Cardiac System

SA Node – Initiates the heart beat. It stimulates the contraction of the atria.
VA Node – Receives the stimulus from the SA node, pauses to let the atria finishes their contraction, then stimulates the contraction of the ventricles
Internodal Tracts – carry the stimulus from the SA node to the VA node.
Bundle of His – carries the stimulus away from the VA node.
Right and Left bundle branches –
Pukinje fibers –
Depolarization –
Polarization/Repolarization –
Systole –
Diastole –
EKG/ECG/Electrocardiamgram –
QRS (QRS Complex) –
T wave -
P-R Interval –
ST Segment –

Cardiac System

SA Node – Initiates the heart beat. It stimulates the contraction of the atria.
VA Node – Receives the stimulus from the SA node, pauses to let the atria finishes their contraction, then stimulates the contraction of the ventricles
Internodal Tracts – carry the stimulus from the SA node to the VA node.
Bundle of His – carries the stimulus away from the VA node.
Right and Left bundle branches – carries the stimulus to either the right or left ventricle.
Pukinje fibers – carries the impulse to the final cardiac muscle cells.
Depolarization – Contraction of the heart muscle
Polarization/Repolarization – relaxation of the heart muscle
Systole – contraction can refer to the heart or a particular chamber.
Diastole – relaxation can refer to the heart or a particular chamber
EKG/ECG/Electrocardiamgram – A standard representation of the reading of electrical impulses of the heart.
P – atrial depolarization
QRS (QRS Complex) – ventricular depolarization
T wave - ventricular repolarization
P-R Interval – time of interval from SA node depolarization to stimulation of AV node
ST Segment – time from the end of the S to the T. The length of time from complete contraction of the ventricles to the start of relaxation of the ventricles.

You don't see atrial repolarization. It is hidden by the contraction of the ventricles.

Cardiac Pulse/Pressure

The Lub-dub sound

- **The lub is**
- **The dub is**
- **The pause is**

The pulse rate is typically given a normal of
The normal range is –
When you feel the pulse
blood pressure, systolic of diastolic,
Mean Pressure:
The following mean pressure from textbooks:

- **Arteries** –
- **Arterioles** –
- **Capillaries** –
- **Venules** –
- **Veins** -

Why should you really use two numbers –

Cardiac Pulse/Pressure

The Lub-dub sound

- **The lub is** – av valves snapping shut
- **The dub is** – the semilunar valves snapping shut.
- **The pause is** the time between cardiac cycles.

The pulse rate is typically given a normal of 72 beats per minutes
The normal range is – 60-100
When you feel the pulse you are likely to be feeling combination of the the “shock wave” of the beat, and the force of the pulse itself.
blood pressure, systolic of diastolic, is a combination of the high number reflecting ventricular contraction/ systole / depolarization over the lower number reflecting the period between beats which is ventricular diastole, repolarization/relaxation
Mean Pressure: systolic pressure + diastolic / 2 (Simply the average of the two pressures)
The following mean pressure from textbooks:

- **Arteries** – 100mm Hg
- **Arterioles** – 85 mm Hg
- **Capillaries** – 35 mm Hg
- **Venules** – 15mm Hg
- **Veins** - <15mm Hg

Why should you really use two numbers – 100 down to 85, Arterioles 85 – 35, etc. You need a pressure gradient for blood to really flow.

Cardiac Terminology

Cardiac Output –
Peripheral resistance -
The term cardiac output means –
Stroke volume –
Basal/resting stroke volume
Since the normal rate is 72 beats per minute, that makes
Ventricle relaxation –
End Diastolic volume –
End systolic volume -
How did we come up with this number?
Ejection Fraction –

Cardiac Terminology

Cardiac Output – the force of the ventricular contraction and the volume of blood ejected.
Peripheral resistance - which means the degree of impedence to blood flow. The low number represent the amount of back flow between beats.
The term cardiac output means – the amount of blood ejected by the left ventricle each minute.
Stroke volume – the amount of blood ejected with each beat (one systolic contraction).
Basal/resting stroke volume is about 70 ml per beat.
Since the normal rate is 72 beats per minute, that makes about 5000ml, or 5 liters. Since our volume is about 5liters, that means we move on average all the blood through in a minute.
Ventricle relaxation – diastole, repolarization.
End Diastolic volume – 120 ml – The amount of blood in a ventricle just before it contracts (120cc).
End systolic volume - The ventricles do not empty complete with each contraction. The amount left is 50 ml. end systolic volume - This unejected amount is called the end systolic volume
How did we come up with this number? 120 – 50 = 70.
Ejection Fraction – the percentage of the end diastolic volume actually ejected and equals about 58%. (this is 70/120)

