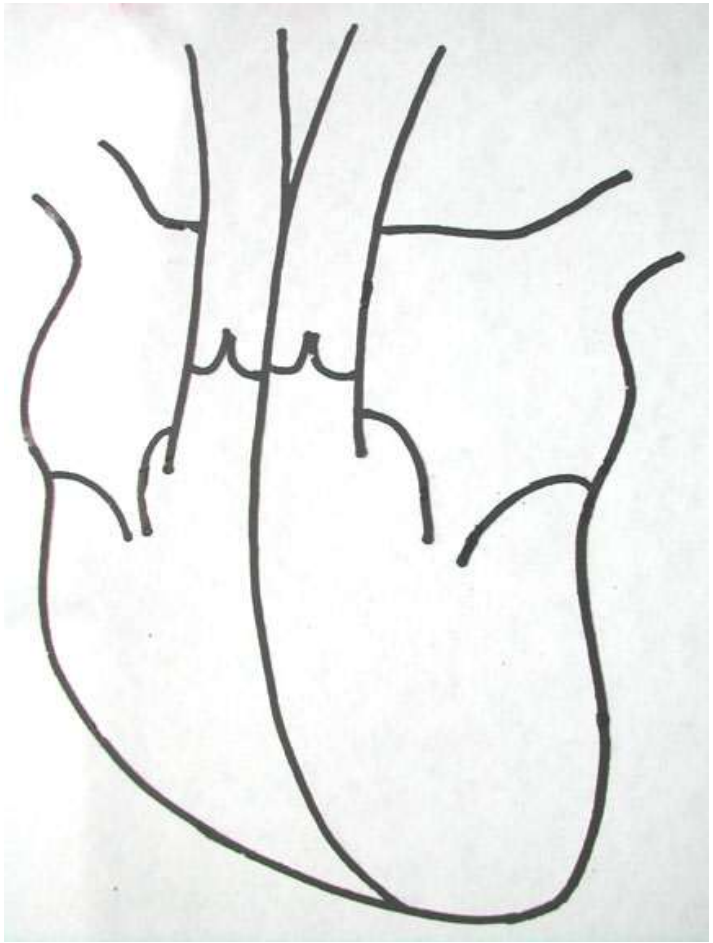
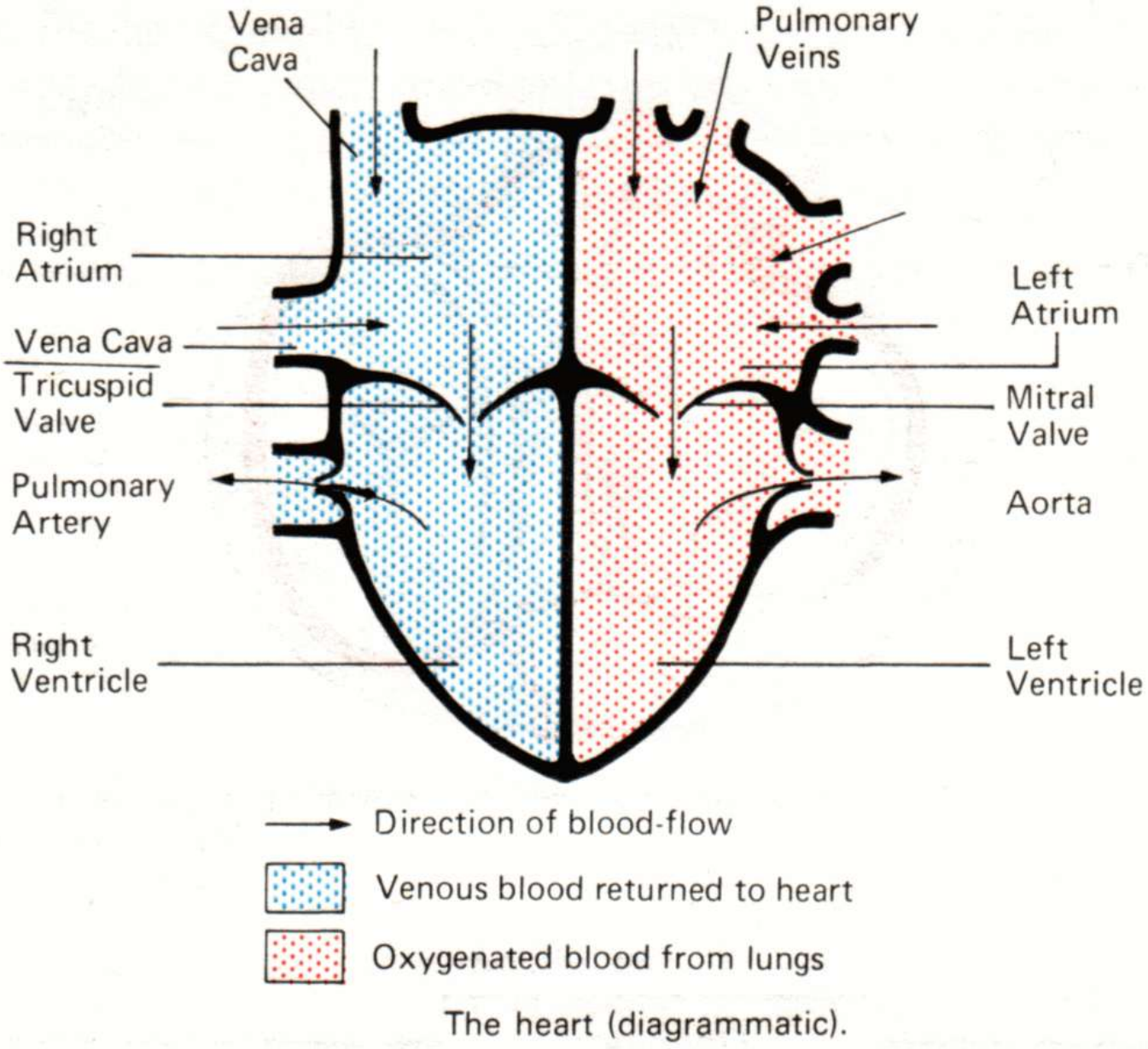
And the beat goes on….

