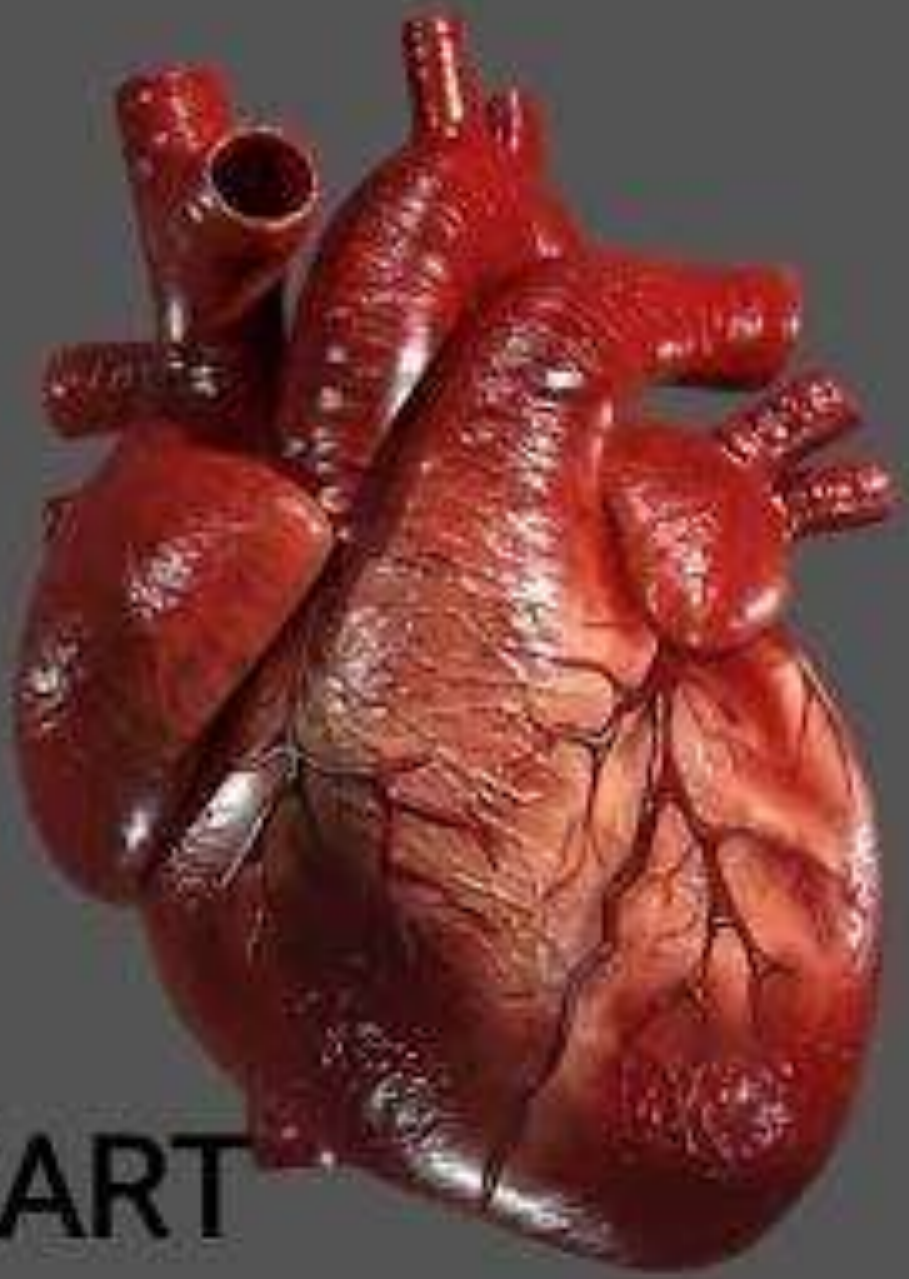
DEPARTMENT OF NUTRITION AND DIETETICS

HEART AND CIRCULATION

HUMAN PHYSIOLOGY

I B.SC NUTRITION AND DIETETICS

SUBJECT INCHARGE: G.K.GOMATHI



HUMAN HEART

The Heart

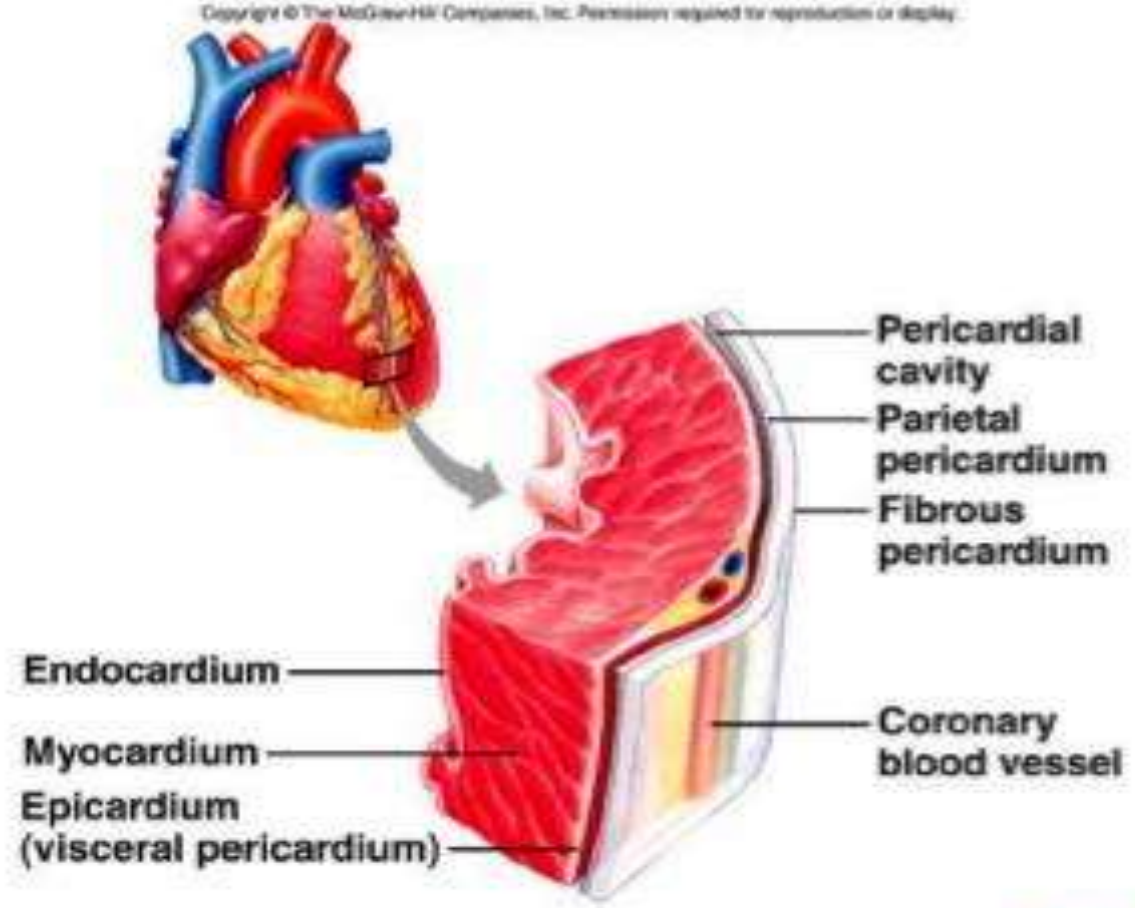
- Heart is a muscular organ that pumps blood throughout the circulatory system
- It is situated in between two lungs in the mediastinum
- It is made up of four chambers, two atria and two ventricles
- The musculature of ventricles is thicker than that of atria. Force of contraction of heart depends upon the muscles

The Heart: Coverings

- Pericardium – a double serous membrane
  - Visceral pericardium
    - Next to heart
  - Parietal pericardium
    - Outside layer
- Serous fluid fills the space between the layers of pericardium

The Heart: Heart Wall

- Three layers
  - Epicardium
    - Outside layer
    - This layer is the parietal pericardium
    - Connective tissue layer
  - **Myocardium**
    - **Middle layer**
    - **Mostly cardiac muscle**
  - Endocardium
    - Inner layer
    - Endothelium