Blood Pressure Changes

The heart rate and stroke volume
The resistance to blood flow
Brief explanation of arteriolar resistance and blood flow –
Changes in blood volume .
Increased viscosity will
Loss of elasticity in the large vessels,

Blood Pressure Changes

The heart rate and stroke volume can increase as needed to meet extra demands by up to four times resting levels. Trained athletes can increase it even more. Increased cardiac output is generally reflected in increased blood pressure.

The resistance to blood flow which is one factor of blood pressure is peripheral resistance which, in normal physiology, is a function of arterioles.

Brief explanation of arteriolar resistance and blood flow – The arterioles open a little bit with each beat, if it opens a little bit, you have resistance, if they open too much, the pressure drops (postural hypotension)

Changes in blood volume will change change blood pressure. An increase in volume will increase pressure, decreases volume will decrease blood pressure.

Increased viscosity will increase BP.

Loss of elasticity in the large vessels, the systolic will rise, ad the diastolic will fall – why – there's nothing acting as q “secondary” pump.

Maintaining Blood Pressure/Cardiac Output

The body is always trying to maintain a stable cardiac output and blood pressure. There are three major mechanism controlling this:

1) Starling's Law –
2) Baroceptors
3) Chemoreceptors
4) Hormonal control –

- Renin-
- Angiotensin -
  -
  -
- Aldosteron

Maintaining Blood Pressure/Cardiac Output

The body is always trying to maintain a stable cardiac output and blood pressure. There are three major mechanism controlling this:

5) Starling's Law – Increases in blood volume in the ventricles or increased diastolic blood pressure, the ventricles will cause a stretching og muscle fibers. This stretching of the fibers will result in an increased strength of contraction that will counterbalance the increases in ventricular volume or increased diastolic. The more you stretch the walls, the harder they will contract. This helps to maintain a constant blood pressure.
6) Baroceptors – (measure PO2, PCO2, and hydrogen ion concentration as well) Measure pressure in the carotid artery and aorta. These receptors communicate with the ANS.
   The ANS feeds back to the heart. SNS to the heart will increase BP, Pns to the heart will decrease BP.
7) Chemoreceptors in the same location will do something if you are on the verge on expiry.
8) Hormonal control – Renin-Angiotensin-aldosteron-mechanism.

- Renin- substance released by the kidney in response to low blood pressure. It is released into the blood stream.
- Angiotensin - a substance already present in the blood stream that is activated by renin. It does two things:
  - Cause arterioles to contract.
  - Stimulates the adrenal glands to release aldosteron
- Aldosteron – cause the kidneys to retain sodium, and thus water.

(Ace inhibitor blocks aldosteron production, calcium channel blockers decrease the “strength” of the heart beat.)

Pressure in the Capillaries

Hydrostatic pressure (HS) –
Osmotic Pressure (OP) –
Albumin –
Lymphatic system –
Mean blood pressure at the arterial end of a capillaries –
Mean blood pressure at the venule end of a capillaries –

Edema can be caused by:

- ✗
- ✗
- ✗

Pressure in the Capillaries

Hydrostatic pressure (HS) – the force on the fluid, your blood pressure (35mm to 15mm)
Osmotic Pressure (OP) – is a substance can't go through a barrier, the fluid will want to go the other way. (25mm)
Albumin – the protein molecule in our blood that is responsible for at least 75% of the osmotic pressure.
Edema – excess fluid in the interstitial spaces.
Lymphatic system – because the system isn't perfect, there's a net of 9, not 10 back in. In order not to cause edema, the excess fluid returns via the lymphatic system. Overflow system that returns the excess interstitial fluids that doesn't make it back into the capillaries.
Mean blood pressure at the arterial end of a capillaries – 35mm Hg
Mean blood pressure at the venule end of a capillaries – 15mm Hg

Edema can be caused by:

- ✗ High blood pressure
- ✗ Too much osmotic pressure
- ✗ Blocked lymphatic system