IB Biology

Topic 6

STARTER: **Label** the heart

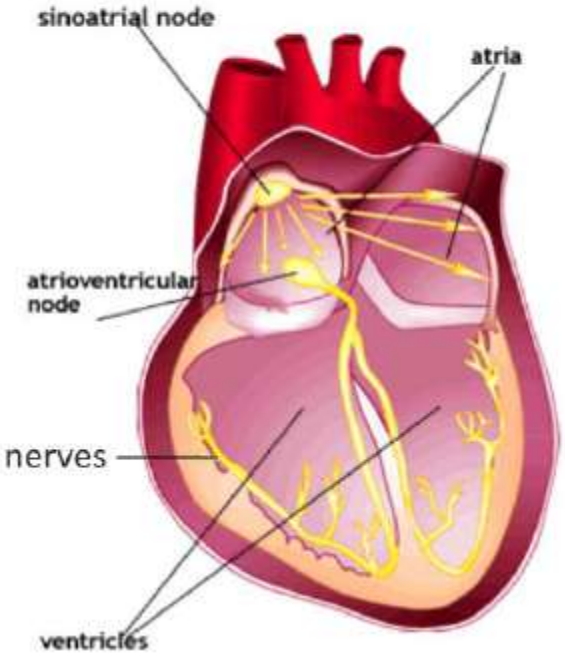




The heart (diagrammatic).

Control of the Heart Beat

Beating of the heart is due to myogenic muscle contraction.

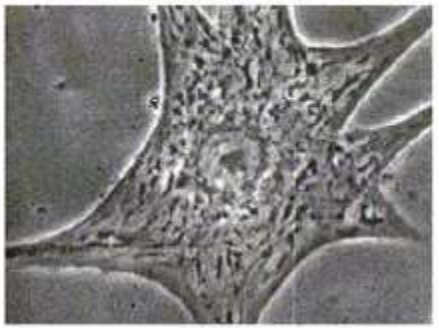


http://www.mda.org/publications/Quest/q106resup.html

This means the myocyte (muscle cell) itself is the origin of the contraction and is not controlled externally.

A region of myocytes called the sinoatrial node (pacemaker) controls the rate of the heartbeat.

