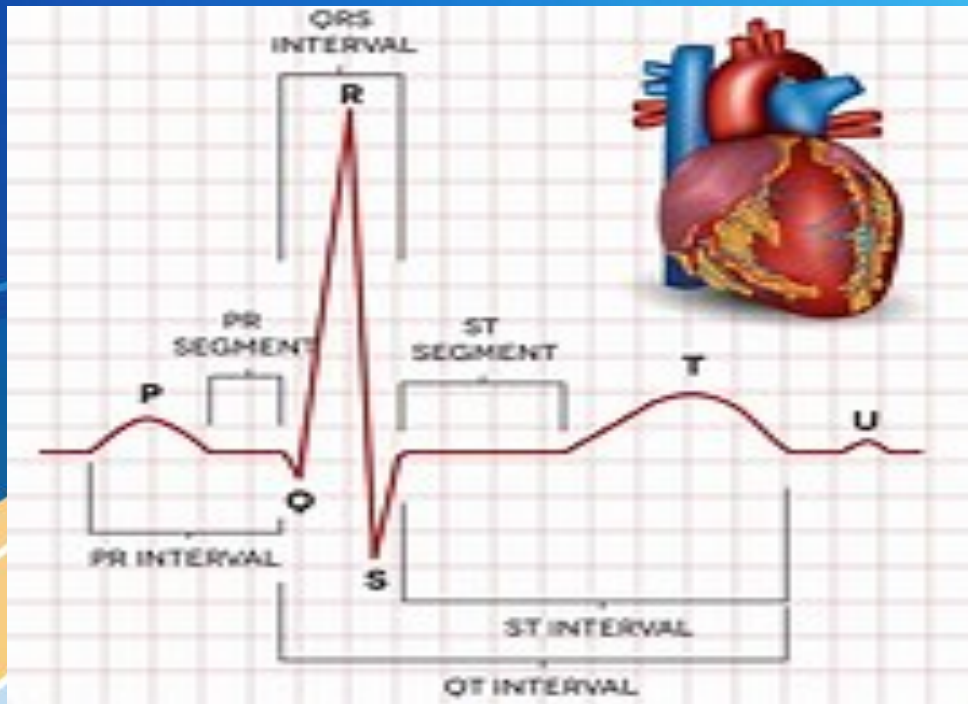


Electrocardiogram (ECG)

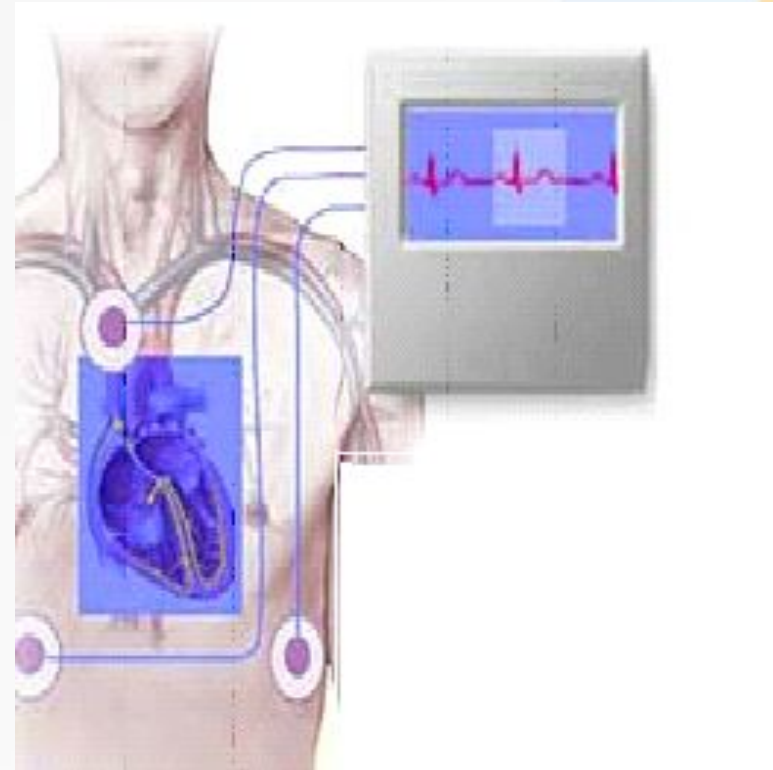


“It makes so much sense that the heart has been associated with love. There’s also a pretty strong brain-gut connection as well”