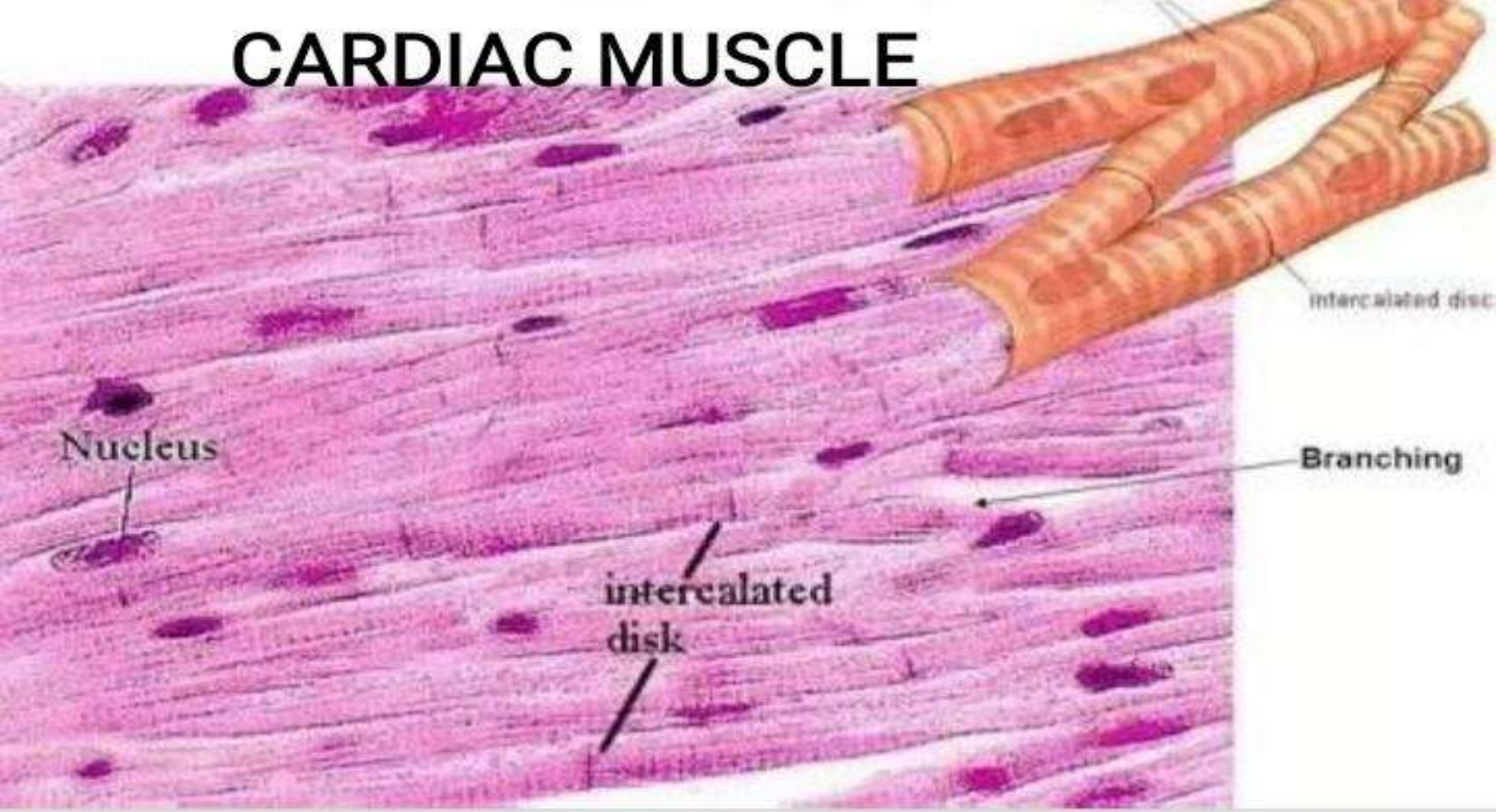
The Heart: Chambers

- Right and left side act as separate pumps
- Four chambers
  - Atria
    - Receiving chambers
      - Right atrium
      - Left atrium
  - Ventricles
    - Discharging chambers
      - Right ventricle
      - Left ventricle

The Heart: Valves

- Allow blood to flow in only one direction
- Four valves