Cardiac cell contracting:



http://www.emc.maricopa.edu/faculty/farabee/BIOBK/heartbeat.gif

A wave of excitations is sent from the sinoatrial node, causing the atria to contract. This excitation is conducted to the atrioventricular node, where it is passed through nerves to the muscles of the ventricles, causing them to contract.

Myogenic initiation of the contraction means that the heart does n stop beating - it is not a conscious process.

GROUP THOUGHT

Cardiac muscle is indefatigable - what does this mean and how would you expect the histology of it to differ from regular muscle tissue?

Electrical conducting system in the heart

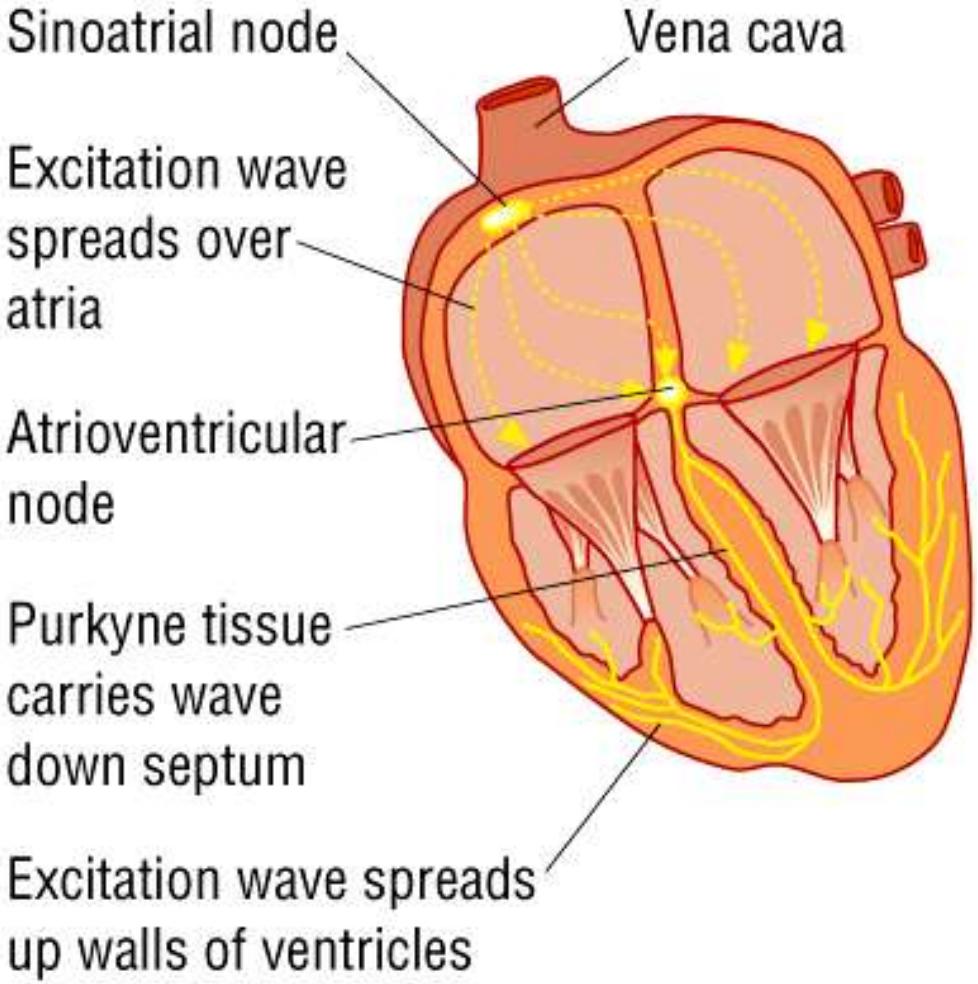
Words to listen for:

Sino-Atrial Node

Action potential

Purkinje fibres

The pathway followed by the wave of excitation



Control of the Heart Beat

Heart rate can be controlled by the autonomic nervous system - the part of the nervous system that responds automatically to changes in body conditions.

Where myocardial contraction maintains the beating of the heart, we may need to speed up or slow down heart rate.