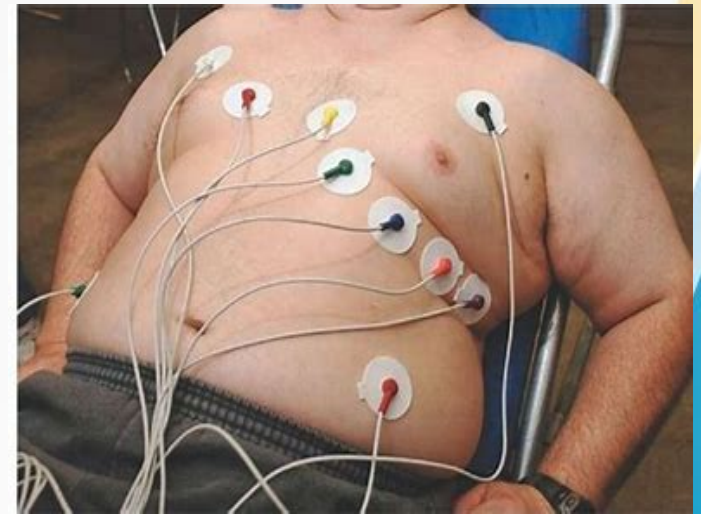
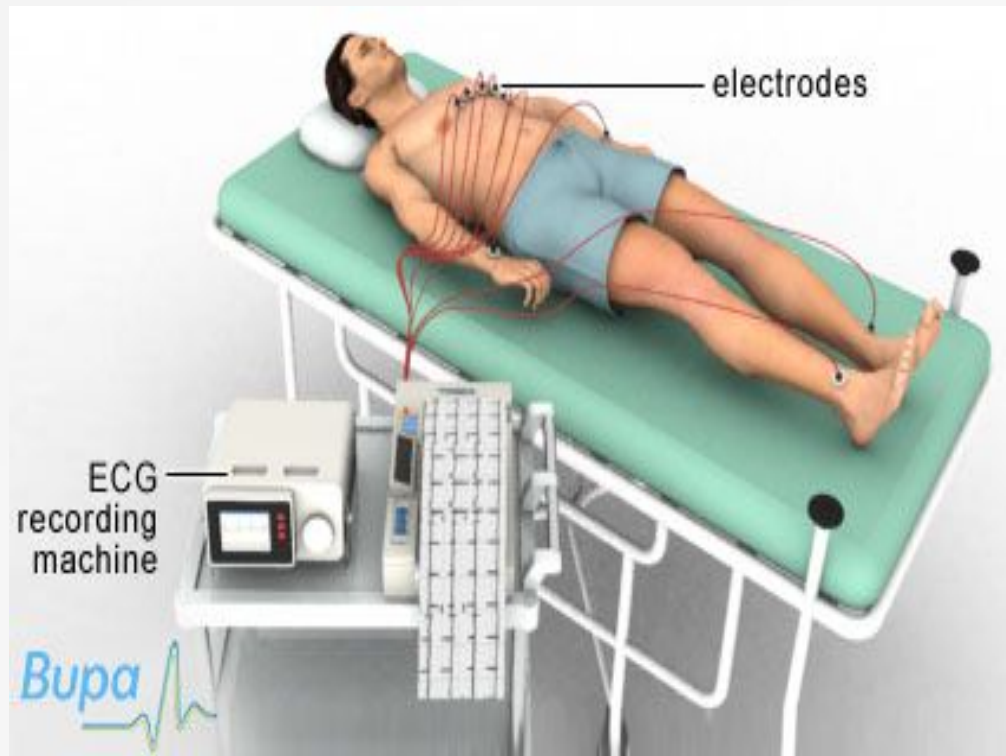


ECG System

- The recorded signal of the heart's muscular potential, over a period of the time is called *electrocardiogram*.
- ECG is the graphic record of the heart's electrical activity which used in the investigation of heart disease.
- ECG is a painless and non-invasive diagnostic test for identifying the functioning of the heart and heart-related problems in people of all age groups.
- Learning Objectives: Recognise a normal traces for normal heart, sinus tachycardia, bradycardia, sinus arrhythmia and ventricular fibrillation.