  - Atrioventricular valves – between atria and ventricles
    - Bicuspid valve (left)
    - Tricuspid valve (right)
  - Semilunar valves between ventricle and artery
    - Pulmonary semilunar valve
    - Aortic semilunar valve

CARDIAC MUSCLE



THE CARDIAC MUSCLE

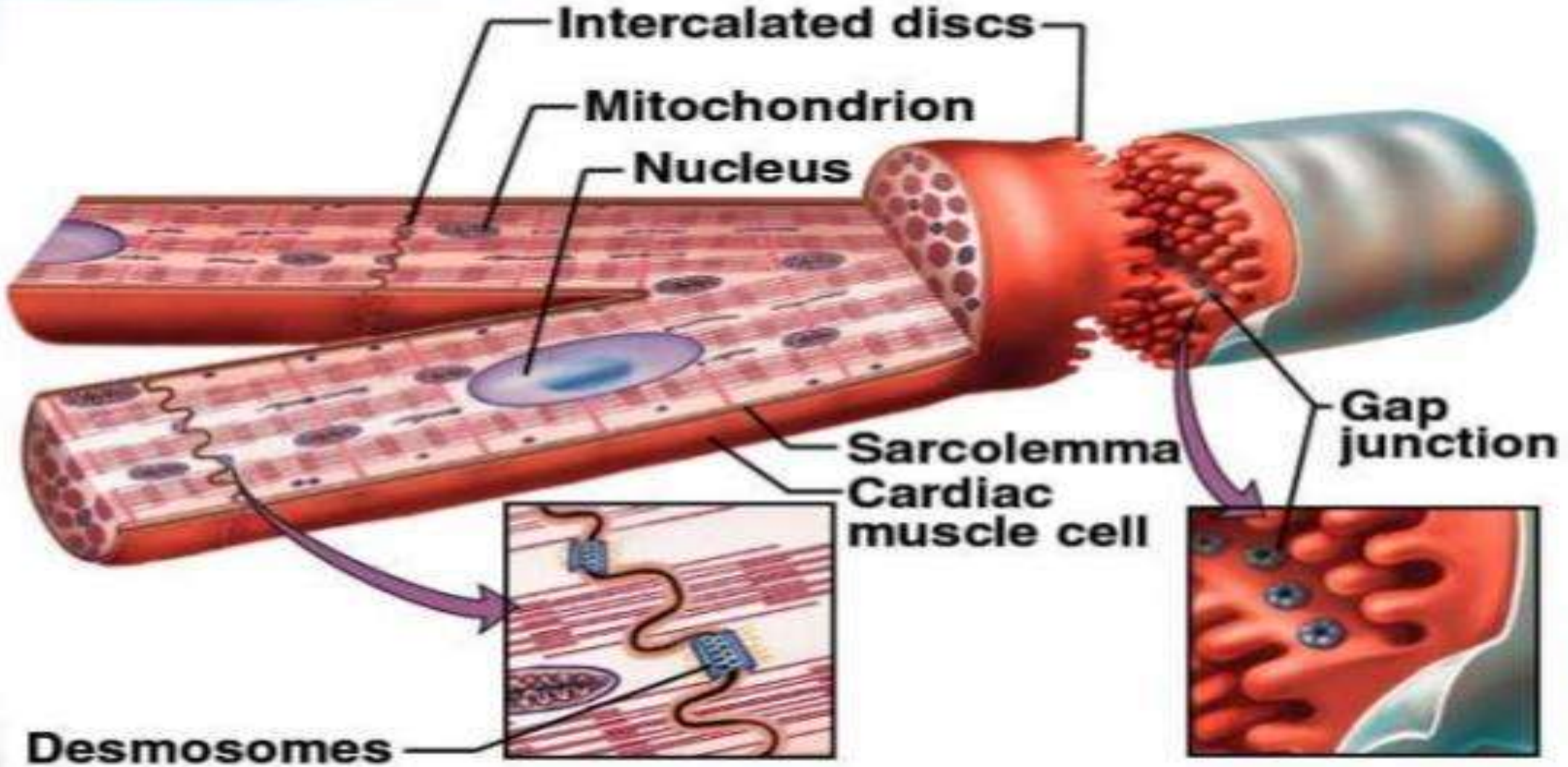
- Myocardium has three types of muscle fibers:

- i. Muscle fibers which form contractile unit of heart (99%)
- ii. Muscle fibers which form pacemaker
- iii. Muscle fibers which form conductive system

Muscle Fibres which Form the Contractile unit

- Striated and resemble the skeletal muscle fibre
- Cardiac muscle fibre is bound by **sarcolemma.** It has a centrally placed nucleus. **Myofibrils** are embedded in the sarcoplasm.
- **Sarcomere** of the cardiac muscle has all the contractile proteins, namely actin, myosin, troponin and tropomyosin.
- **Sarcotubular system** in cardiac muscle is slightly different to that of skeletal muscle.

Structure of Cardiac Muscle Cell



Properties of cardiac muscle

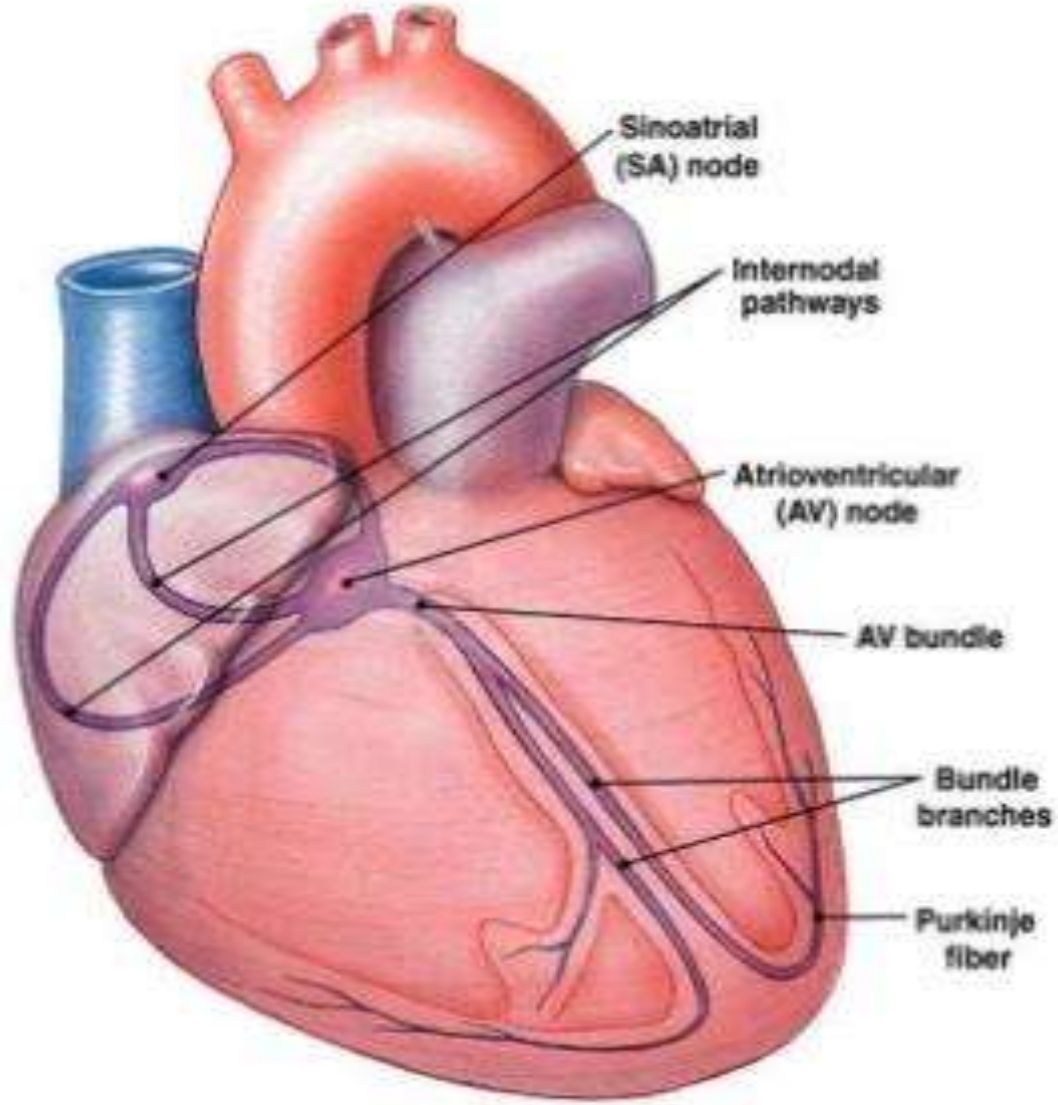
- Electrical
  - Excitability (Bathmotropic action)
  - Auto rhythmicity
  - Conductivity (Dromotropic action)