When exercising, more CO_2 is present in the blood. This is detected by chemoreceptors in the brain's medulla oblongata, resulting in a a nerve signal being sent to the SA node to speed the heart rate.

When CO_2 levels fall, another nerve (Vagus) reduces heart rate.

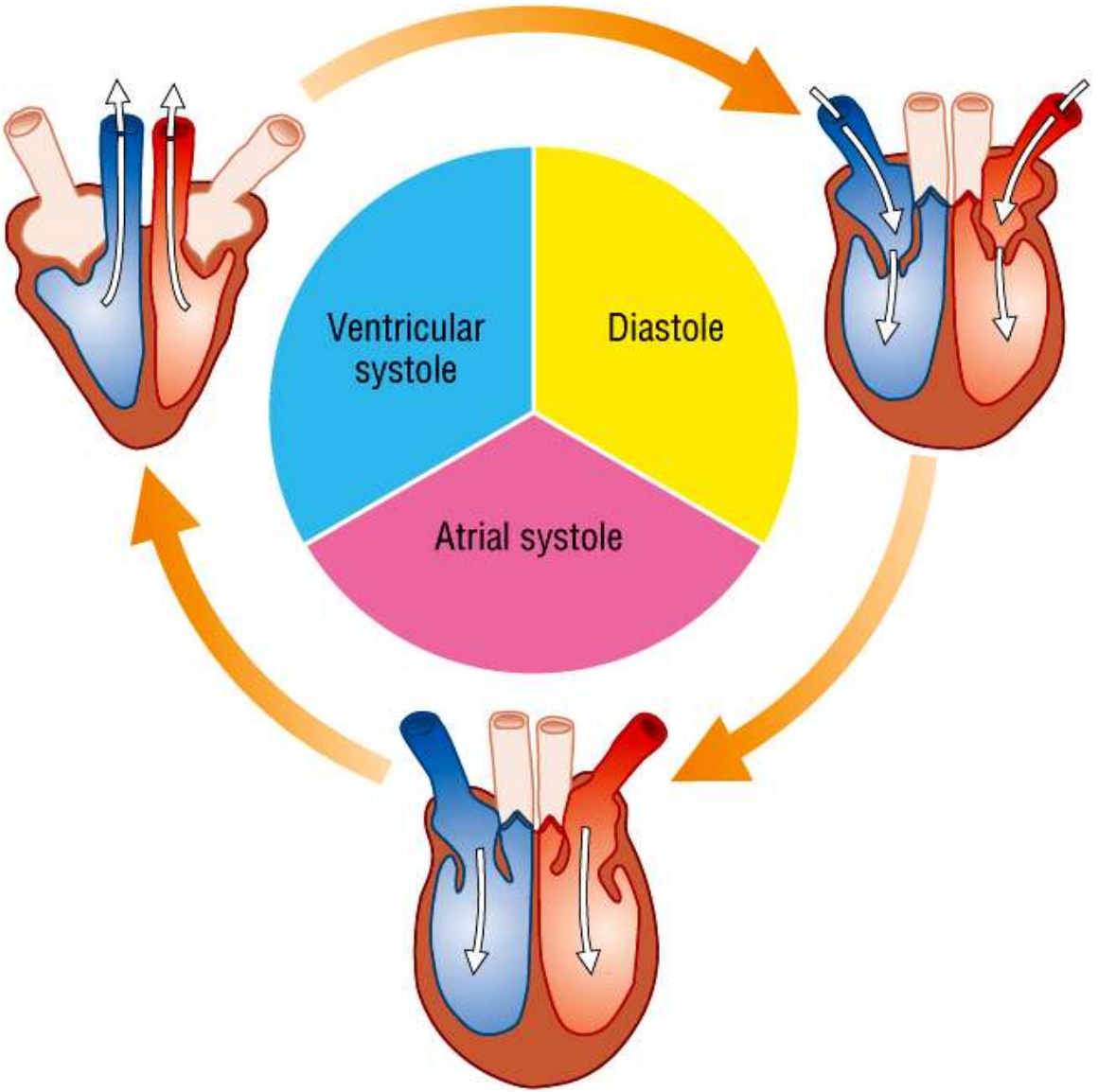
Now try the EXPLAIN exercise on your handout INDIVIDUALLY!