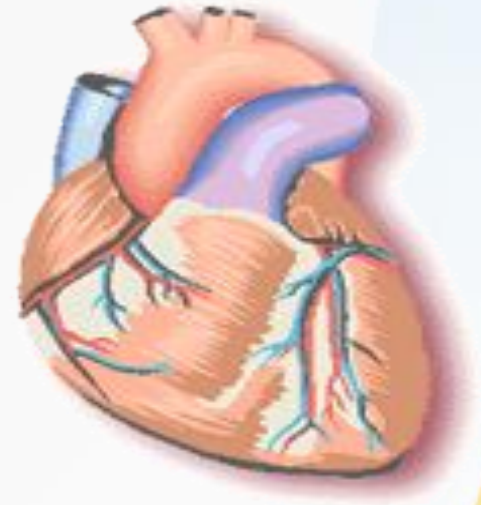


ECG Recording



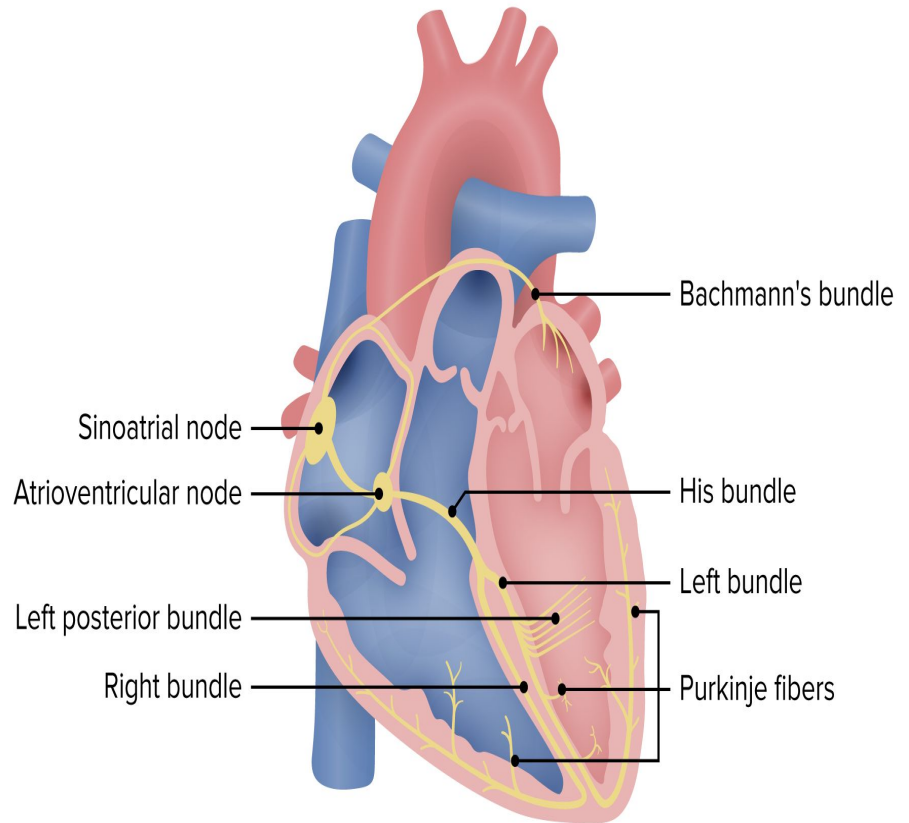
Principles of Electrocardiograph

- ❑ Heart is a muscle that works like a pump for blood.
- ❑ The heart contraction creates action potential which initiates electrical current.
- ❑ The different electrical potentials between different parts of the body can caused cardiogram