- Mechanical
  - Contractility (Inotropic action)
  - Refractory period
  - Staircase / treppe effect

Conducting system of heart

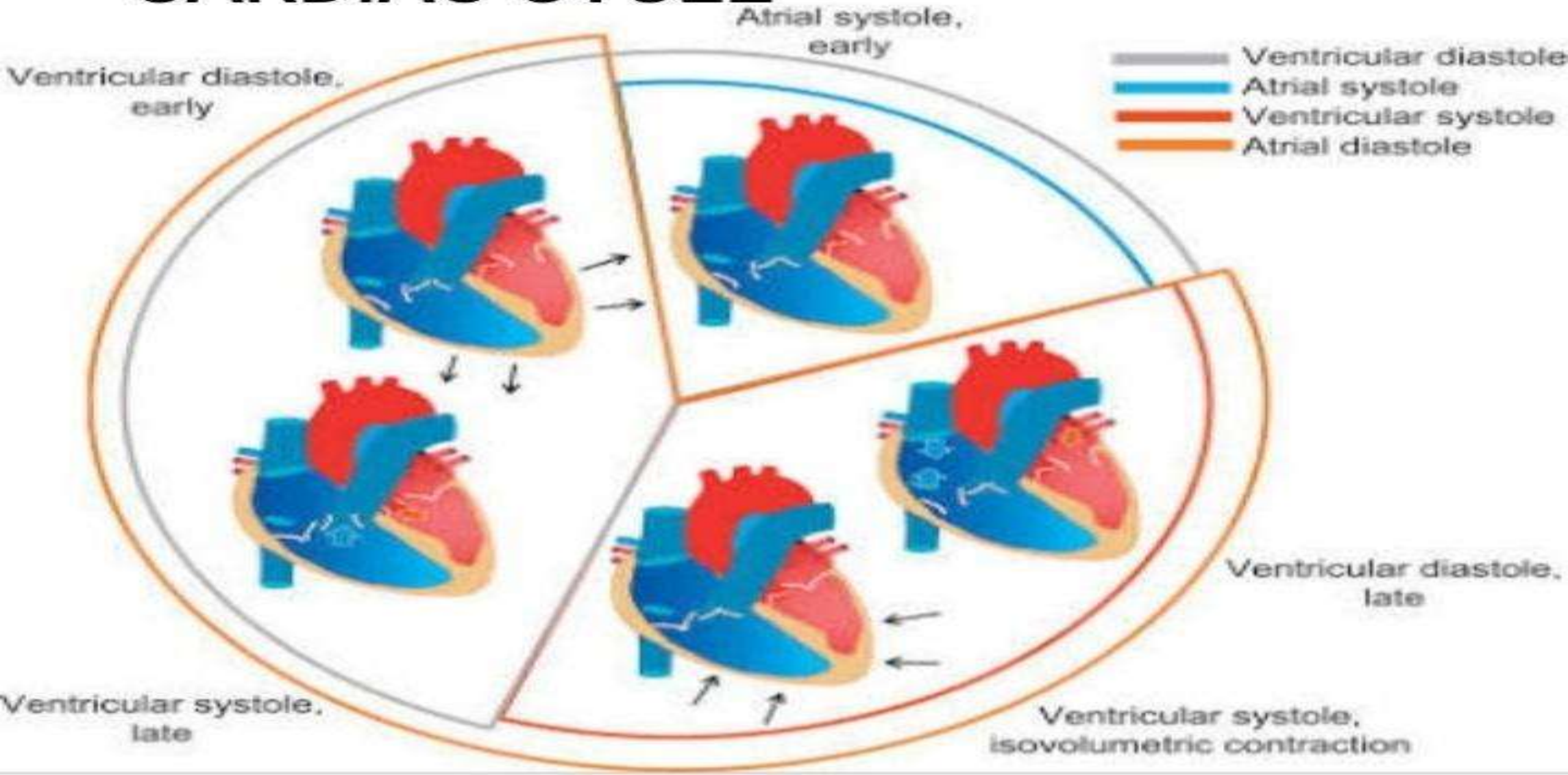
Cardiac Conduction System Overview

- Sinoatrial node
- Atrial syncytium
- Junctional fibers
- Atrioventricular node
- A-V bundle
- Bundle branches
- Purkinje fibers
- Ventricular syncytium