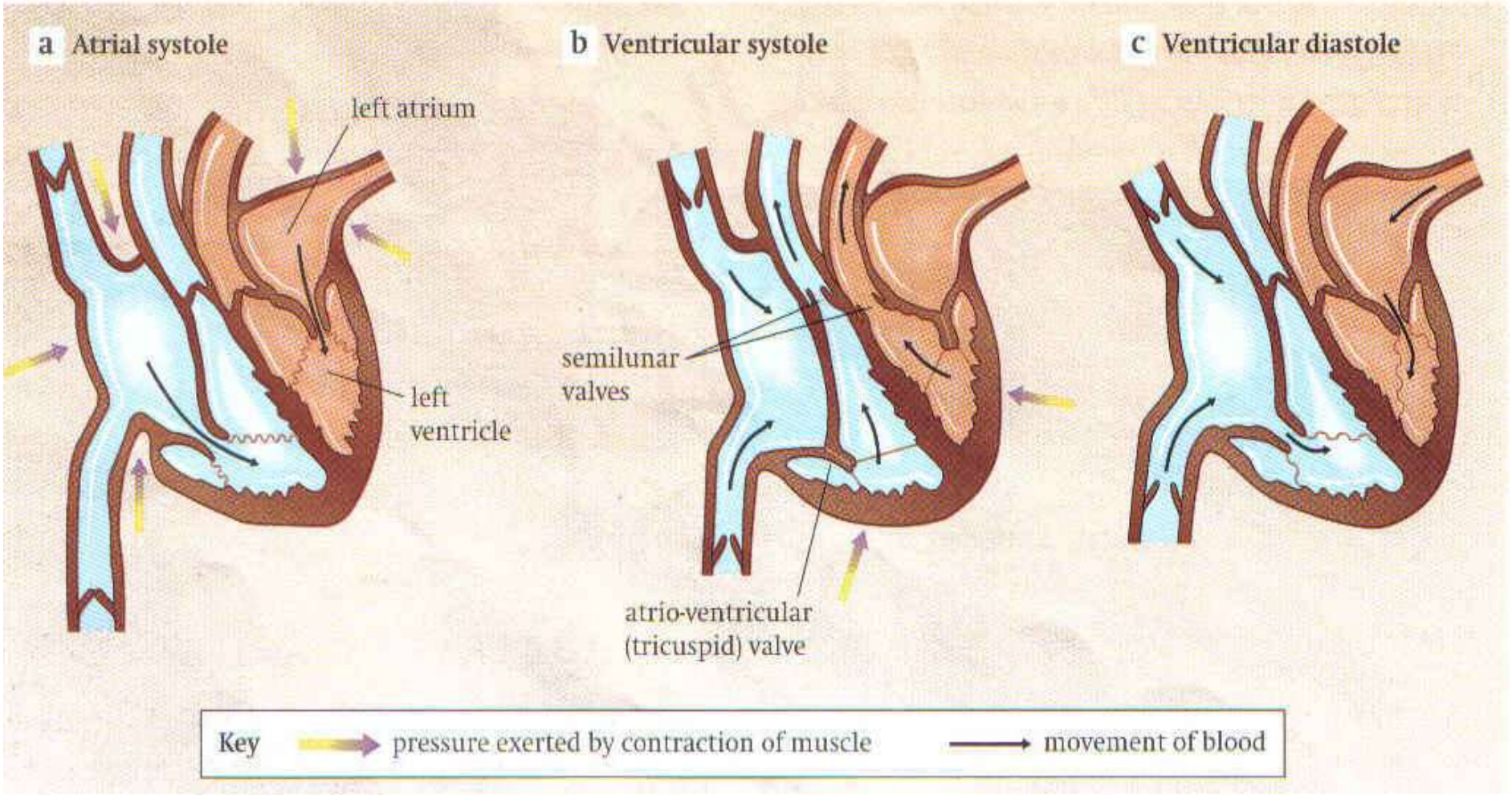
The hormone adrenalin causes a rapid increase in heart rate in fight-or-flight responses, preparing the body for action.

This effect can be mimicked by stimulant drugs.

