OVIDUCTS, and passed out via the CLOACA through the VENT. Males have TESTES that make the sperm which passes through tubules called VAS DEFERENS to the CLOACA and out of the body. Fertilization in turtles is INTERNAL. Males have a PENIS to deposit the sperm inside the female's body which increases the chances of fertilization. The reproductive pattern seen in turtles and tortoises is OVIPARITY. The female's reproductive tract encloses each egg in a tough protective shell as it passes through the OVIDUCTS. The female scoops out a hole with her hind legs, deposits the eggs, and covers the nest. Most species of reptiles provide no care for their eggs or young. Marine turtles often migrate long distances to lay their eggs on the same beach where they hatched. Reptiles, including turtles, have DIRECT DEVELOPMENT. Baby turtles hatch from their eggs looking like miniature adults.

In most organisms, an individual's sex is determined by the presence of X or Y chromosomes. In humans XX makes you a female, Xy makes you a male. In many reptiles, sex is determined by the temperature at which the egg is incubated. Location OF the nest (shady or in the sun) and location IN the nest (bottom or top) determines whether the baby turtle will be a boy or girl. Some studies suggest that female reptiles may put their nests in different places depending on the male: female ratio in the population.

Turtles lay **AMNIOTIC EGGS** with 4 specialized membranes, which surround the embryo in a self-contained aquatic environment. The tough shell on the outside provides more protection to the embryo inside than the jelly coating of an amphibian egg. The **AMNIOTIC EGG** is an advancement that allowed reptiles to move out onto land and not have to return to water to lay their eggs.



The diagram above shows the internal structure of such an egg. The egg is named for the **AMNION** the thin membrane that encloses the developing embryo and the fluid that surrounds it; The **YOLK SAC** encloses the yolk, a fat-rich food source for the growing embryo; The **ALLANTOIS** stores nitrogen waste produced by the growing embryo **AND** exchanges gases with the environment; The **CHORION** surrounds all the other membranes and helps protect the developing embryo. Protein and water needed by the embryo are contained in the **ALBUMEN**.

The amniotic egg first evolved in reptiles but also occurs in birds and a few mammals (like the platypus). *Scientists believe this is evidence that reptiles, birds, and mammals evolved from a common ancestor.*

NAME _____

LAB QUESTIONS

Latin meaning

KINGDOM _____

PHYLUM _____

SUBPHYLUM _____

CLASS _____

ORDER _____

Tell 2 ways you tell the sex of a turtle by LOOKING at the OUTSIDE of a turtle.

MALES

FEMALES

Name the three body systems that share the cloaca as an exit cavity.

Tell one advantage of being an ECTOTHERM.

Tell two disadvantages of being an ECTOTHERM.

How is the ventricle in a turtle different than the ventricle in a frog?

Turtles have a _____ chamber heart and a _____ loop circulatory system.
(how many?) (how many?)

Reptiles excrete their nitrogen waste in the form of URIC ACID. WHY is this better than excreting as UREA like amphibians do? _____

How are the SINUS VENOSUS and CONUS ARTERIOSUS different in reptiles compared to frogs?

COMPARE	TURTLES	FROGS
Fertilization? INTERNAL? EXTERNAL?		
Development? DIRECT? INDIRECT?		
What covers egg?		

In most animals the sex of offspring is determined by the presence of X and Y sex chromosomes. What determines whether a baby turtle will be male or female?

Give 2 examples of when a reptile might bypass (SKIP) its pulmonary circulation and direct blood just to the systemic circulation?

How are the lungs in a turtle different than those in a frog?

Which characteristic is seen in reptiles, birds and some mammals, that allows reptiles to reproduce outside of water, makes scientists think these groups share a common ancestor?

SUBSTANCE	MADE BY ?	FUNCTION
		Causes cells to release stored glycogen into bloodstream as glucose
		Causes cells to take up glucose from blood and store it as glycogen
		Breaks down fats
		Breaks down proteins
	All cells, especially LIVER	Storage form of glucose used by animal cells to save energy

COMPARE	
Osmoregulation	
Thermoregulation	

TURTLES are/have:

Invertebrate protostomes Invertebrate deuterostomes Vertebrate deuterostomes

blastopore → mouth
determinate spiral cleavage

blastopore → anus
indeterminate radial cleavage

VENTRAL nerve cord/DORSAL heart

DORSAL nerve cord/VENTRAL heart

ACOELOMATES

PSEUDOCOELOMATES

EUCELOMATES

Open circulation

Closed circulation

Asexual reproduction

Sexual reproduction

Hermaphrodites

Separate sexes

Indirect development

Direct development

External fertilization

Internal fertilization

Asymmetry

Radial symmetry

Bilateral symmetry

TELL THE BODY ORGAN THAT MATCHES THE FUNCTION GIVEN:

Dorsal shell _____

Ventral "tummy" shell _____

Nostrils _____

Part of the heart that pumps the blood _____

Receives blood returning to heart from body organs _____

Receives blood returning to heart from lungs _____

Receives blood from sinus venosus _____

Smooths flow of blood leaving ventricle _____

Parts of the heart that carry both
HIGH and LOW oxygen blood _____ & _____

Parts of the heart that carry ONLY
LOW oxygen blood _____ & _____

Part of the heart that carries ONLY HIGH oxygen blood _____

Stores glycogen and vitamins _____

Processes toxins including nitrogen waste for kidneys _____

Makes trypsin, insulin, & glucagon _____

Eardrum _____

Membrane that covers eyes like "swim goggles" _____

Membrane that connects and holds the digestive organs together _____

Makes, stores, and recycles red blood cells _____

Makes bile _____

Stores urine _____

Stores bile _____

Made up of duodenum and ileum _____

Removes water and concentrates digestive waste _____

Tubules where sperm mature & grow tails _____

Tubules that carry sperm from epididymis to cloaca _____

Tubes that carry eggs & add shell _____

Opening to the lungs _____

Opening to the digestive system _____

Tubes that connect back of throat to inner ears _____

Carries food from gullet to stomach _____

First part of small intestine where trypsin & bile are
added and digestion is finished _____

Lower part of small intestine where nutrients are absorbed _____

Produces acid and BEGINS the breakdown of food _____

Carries air from glottis to bronchi _____

Carries air from trachea to lungs _____

Exchanges gases _____

Regulates ion/water concentration (OSMOREGULATION) _____

Circular muscle that controls food passing between _____
between the stomach & small intestine (duodenum)

Collecting SPACE for urine, feces, and eggs/sperm _____

Exit OPENING shared by excretory, digestive, & reproductive _____

Fingerlike extensions inside the small intestine
to increase surface area and absorb more nutrients _____

Air sacs inside lungs that increase surface area _____

Also called COLON _____

Male organ used to transfer sperm to the female _____

Partial dividing wall inside the ventricle _____

Removes uric acid from blood & dilutes it to make urine _____

Makes THYROXINE to control heart rate, growth, metabolism, & reproduction _____

USE ARROWS TO SHOW THE PATH OF BLOOD IN A TURTLE:

USE RED for HIGH OXYGEN blood. USE BLUE for LOW OXYGEN blood.

SINUS
VENOSUS

BODY

LUNGS

RIGHT
ATRIUM

LEFT
ATRIUM

VENTRICLE

CONUS
ARTERIOSUS