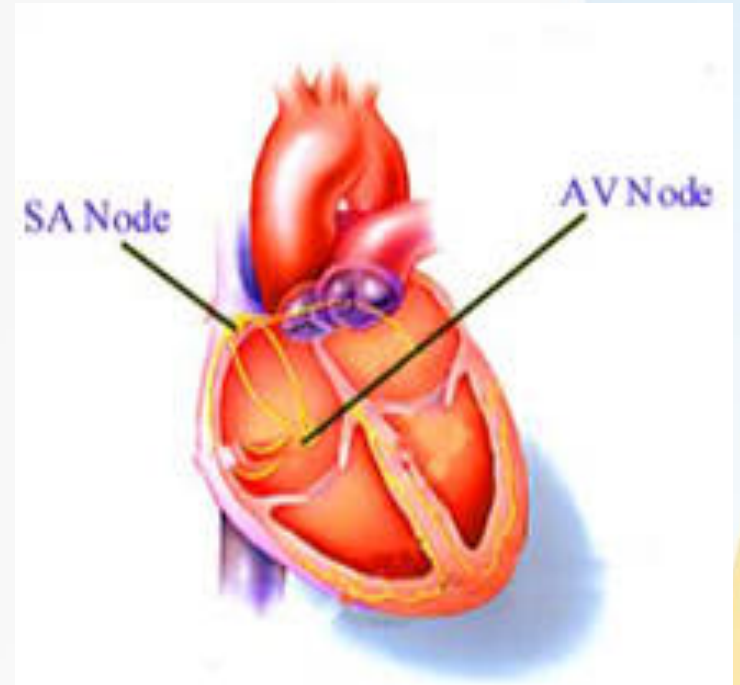
THE CONDUCTING SYSTEM

- SA Node
- Inter-nodal pathway
- AV Node
- Bundle of HIS
- Bundle Branches
- Purkinje Fibers



- Sino-atrial (SA) node:

- It is the heart's **natural pacemaker**.
- The SA node sends electrical signals in a steady, rhythmic pattern to pace the heart's beat. Signals from the SA node travel to:



- Atrio-ventricular (AV) node:

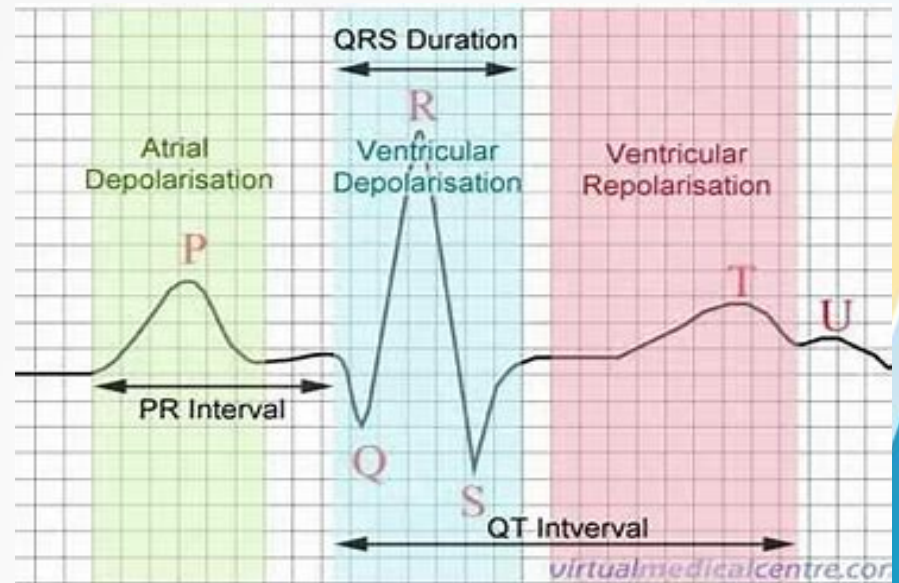
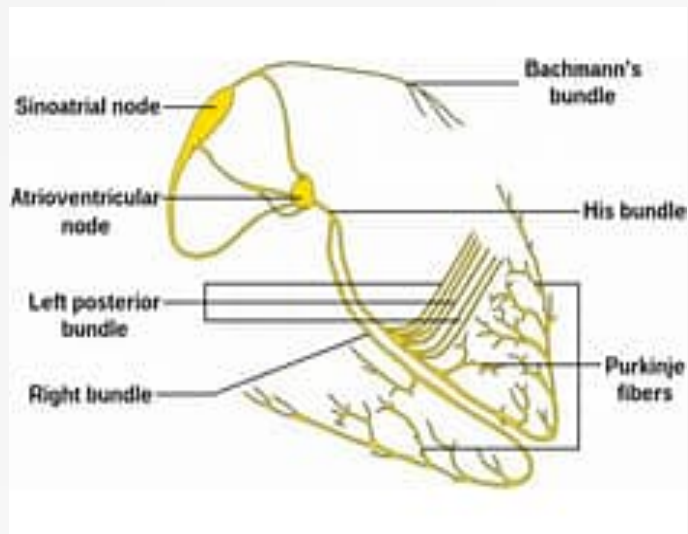
- Which transmits the signal from the upper chambers, or atria, to the lower chambers (ventricles).
- The ventricles are the major pumping chambers of the heart. The transmitted electrical signal triggers the powerful muscle contraction needed to pump blood into the lungs and throughout the body.