HL – Pay special attention to the information here – we will meet it again in our HL Option E – The Brain topic

STARTER: *Describe what is happening in each stage of the cardiac cycle*

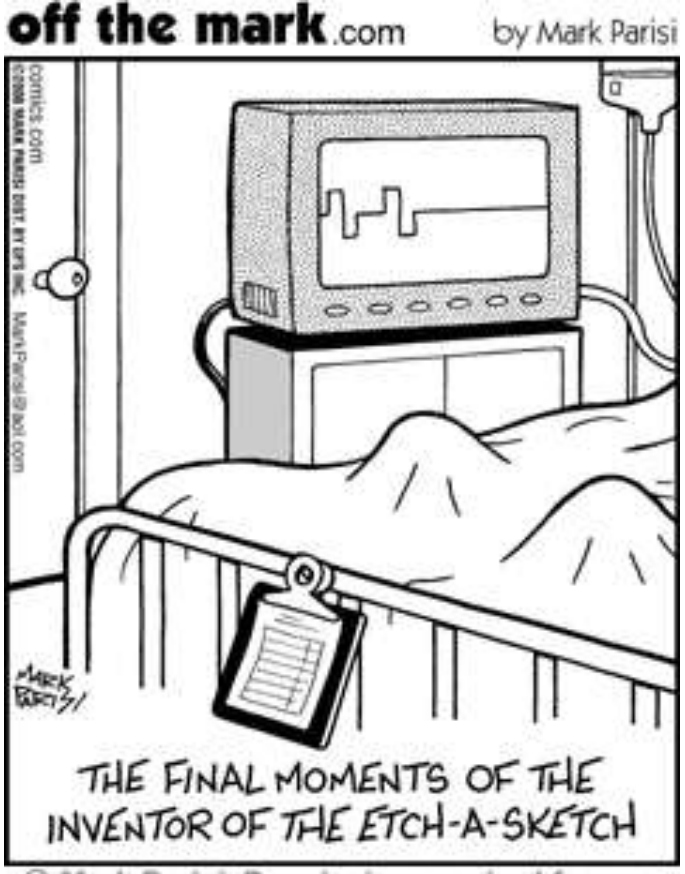




The cardiac cycle. Only three stages in this continuous process are shown.
a Atrial systole Both atria contract. Blood flows from the atria into the ventricles. Backflow of blood into the veins is prevented by closure of valves in the veins.
b Ventricular systole Both ventricles contract. The atrio-ventricular valves close. The semilunar valves in the aorta and pulmonary artery open. Blood flows from the ventricles into the arteries.
c Ventricular diastole Atria and ventricles relax. Blood flows from the veins through the atria and into the ventricles.

Using your knowledge of the cardiac cycle…

- Can you sort your cards into order? *(cut up the statements on the following slide)*



Now can you **label** the diagram on your sheet?

Heart relaxed
AV valves are open

Deoxygenated blood from vena cava flows into RA
Oxygenated blood from pulmonary vein flows into LA
Blood passes into ventricles passively

SA node sends impulses through atria
Atria contract (top downwards) – forces additional blood into ventricles through cuspid valves
Blood from RA to RV; blood from LA to LV

