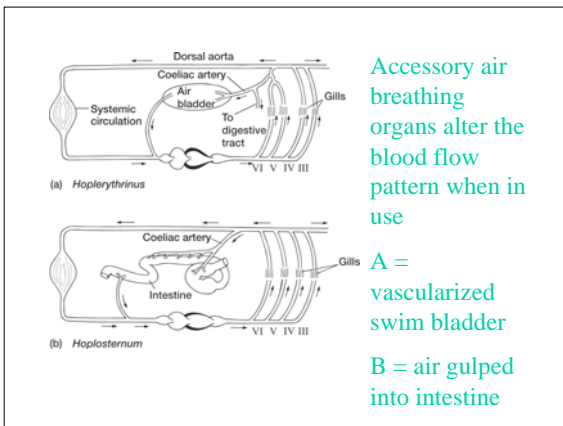


Mammal – four chambered heart with same chambers as birds

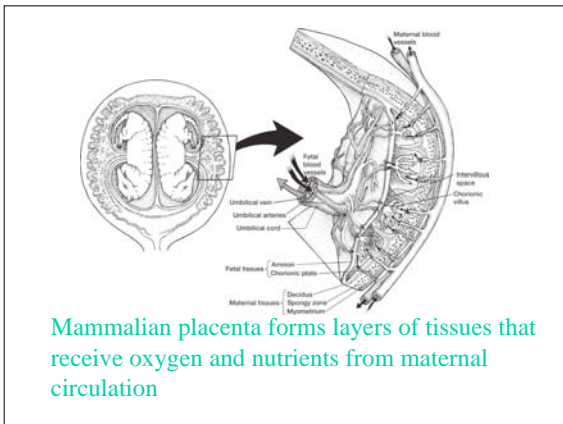
Maybe complete separation is required in endotherms



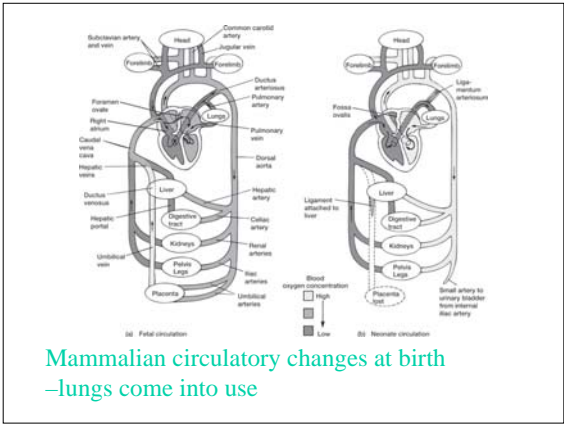
Accessory air breathing organs alter the blood flow pattern when in use