(ECG or EKG)

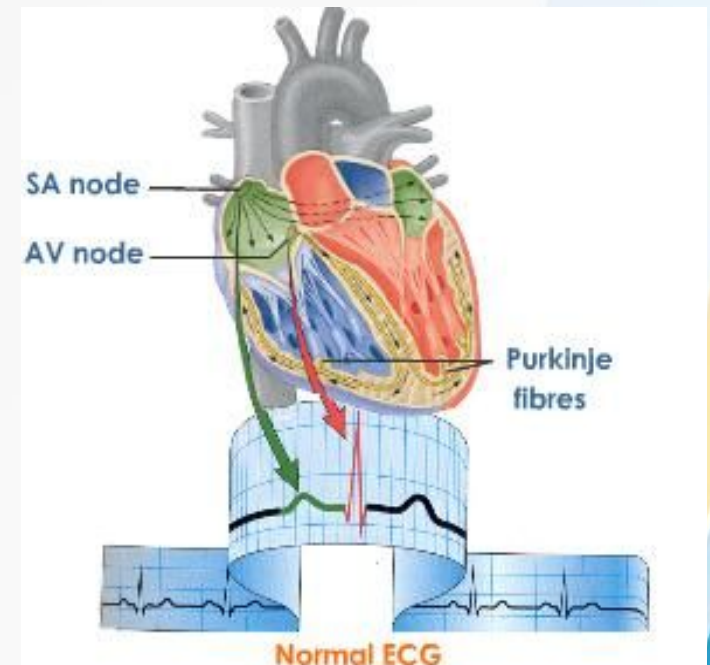
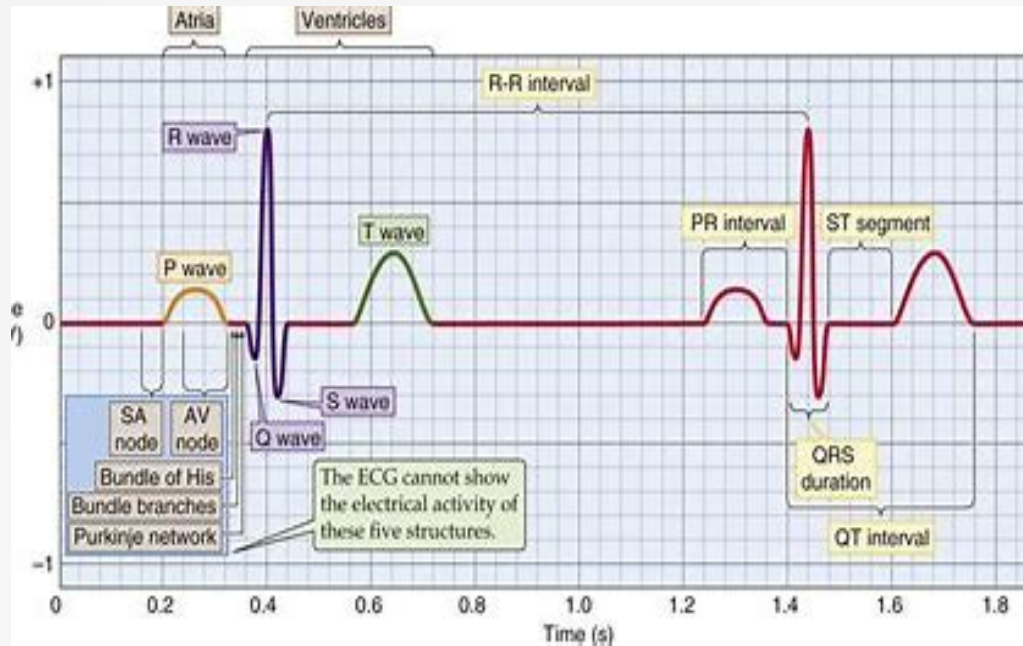
- ecg picks up electrical impulses generated by the polarization and depolarization of cardiac tissue and translates into a waveform.
- The waveform is then used to measure the rate and regularity of heartbeats, as well as the size and position of the chambers, the presence of any damage to the heart, and the effects of drugs or devices used to regulate the heart, such as a **pacemaker**.