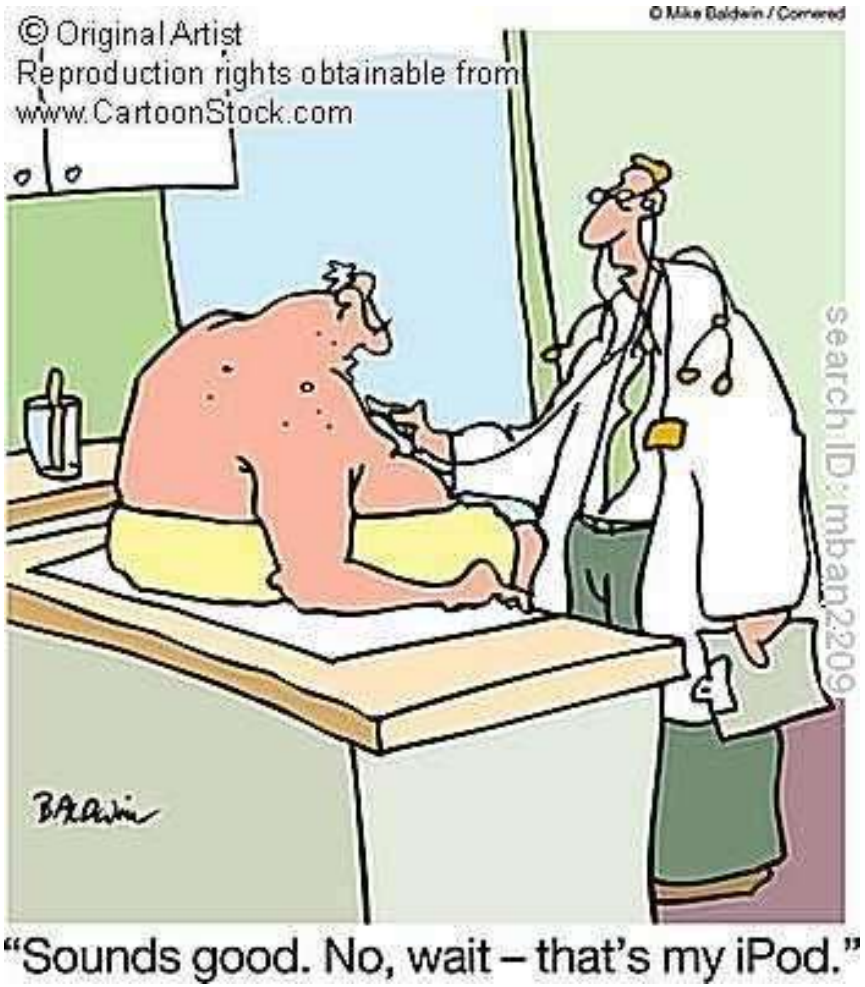
Ventricles receive impulses from AVN via Purkinje fibres – ventricles contract (bottom upwards) – force of blood causes cuspid valves to close (lub)– prevents blood flowing back into atria

Blood is forced from RV into PA through pulmonary semilunar valves and from LV into aorta through aortic semi lunar valves

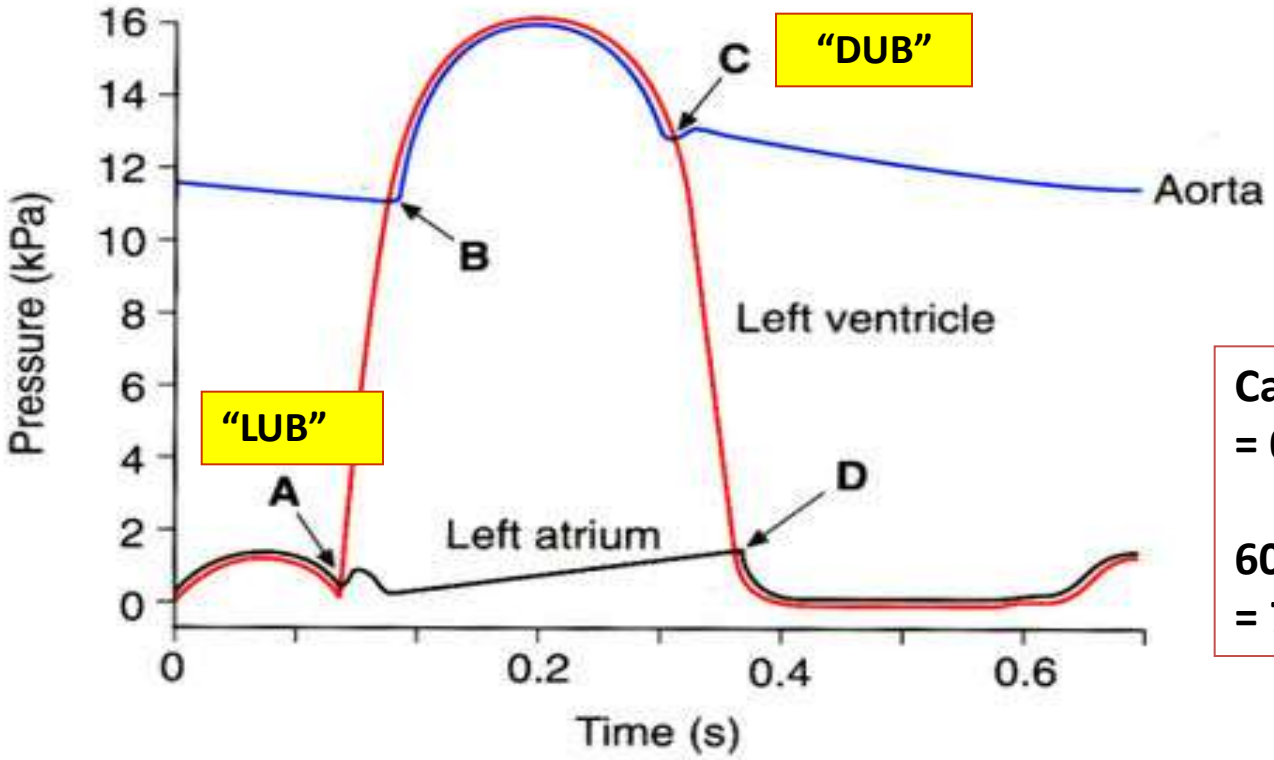
Heart relaxes – semilunar valves close due to force of blood (dub)- prevent backflow from pulmonary artery and aorta into heart - cuspid valves open