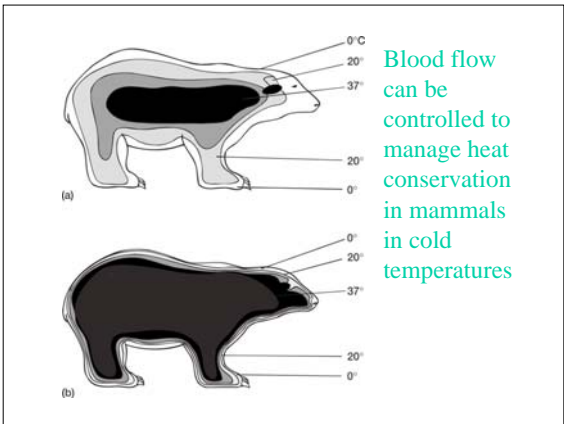
A = vascularized swim bladder

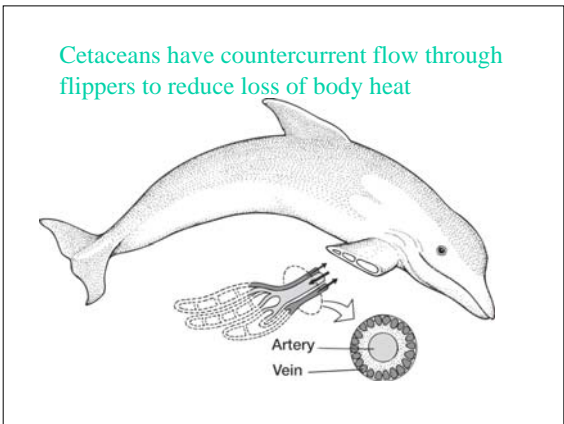
B = air gulped into intestine

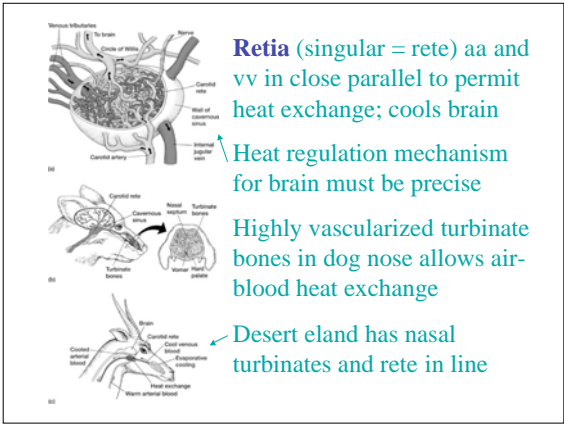


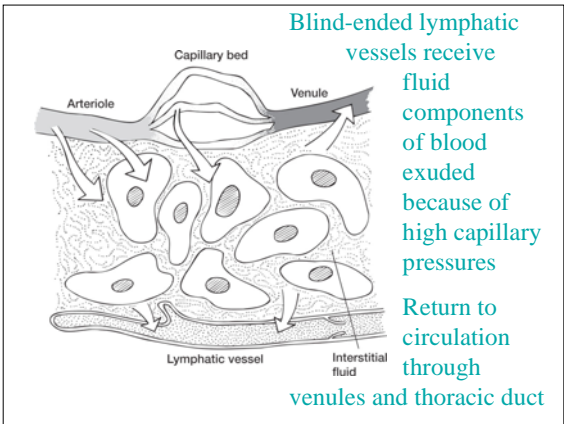
Mammalian placenta forms layers of tissues that receive oxygen and nutrients from maternal circulation