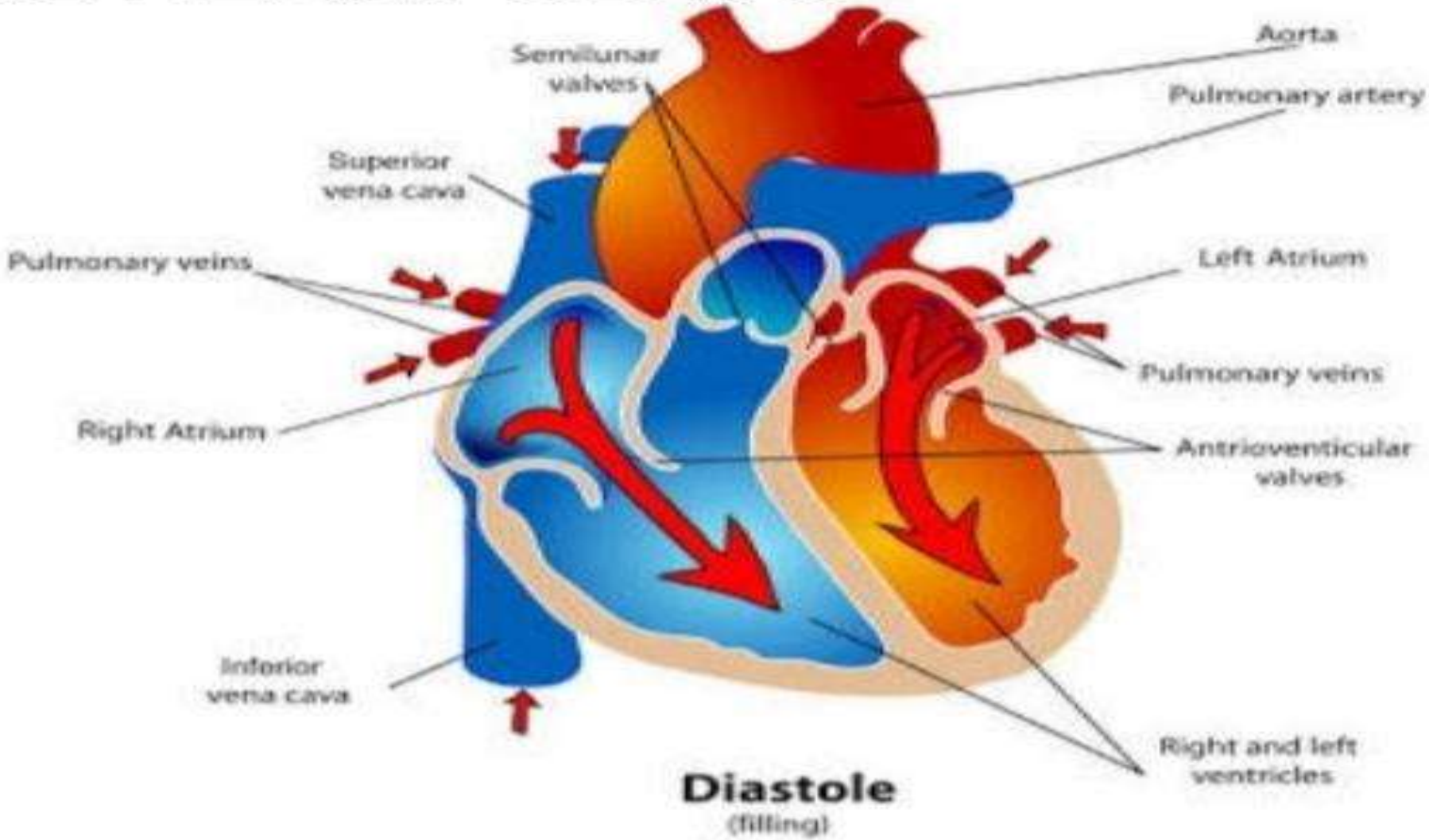


The conducting system

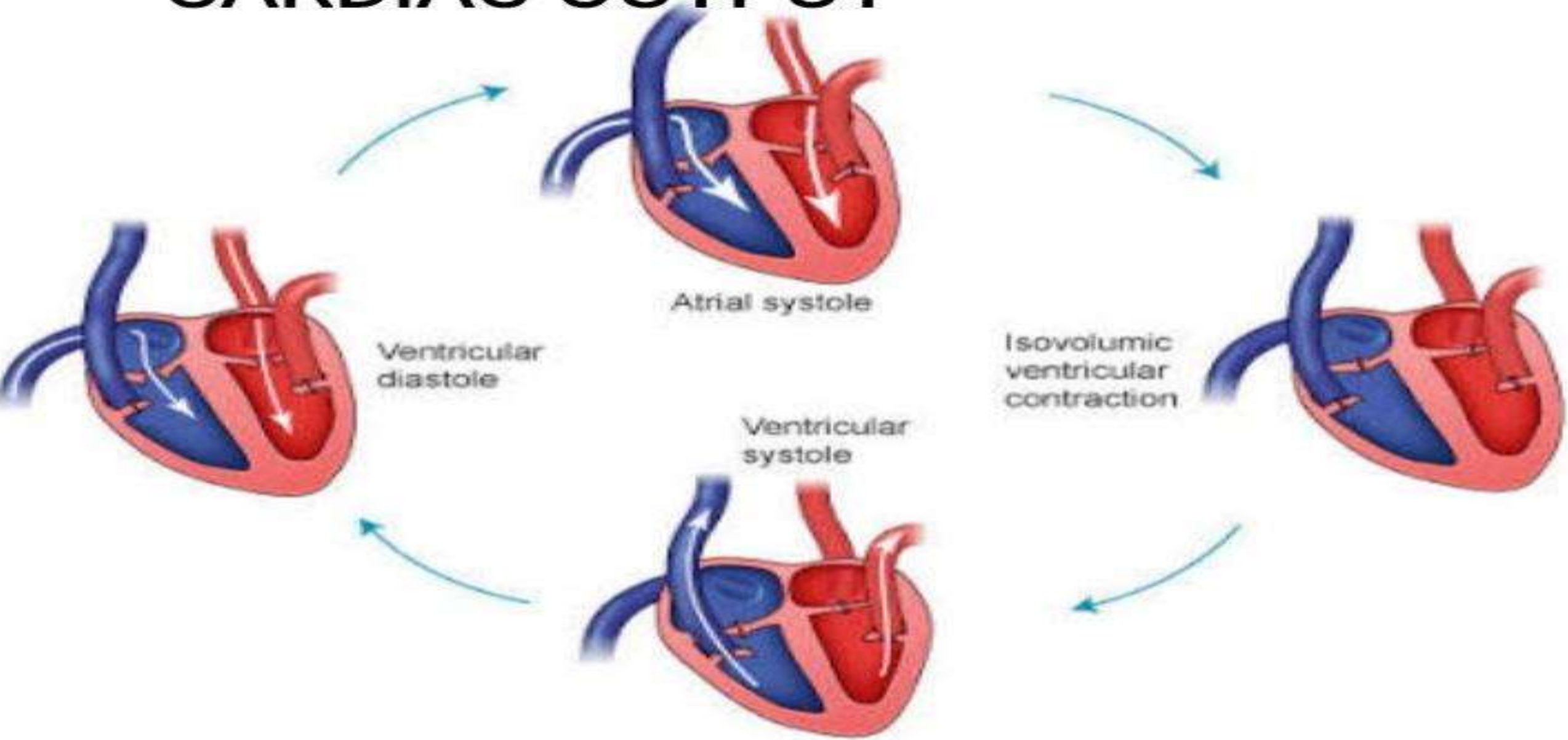
CARDIAC CYCLE



PHASES OF THE CARDIAC CYCLE WHEN THE HEART BEATS



CARDIAC CYCLE AND CARDIAC OUTPUT

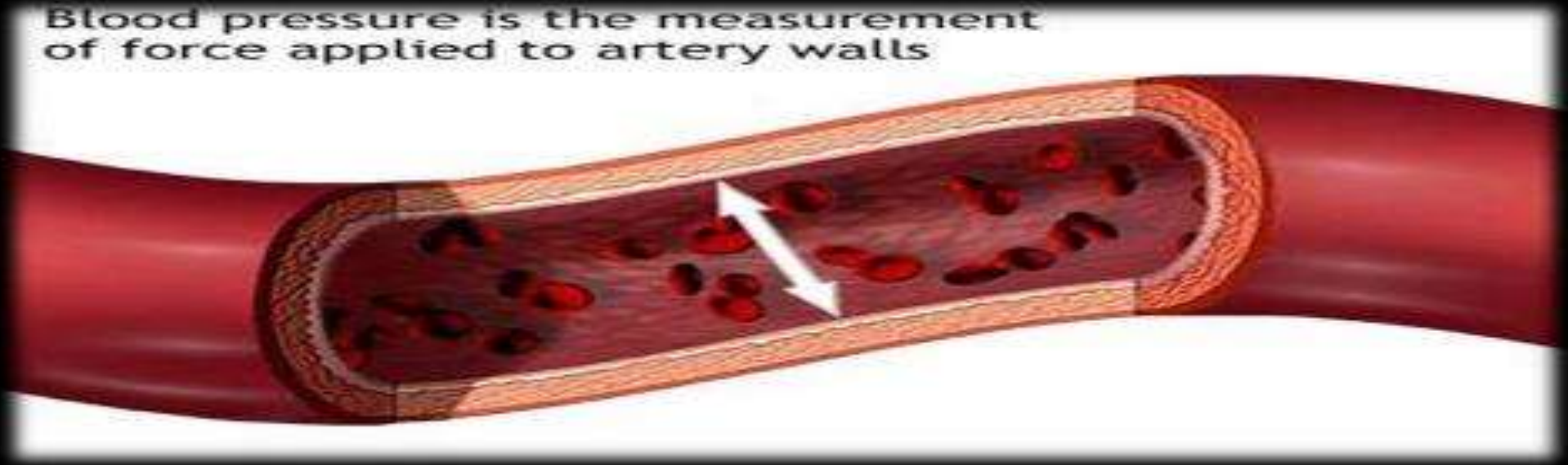


MEASUREMENT OF ARTERIAL BLOOD PRESSURE


ADAM.

ARTERIAL BLOOD PRESSURE

Definition : Arterial blood pressure can be defined as the lateral pressure exerted by the moving column of blood on the walls of the arteries.