RELATIONSHIP



Cardiac Cycle

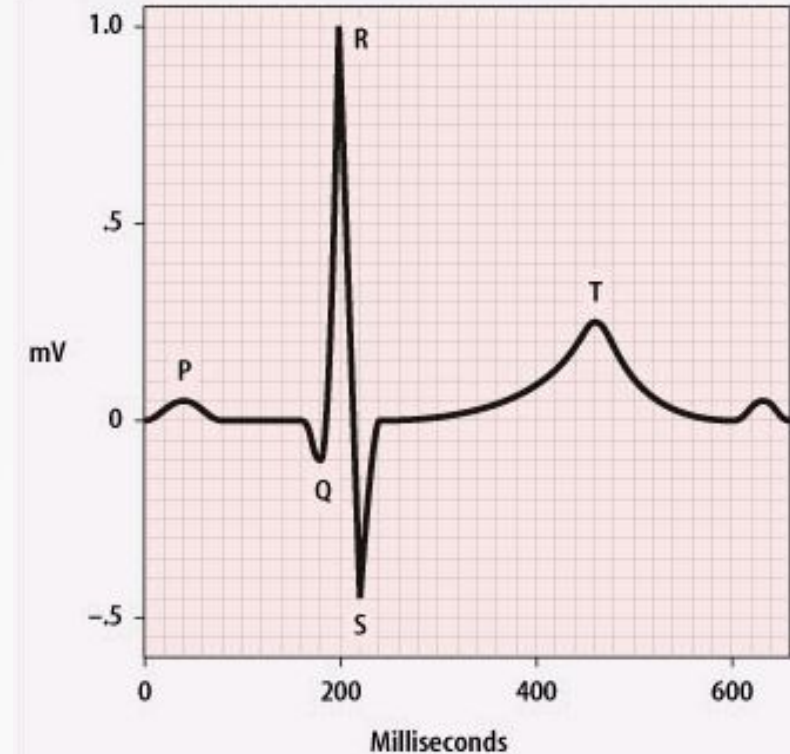


Normal Conduction Pathway: SA node -> atrial muscle -> AV node -> bundle of His -> Left and Right Bundle Branches -> Purkinje fibres

ECG waveform

Elements of the ECG:

- P wave: Depolarisation of both atria;
 - Relationship between P and QRS helps distinguish various cardiac arrhythmias
 - Shape and duration of P may indicate atrial enlargement
- PR interval: from onset of P wave to onset of QRS
 - Normal duration = 0.12-2.0 sec (120-200 ms)
 - Represents atria to ventricular conduction time (through His bundle)
 - Prolonged PR interval may indicate a **heart blockage**