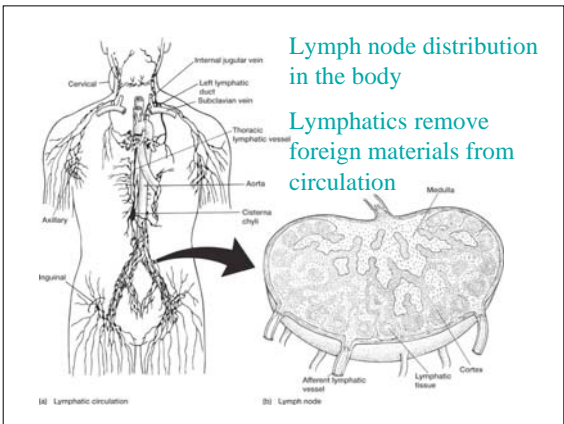


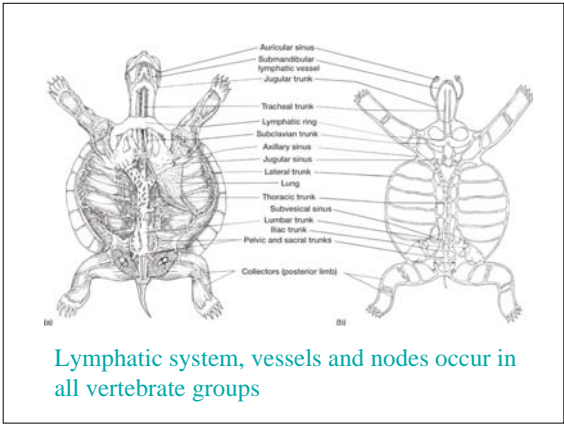




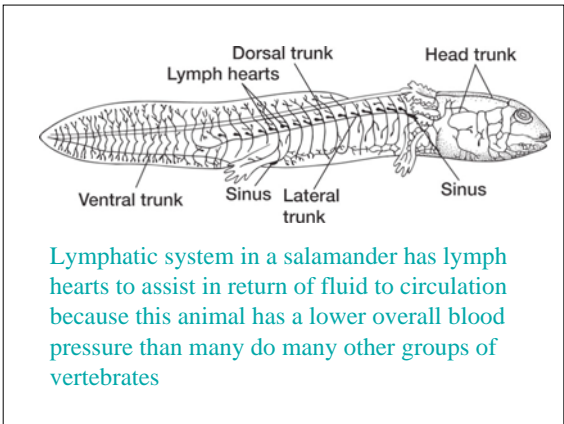




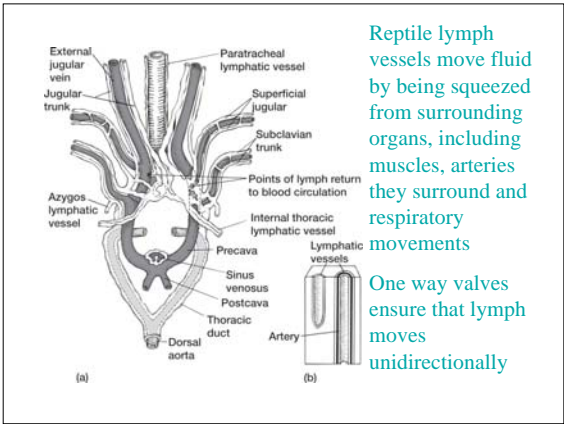




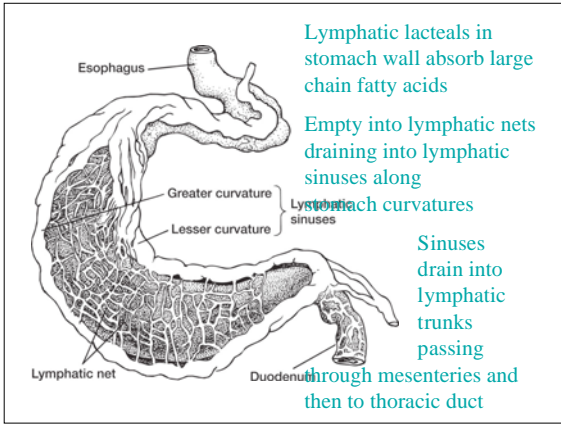
Lymphatic system, vessels and nodes occur in all vertebrate groups



Lymphatic system in a salamander has lymph hearts to assist in return of fluid to circulation because this animal has a lower overall blood pressure than many do many other groups of vertebrates



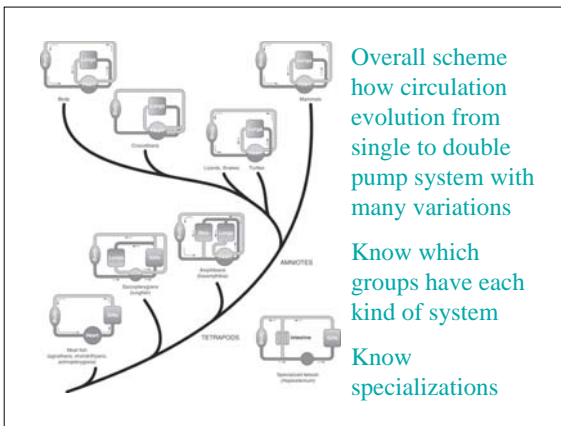
Reptile lymph vessels move fluid by being squeezed from surrounding organs, including muscles, arteries they surround and respiratory movements
One way valves ensure that lymph moves unidirectionally



Lymphatic lacteals in stomach wall absorb large chain fatty acids

Empty into lymphatic nets draining into lymphatic sinuses along each curvature

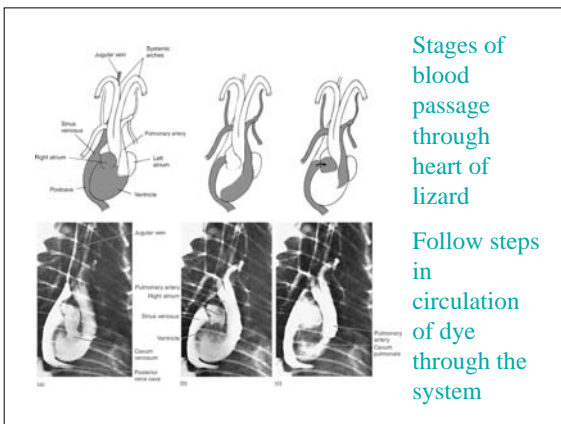
Sinuses drain into lymphatic trunks passing through mesenteries and then to thoracic duct



Overall scheme how circulation evolution from single to double pump system with many variations

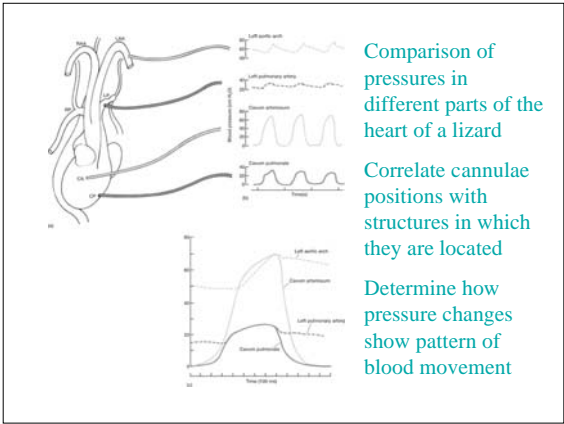
Know which groups have each kind of system

Know specializations



Stages of blood passage through heart of lizard

Follow steps in circulation of dye through the system



Body size affects blood pressures, heart rates as well as blood volume.

The larger the animal, the larger the blood volume.

Larger animals have slower heartbeats that also correlate with lower metabolic rates in mammals

FINIS!