Normal Values

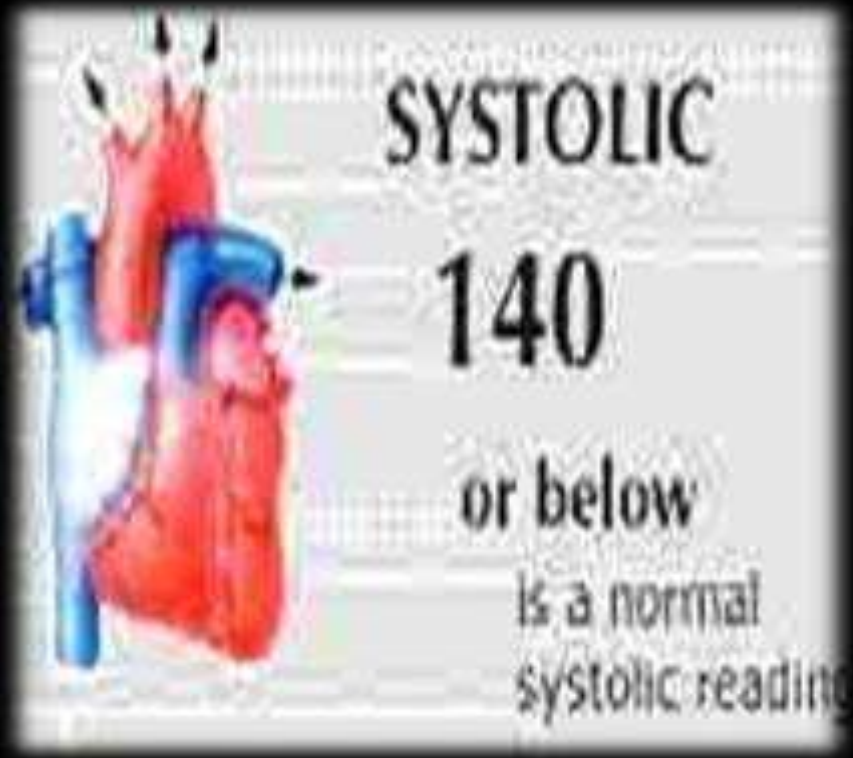
- Normal Adult range
- Can fluctuate within a wide range and still be normal
- Systolic/diastolic
- 100/60 - 140/80

Systolic B.P (S.B.P)

Defined as the maximum
B.P in the arteries
Attainable during systole.
Normal 120 ± 20 mm Hg.
This is mainly contributed by

1. Force of heart beat
2. Normal blood volume
3. Cardiac output.

Normal range
90-140 mm Hg.

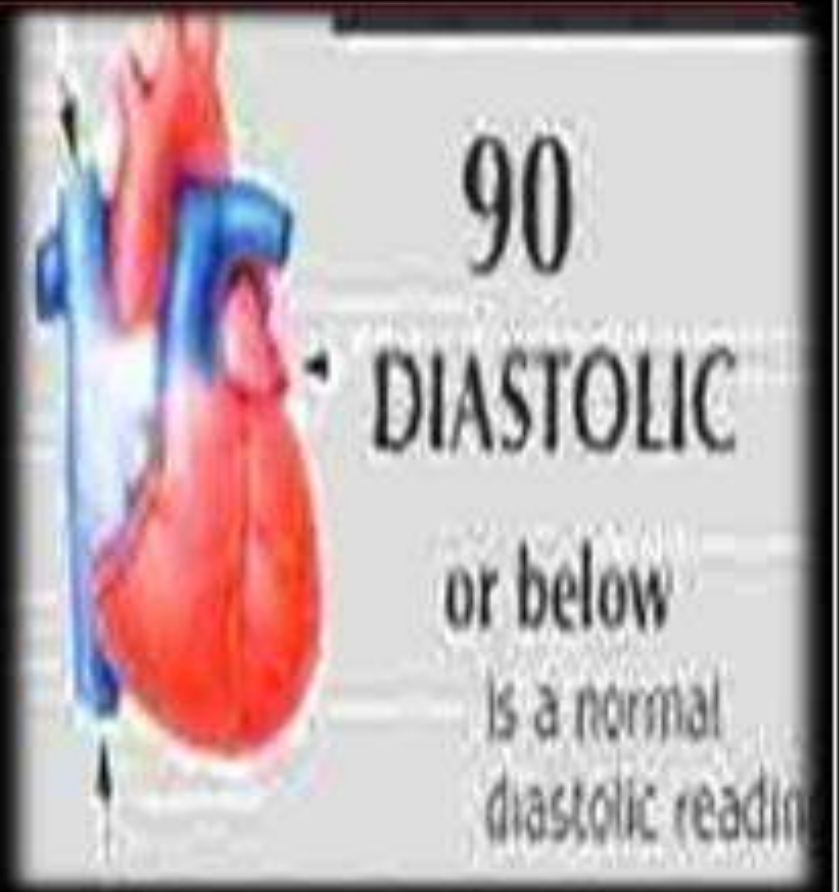


DIASTOLIC B.P (D.B.P)

Def--- as the minimum pressure that is obtained at the end of the ventricular diastole.

Normal range 60 -90 mm Hg.

1. It represents a constant load on the arterial walls with little or no fluctuation at all.
2. It is an index to the peripheral resistance and decides the filling of the Coronary system.



Pulse Pressure (P.P)

Denotes the difference between systolic and diastolic pressure.

PP= SBP - DBP = 40 mm Hg

MEAN ARTERIAL PRESSURE

Mean arterial .BP = DBP + 1/3 Pulse Pressure

normal = 95 mm Hg.

- **Not the arithmetical mean but geometrical mean.**
- **It is because the period of the systole is only 0.3 sec when compared to 0.5 sec of the diastole.**


Thank
You.