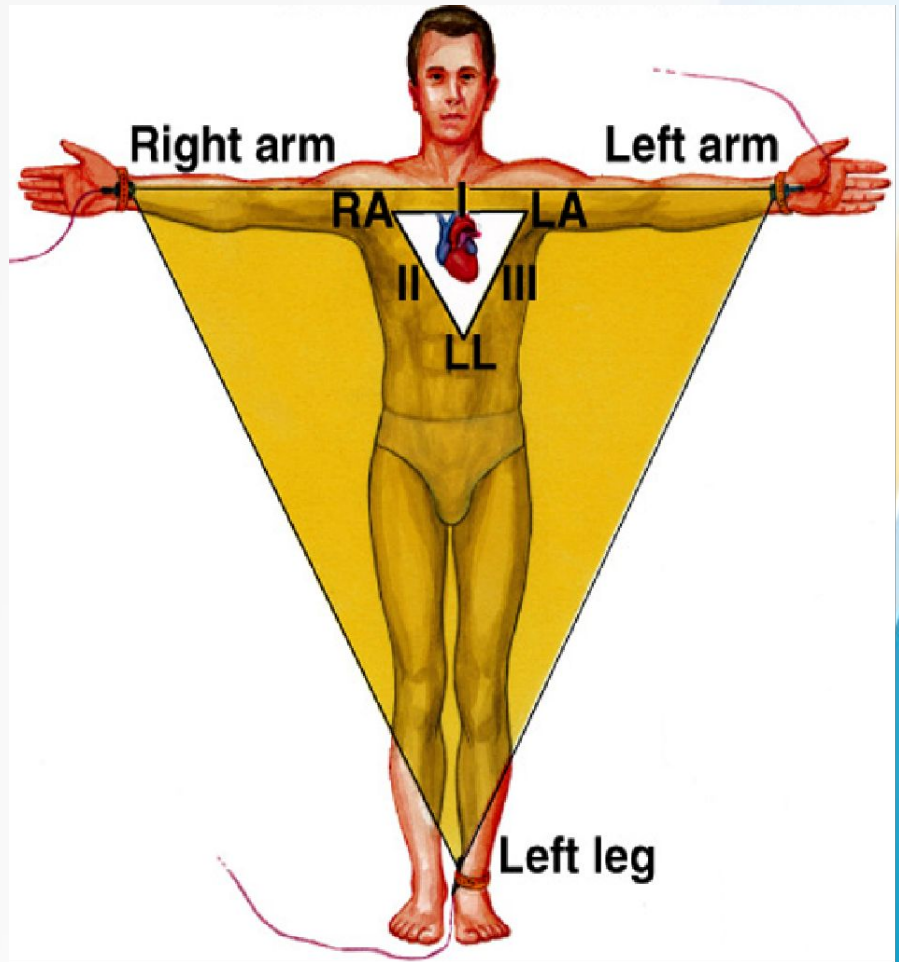
□ QRS complex:

- Represents ventricular depolarization
- Larger than P wave because of greater muscle mass of ventricles
- Normal duration = 0.08-0.12 seconds
- Its duration, amplitude, and morphology are useful in diagnosing cardiac arrhythmias, ventricular hypertrophy, MI (heart attack), electrolyte derangement, etc.
- Q wave greater than $\frac{1}{3}$ the height of the R wave, greater than 0.04 sec are abnormal and may represent MI

Types of ECG Recordings

- 12 leads system (3 bipolar, 3 augmented, 6 chest lead)
- Bipolar leads record voltage between electrodes placed on wrists & legs (right leg is ground)
- Lead I records between right arm & left arm
- Lead II: right arm & left leg
- Lead III: left arm & left leg

$$II = I + III$$



Einthoven Triangle

12 Leads

□ Bipolar leads

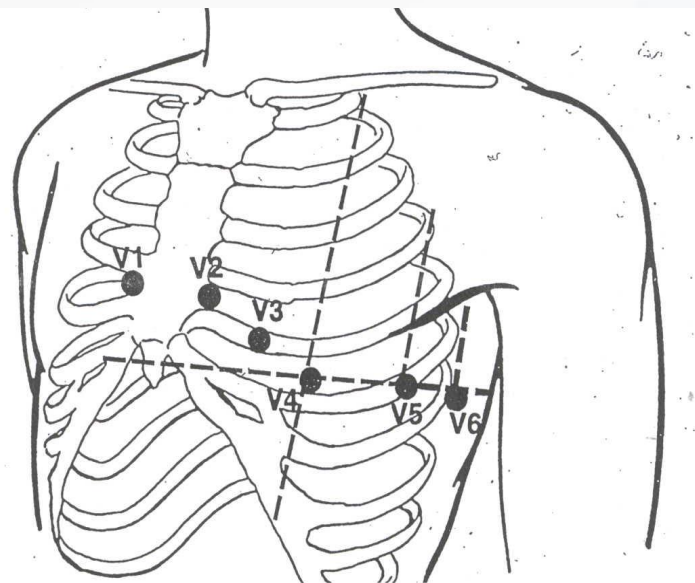
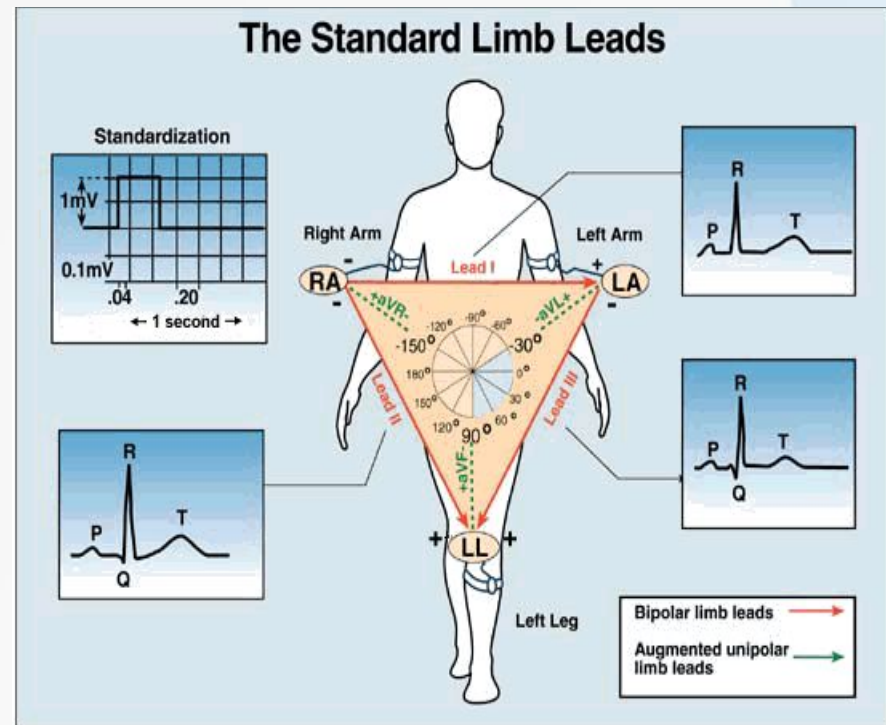
I II III

