Blood Circulation within the Heart
The human heart is connected with blood vessels coming from around the body. The blood is pumped into the blood vessels through the heart. This pumping of blood goes through a complex process, where in the deoxygenated blood or impure blood is cleansed and oxygenated blood or pure blood is sent throughout the body. Let's go through the details of blood flow through the heart. But before that, you can have a look at the blood flow through the heart diagram below, that will help understand the heart better.

Chambers of the Heart
The heart is divided into two chambers, left and right, the right atrium and ventricle lie on the right side and the left atrium and ventricle on the left side. These two chambers are not directly connected to each other.

Synchronization of the Two Chamber
The right and left side or chambers of the heart work in tandem with each other. Blood from all over the body will reach the heart through pulmonary veins; inferior vena cava and the superior vena cava. The deoxygenated blood will first enter the right atrium and simultaneously the left atrium receives oxygenated blood from the lungs.

Contraction of Atria
The walls of the atria contract and the blood from left and right atria are pumped into the right and left ventricles. The blood from right atrium enters the right ventricle through an open tricuspid valve. When the ventricles are filled with blood, the tricuspid valves close. This helps in prevention of back flow of blood into the atria. In the left atrium, the blood flows to the left ventricle through the mitral valve (bicuspid valve). When the ventricles are full of blood, the mitral valve closes. Again, for the same reason; prevention of blood backflow.
Flow to Lungs
The deoxygenated blood from in the right ventricle is taken to the lungs with the help of pulmonary trunk that arises from the right ventricle. Coronary arteries and the systemic circulation of blood from aorta of left ventricle carry the oxygenated blood from lungs back to heart. The backflow of blood in pulmonary trunk and aorta is prevented due to presence of semilunar valves.

Pulmonary Circulation
The deoxygenated blood from the heart enters the lungs through the pulmonary valve as seen in the human heart diagram. This process is called pulmonary circulation. From the pulmonic valve, the blood travels to the pulmonary artery into the tiny capillary vessels of the lungs. The oxygen present in the tiny air sacs enters the blood through the walls of the capillaries into the blood. Carbon dioxide, the metabolic waste is passed into the air sacs. As one exhales during respiration, carbon dioxide is removed from the body. The purified blood is oxygenated and sent back to the left atrium through the pulmonary veins.

Circulation into the Body
The oxygenated blood that returns to the heart through the pulmonary vein into the left atrium is passed to the left ventricle through the mitral valve (bicuspid valve). Then the left ventricle pumps the blood into the aorta through systemic circulation. From the aorta, the blood travels to various parts of the body carrying oxygen and nutrients. It then returns back to the heart through the veins in the form of deoxygenated blood. And the cycle of blood flow through the heart continues.

Understanding Blood Pressure
The pressure created in the arteries by the contraction of the left ventricle is what creates our systolic blood pressure. Once the left ventricle has fully contracted it begins to relax and refill with blood from the left atria. The pressure in the arteries falls while the ventricle refills and this is what causes the diastolic blood pressure.

Cardiac Conduction System
The pump or the heart, needs electricity to work. There is a specific pathway of electric impulse that travels through the heart and is made up of 5 elements.
- The sino-atrial (SA) node
- The atrio-ventricular (AV) node
- The bundle of His
- The left and right bundle branches
- The Purkinje fibers
SA node
The SA node is the natural pacemaker of the heart. You most likely have heard of Transcutaneous Pacemakers (external) and Transvenous Pacemakers (internal). These pacing interventions are used when the SA node has ceased to function properly.

The SA node releases electrical stimuli at a regular rate, which are indicated by the needs of the body. Each stimulus passes through the myocardial cells of the atria creating a wave of contraction which passes through both atria. As an analogy, imagine a picture made up of dominoes. One domino is pushed over causing a wave of collapsing dominoes spreading out across the picture until all the dominoes are down.

The heart is made up of around half a billion cells, as you can see in the diagram above there is different muscle mass in the various chambers. The majority of the cells make up the ventricular walls. The rapid atrial contraction is such that around 100 million myocardial cells contract in less than 1/3 of a second. This happens so fast that it appears instantaneous.

AV node
The electrical stimulus from the SA node eventually reaches the AV node and is delayed briefly so that the contracting atria have enough time to pump all the blood into the ventricles. Once the atria are empty of blood the valves between the atria and ventricles close. At this point the atria begin to refill and the electrical stimulus passes through the AV node and Bundle of His into the Bundle branches and Purkinje fibres.