Atria fill with blood again to start cycle again

And the beat goes on….



Atrial Systole | Ventricular Systole | Diastole



Cardiac cycle = 0.8 sec

60/0.8 bpm = 72 bpm

A	Atrioventricular (bicuspid / mitral) valve(s) closes ("snaps shut"– makes 1st louder heart sound "LUB"
B	Semilunar valve(s) (aortic valve) opens
C	Semilunar valve(s) closes – makes second softer heart sound "DUB"- shut due to blood accumulating in their pockets
D	Atriioventricular (bicuspid) valve(s) opens

Electrocardiogran (ECG)

Electrodes are placed on the skin over opposite sides of the heart, and the electrical potentials generated recorded with time. The result is an ECG.

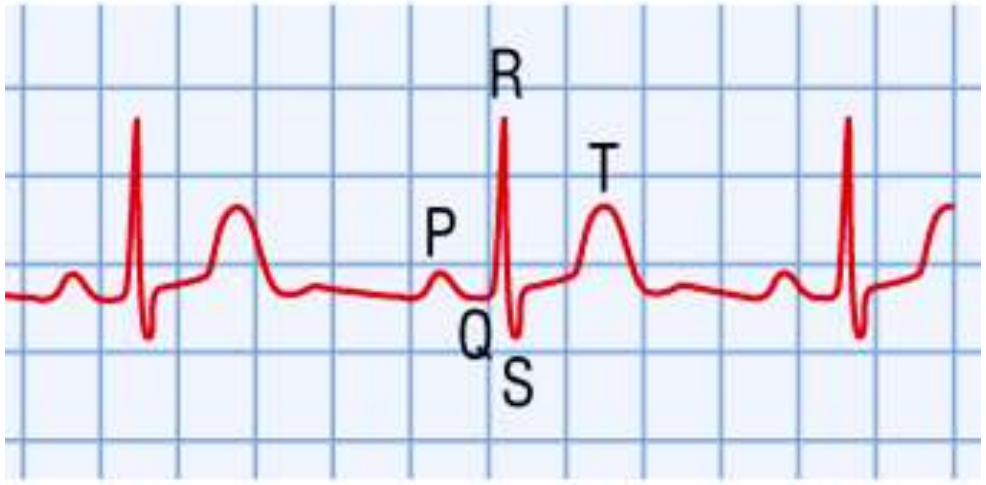
P wave = electrical activity during atrial systole

QRS complex = electrical activity during ventricular systole

T wave = ventricular repolarisation (recovery of ventricular walls)

Q-T interval – contraction time (ventricles contracting)

T-P interval – filling time – ventricles relaxed and filling with blood



Pattern are studied in different conditions and compared to the standard ECG in order to diagnose heart conditions, such as arrythmias and fibrillation. Fibrillation is stopped by passing a strong electric current through the chest wall – the heart stops for up to 5 seconds after which it begins to beat in a controlled way