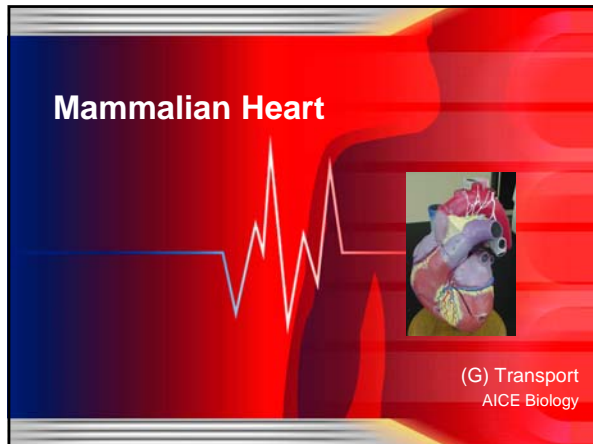


Mammalian Heart




(G) Transport
AICE Biology

Learning Outcomes

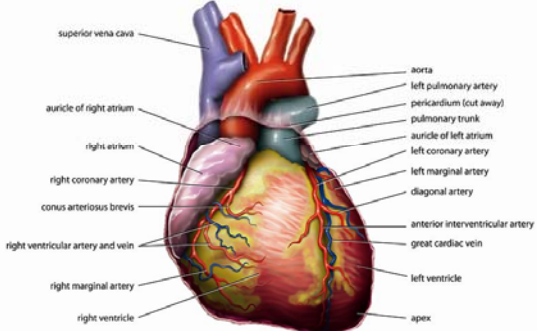
- (t) describe the external and internal structure of the mammalian heart;
- (u) explain the differences in the thickness of the walls of the different chambers in terms of their functions;
- (w) describe the cardiac cycle;
- (x) explain how heart action is initiated and controlled (reference should be made to the sinoatrial node, the atrioventricular node and the Purkyne tissue);
- (y) use the knowledge gained in this section in new situations or to solve related problems.

The Heart

- Arteries carry blood away from the heart and veins towards the heart
 - names given to blood vessels serving organs e.g.
 - pulmonary = lungs
 - coronary = heart
 - hepatic = liver
 - renal = kidney



External Human Heart

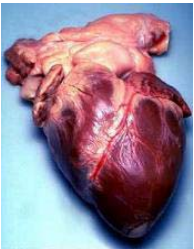


Labels on the left: superior vena cava, auricle of right atrium, right auricle, right coronary artery, conus arteriosus brevis, right ventricular artery and vein, right marginal artery, right ventricle.

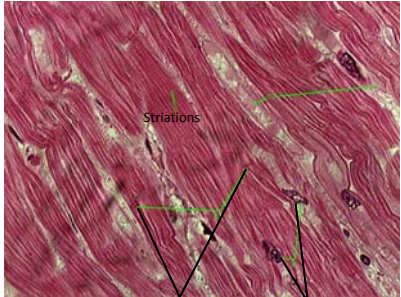
Labels on the right: aorta, left pulmonary artery, pericardium (cut away), pulmonary trunk, auricle of left atrium, left coronary artery, left marginal artery, diagonal artery, anterior interventricular artery, great cardiac vein, left ventricle, apex.

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- Heart from a deceased 65 year old man



Cardiac Muscle

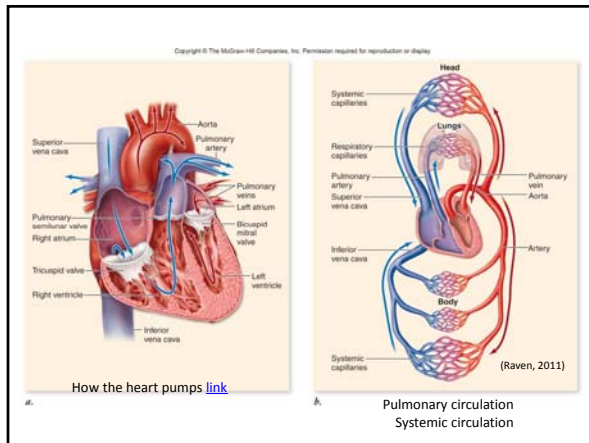
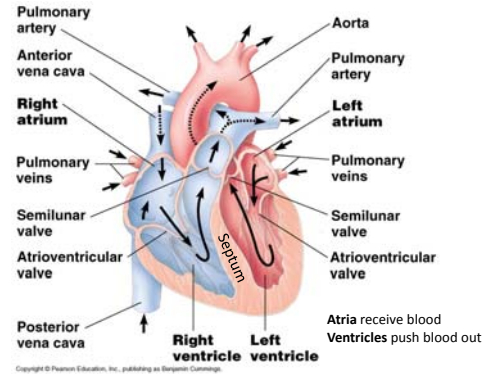


Labels: Striations, Junction between muscle cells, nucleus, Spaces between fibres, containing connective tissue and blood capillaries.

