1. Fish vs. human – one circuit vs. two
    a. Pump – the heart
    b. Pipes
        i. Arteries
        ii. Capillaries
        iii. veins
2. Human circulation
    a. Heart
    b. Blood vessels of heart, aortic arch
    c. Blood vessels of adomen
        i. Unpaired
            1. celiac
            2. superior mesenteric
            3. inferior mesenteric
        ii. paired
            1. renal
            2. gonadal
        iii. anastomoses
3. Primitive condition - elasmobranchs
    a. Heart
        i. Sinus venosus
        ii. Atrium
        iii. Ventricle
        iv. Conus/bulbus arteriosus
    b. Arteries
        i. Ventral aorta
        ii. Afferent branchials – ventral arches II-VI
        iii. Collector loops (pretrematic and posttrematic)
        iv. Efferent branchials (dorsal 1-VI)
        v. External carotid
        vi. Internal carotid
        vii. Dorsal arota
4. Lungfish
    a. Anatomy
        i. Conus arteriosus with spiral valve targets blood to different arches
        ii. 1st arch lost
        iii. 1st gill lost, 3rd gill lost
        iv. lung with pulmonary artery from 6th dorsal arch (efferent branch)
        v. anastomosis between ventral aorta and external carotid a.
        vi. part of 6th arch to dorsal aorta is the ductus arteriosus
        vii. valves in arch vessels
    b. aquatic breathing
        i. valves to external carotid, 3rd, 4th, and pulmonary artery closed
        ii. blood exiting heart goes through 2nd, 5th, 6th arches, not to lungs
    c. air breathing
        i. valve to 2nd, 5th arch closed, ductus arteriosus closed

ii. Oxygen poor blood enters right side of sinus venosus, goes through heart and spiral valve targets this blood to 6th arch, to lung
iii. Oxygen rich blood enters atrium directly (not through SV), remains largely separated from O2-poor blood, and spiral valve tagets blood to arches 2, 3, and 4. Note blood through 2nd arch travels up external carotid.

5. Amphibians
    a. Anatomy
        i. 1st and 2nd arches lost, external carotid now just an anterior extension of ventral aorta
        ii. 3rd becomes part of internal carotid (dorsal aorta going anteriorly into head)
        iii. ventral aorta anterior to arch 4 becomes common carotid
        iv. carotid duct (dorsal aorta between arches 3 and 4) lost
        v. arches 5 and 6 lost, except part of 6th going to lungs
        vi. what is left is a ventral aorta with 2 arches (3 & 4), with 3 going to head and 4 is the systemic arch (body)
        vii. atria is completely divided into R and L sides by interatrial septum. As in lungfish, R side receives systemic blood and L side receives pulmonary blood (although in lungfish the atrium is not divided).
    b. Function
        i. Valve in conus arteiosus largely directs R side blood to lungs and L side blood to ventral aorta.
6. Lizards, turtles, crocs
    a. Anatomy
        i. Same as amphibians except that ventral aorta divided into 3 tubes: one pulmonary trunk and a R and L aortic arch
        ii. Trunk of left arch (arch 4) is isolated. Trunk of R arch gives rise to common carotid (remainder of ventral aorta and internal and external carotids).
        iii. Ventricle completely divided in crocs (will talk about this tomorrow) and partly divided in other reptiles
7. Birds
    a. Anatomy
        i. Lost left aortic arch
        ii. Single pulmonary trunk and single systemic trunk (aorta) exiting completely divided ventricle
8. mammal
    a. Right arch becomes R. subclavian. Left subclavian branch off left arch