Bundle Branches
Consider the bundle branches as motorways and the Purkinje fibres as roadways A and B that will spread across the ventricles. This way, all the cells in the ventricles receive an electrical stimulus causing them to contract.

Using the same domino analogy, about 400 million myocardial cells that make up the ventricles contract in less than one third of a second. As the ventricles contract, the right ventricle pumps blood to the lungs where carbon dioxide is released and oxygen is absorbed, while the ventricle pumps blood into the aorta from where it passes into the coronary and arterial circulation.

At this point the ventricles are empty, the atria are full and the valves between them are closed. The SA node is about to release another electrical stimulus and the process is about to repeat itself. However, there is a 3rd section to this process. The SA node and AV node contain only one stimulus. Therefore every time the nodes release a stimulus they must recharge before they can do it again.

The SA node recharges while the atria are refilling, and the AV node recharges when the ventricles are refilling. In this way there is no need for a pause in heart function. This whole process takes less than one third of a second.

The terminology used for the release (discharge) of an electrical stimulus is “depolarization” and the term for recharging is “repolarization”.

So, the 3 stages of a single heart beat are:

- Atrial depolarization
- Ventricular depolarization
- Atrial and ventricular repolarization.

In reality, the heart has several pacemakers known as autonomic foci, each which fires at its own intrinsic rate:

- SA node: 80–100 bpm
- Atrial foci: 60–80 bpm
- Junctional foci: 40–60 bpm
- Ventricular foci: 20–40 bpm
The potentials will normally travel in order
SA node → atrial foci → junctional foci → ventricular foci

Pacemaker potentials are fired not only by SA node, but also by the other foci. However, the other firing frequencies are slower than the one of the SA node (as seen above). Normally, all the foci will end up firing at the SA node rate, not their intrinsic rate. The other foci attempt to fire at their intrinsic rate, but they are activated by the SA node before they can fire. This rapid firing causes all the foci to fire faster than their intrinsic rates, a phenomenon known as overdrive-suppression. Thus, in the normal, healthy heart, only the SA node intrinsic rate is observable.

If we were then going to evaluate the ECG complex and determine what is actually taking place in the heart, it would follow the following pattern.

- P wave: the sequential activation (depolarization) of the right and left atria.
- QRS complex: right and left depolarization (normally the ventricles are activated simultaneously)
- ST-T wave: ventricular repolarization
- U wave: origin for this wave is not clear—but probably represents “afterdepolarizations” in the ventricles.
- PR interval; time interval from onset of atrial depolarization (P wave) to onset of ventricular depolarization (QRS complex).
- QRS duration: duration of ventricular muscle depolarization.
- QT interval: duration of ventricular depolarization and repolarization.
- RR interval: duration of ventricular cardiac cycle (an indicator of ventricular rate).
- PP interval: duration of atrial cycle (an indicator of atrial rate).

We hope this helps you understand the function of the heart. We have covered how the blood travels through the cardiac muscle, how the electrical impulse travels through the heart, what happens to the muscle as that impulse goes through it and also reviewed what that ECG complex means in comparison to that impulse. Now you are all ready for that next cardiac call...right!

Ref- http://www.buzzle.com/articles/blood-flow-through-the-heart-diagram.html
Ref- http://www.nottingham.ac.uk/nursing/practice/resources/cardiology/function/conduction.php
Name: _________________________

Department: ____________________

Date: ____________________________

Level of Practice: _________________

1) Blood from all over the body will reach the heart through___________________,
___________________ and the ____________________.

2) The oxygenated blood that returns to the heart through the pulmonary vein into the left atrium is passed to the
left ventricle through the __________________________.

3) 3 stages of a single heart beat are: ___________________________, ______________________________,
______________________________________.

4) Blood from the right atrium enters the right ventricle through an open __________________________.

5) The specific pathway of electric impulse that travels through the heart is made of these 5 elements.
___________________________, ____________________________, _________________________,
___________________________, ____________________________.

6) The heart has several pacemakers. Identify each and the rate for each foci.

a. _________ :  ___________
b. _________ :  ___________
c. _________ :  ___________
d. _________ :  ___________

7) During an ECG complex, what is happening during the PR interval.
_________________________________________________________________________________________.

8) Deoxygenated blood from the heart enters the lungs through the _________________ valve. Blood then travels
through the pulmonary ______________ into the capillary vessels in the lungs.

9) Systolic blood pressure is caused by ________________________________________ and diastolic pressure is
_____________________________________________________________________.

10) The two types of pacing interventions that are used if the SA node ceases to function properly are?
________________________________________ or ________________________________.
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