Cardiac muscle

- **Myogenic:** the nerve contraction of the heart muscle lies within the heart muscle itself
- Electric contraction of the heart muscle stays within the heart itself
- Muscle is supplied with the first blood of the systemic circulation from the coronary artery, a branch of the aorta
- Major arteries leaving the heart are the pulmonary and the aorta
- Vena cava and pulmonary veins return blood back to the heart

Internal Human Heart

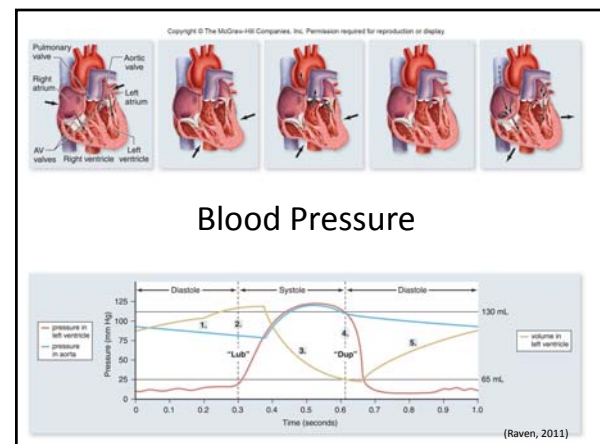


Cardiac cycle

- About 70 beats per minute, continuous, learn the lub-dub. Begin when the heart is completely filled with blood
- **Atrial systole:**
 - contraction of atria, semilunar valves in veins prevent backflow, weak in pressure, enough to force the blood through av valves into the ventricles
- **Ventricular systole:**
 - when pressure in ventricles become greater than in atria, the av valves close and blood is pushed into the arteries
- **Ventricular diastole:**
 - as the muscle relaxes, pressure drops, whole heart relaxes and blood from the veins flows into the atria, some trickles in ventricles
- Heart is never 'empty'

Control of heart beat

- Myogenic: in control of its own electrical rhythm
- Sequence is initiated in the sino-atriole node or **SAN**, the pacemaker, located in the right atrial wall
- SAN muscle cells contract simultaneously and send a wave of excitation throughout the atria (both)
- Slight delay before reaching ventricles, the wave is blocked and next wave comes from the atrio-ventricular node or **AVN**, aka the bundle of His, located in the inter-ventricular septum
- From AVN the excitation spreads through conducting fibers called the Purkyne (Purkinje) tissue which runs down the septum between the ventricles. This wave causes ventricular constriction
- Fibrillation is the lack of coordination gone wrong and the heart is just fluttering. Corrected with shock panels



Blood Pressure

- In the United States, high blood pressure is defined as a systolic reading of 140 or higher and a diastolic reading of 90 or more.
- High-normal blood pressure, also known as prehypertension, is generally defined as having a systolic reading of between 120 and 139 and/or a diastolic reading of 80 to 89.
- **Atrial fibrillation**
 - an irregular -- and sometimes rapid -- heartbeat
 - resulting when the two upper chambers and two lower chambers of the heart are not contracting in sync
- See fig. 9.9 in textbook

Blood flow

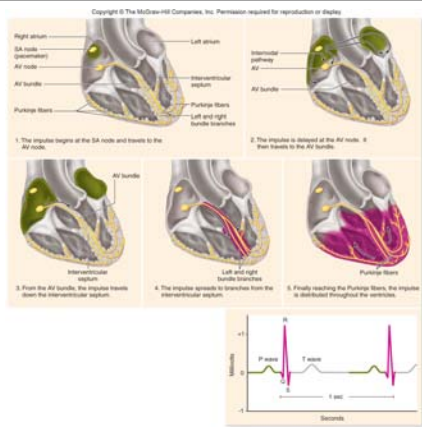
- Blood flow in goldfish tail
 - <http://www.youtube.com/watch?v=DQpLXBG27hg>



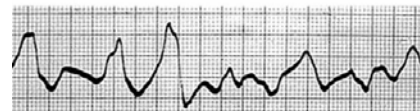
- <http://www.youtube.com/watch?v=hL8WR-tOXx8&feature=related>

Electrocardiograms

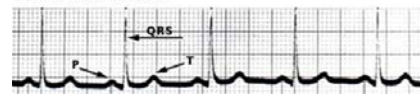
- Electrodes placed over the heart pick up the electrical potential and is easily recorded
- PQRST wave
- P- wave of excitation over atrial walls
- QRS; represent the wave of excitation over the ventricular walls
- T-recovery of the ventricular walls



ECG: Ventricular Fibrillation



ECG: Normal Heartbeat

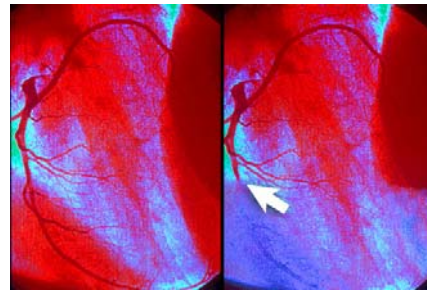


Complications

- Congestive Heart Failure [link](#)

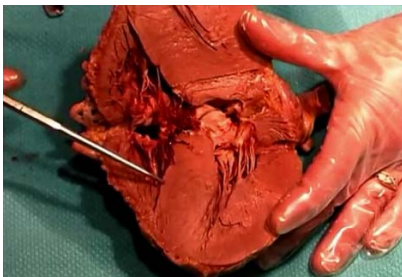
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Coronary Artery Disease



(WebMD, 2011)

Comparing left and right ventricles



<http://www.youtube.com/watch?v=KYZm5rEBfB4&feature=related>

Heart Dissection

- Pig heart:
<http://www.youtube.com/watch?v=Vr-DAhgq75w&feature=related>
- Sheep heart dissection:
http://www.youtube.com/watch?v=R_51gA9xXa0&feature=related

Heart dissections

- Exterior surface presents the coronary arteries and veins, the semilunar valves will be seen from the superior surface of the arteries, the bi/tricuspid valves from the veins
- Frontal or coronal planes are cut vertically with anterior and posterior of heart separated
- Right and left sides are divided by a septum
- Upper chambers are atrium: receive blood from veins, small in size. Lower in pressure
- Lower chambers are ventricles: receive blood from atria and pump into arteries
- Atria and ventricles are separated by the a-v valves. Mitral or bicuspid on the left and tricuspid on the right

Resources

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