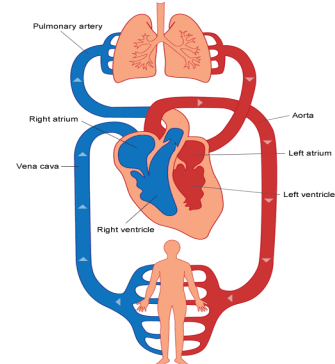


# Cardiovascular system

By Shei Jini

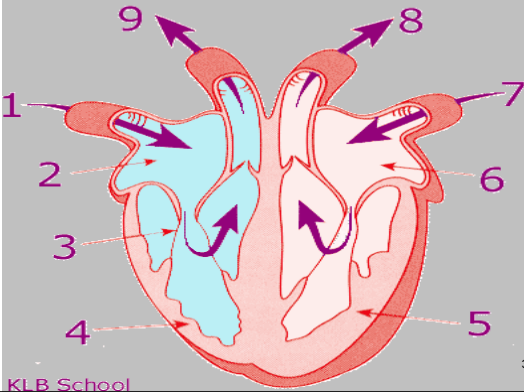
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## Cardiovascular system



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## Diagram of the Heart

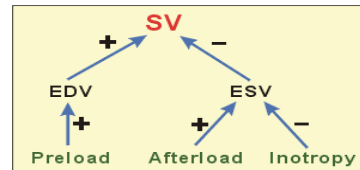


KLB School

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## Cardiac output

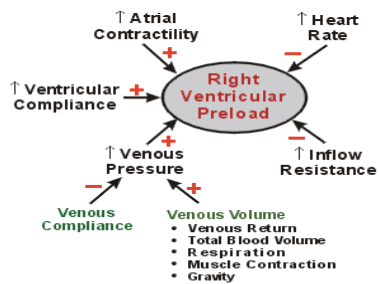
- $CO = HR \times SV$      $HR = \text{Heart rate}$      $SV = \text{Stroke volume}$
- $SV = EDV - ESV$      $EDV = \text{End diastolic volume}$      $ESV = \text{End systolic volume}$



Factors determining stroke volume (SV), where  $SV = \text{end-diastolic volume (EDV)} - \text{end-systolic volume (ESV)}$ .

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## Regulation of stroke volume

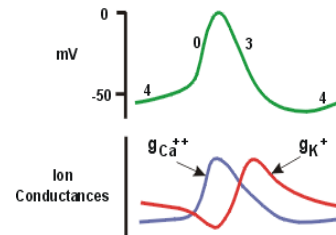


Factors determining right ventricular preload. A "+" sign indicates that an increase in this particular variable increases right ventricular end-diastolic volume, and therefore preload, while the "-" indicates that the variable decreases preload.

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## Origin and initiation of heart beat

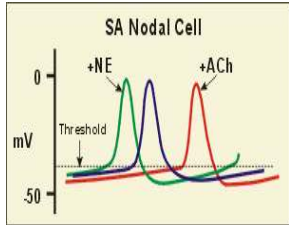
- PHASE 0 = INCREASE IN CALCIUM IONS
- PHASE 3 = INCREASE IN POTASSIUM IONS AND DECREASE IN CALCIUM IONS
- PHASE 4 = DECREASE IN POTASSIUM IONS, SLIDE INCREASE IN CALCIUM IONS, AND INCREASE IN SODIUM IONS



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### Regulation of pacemaker activity

Parasympathetic (vagal) activation, which releases acetylcholine (ACh) onto the SA node, decreases pacemaker rate  
 Sympathetic activation, which releases norepinephrine (NE), increases pacemaker rate



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### Electrocardiogram (EKG, ECG)

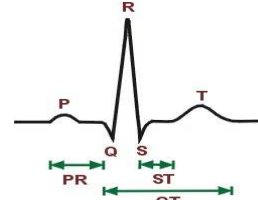
P CURVE= wave of depolarization that spreads from the SA node throughout the atria

PR SEGMENT= onset of atrial depolarization and the onset of ventricular depolarization

QRS= ventricular depolarization.

T CURVE= ventricular repolarization

QT=represents the time for both ventricular depolarization and repolarization to occur,



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### Heart diseases

- hypertension
- Valvular dysfunction
- systolic dysfunction
- diastolic dysfunction
- Coronary diseases

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### Interrelationship between blood flow, perfusion pressure and resistance

• Flow = perfusion Pressure (p) / Resistance

$$F = \frac{(P_A - P_V)}{R}$$

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### Applicability of Physical Principles to Flow in Blood Vessels

•  $V = Q/A$  The average velocity of blood flow depends on the cross sectional area of the vessel

•  $KE = \frac{1}{2} \rho V^2$ ; where  $\rho$  = density and  $V$  = mean velocity).  
 Total energy  $E = KE + PE$  ,  
 Increase in velocity, there is increase in KE hence increase in total blood flowing energy. Bernoulli Principle

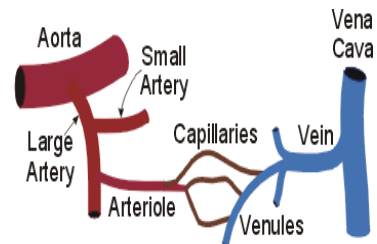
• Resistance to blood flow..... $\eta$ =blood viscosity,  
 $L$ =length  $r$ =radius. Poiseuille's Equation

$$R \propto \frac{\eta \cdot L}{r^4}$$

$$F \propto \frac{\Delta P \cdot r^4}{\eta \cdot L}$$

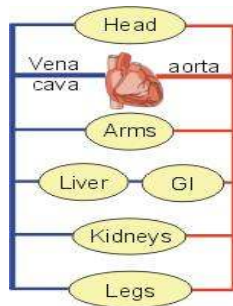
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### Systemic circulation Vascular network



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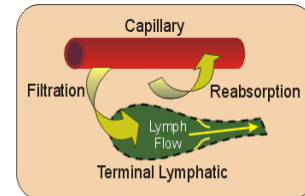
## Systemic circulation



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## Microcirculation

The rate of exchange, in either direction, is determined by hydrostatic pressure, oncotic pressure, and the permeability of the capillary wall.



The interstitial volume (bounded area) depends upon the rates of filtration, reabsorption, lymph flow, and the compliance of the interstitial compartment.

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## When are you considered truly death?

When your heart stops beating or when your brain stops working?

Do you receive Christ in your heart or with your mind (brain)?

Will you prefer to donate your heart or your brain?

*Shei thinks the heart is more important*

*Thanks for listening*

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