□ Augment leads

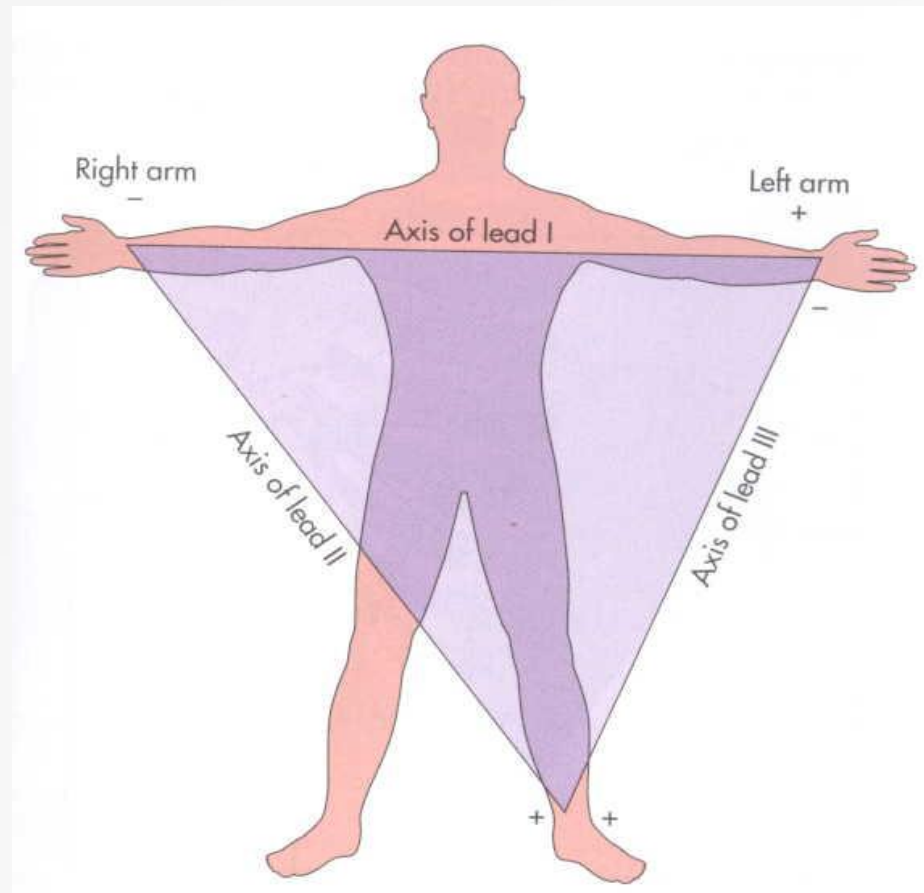
Avr Avl Avf

□ Chest Leads

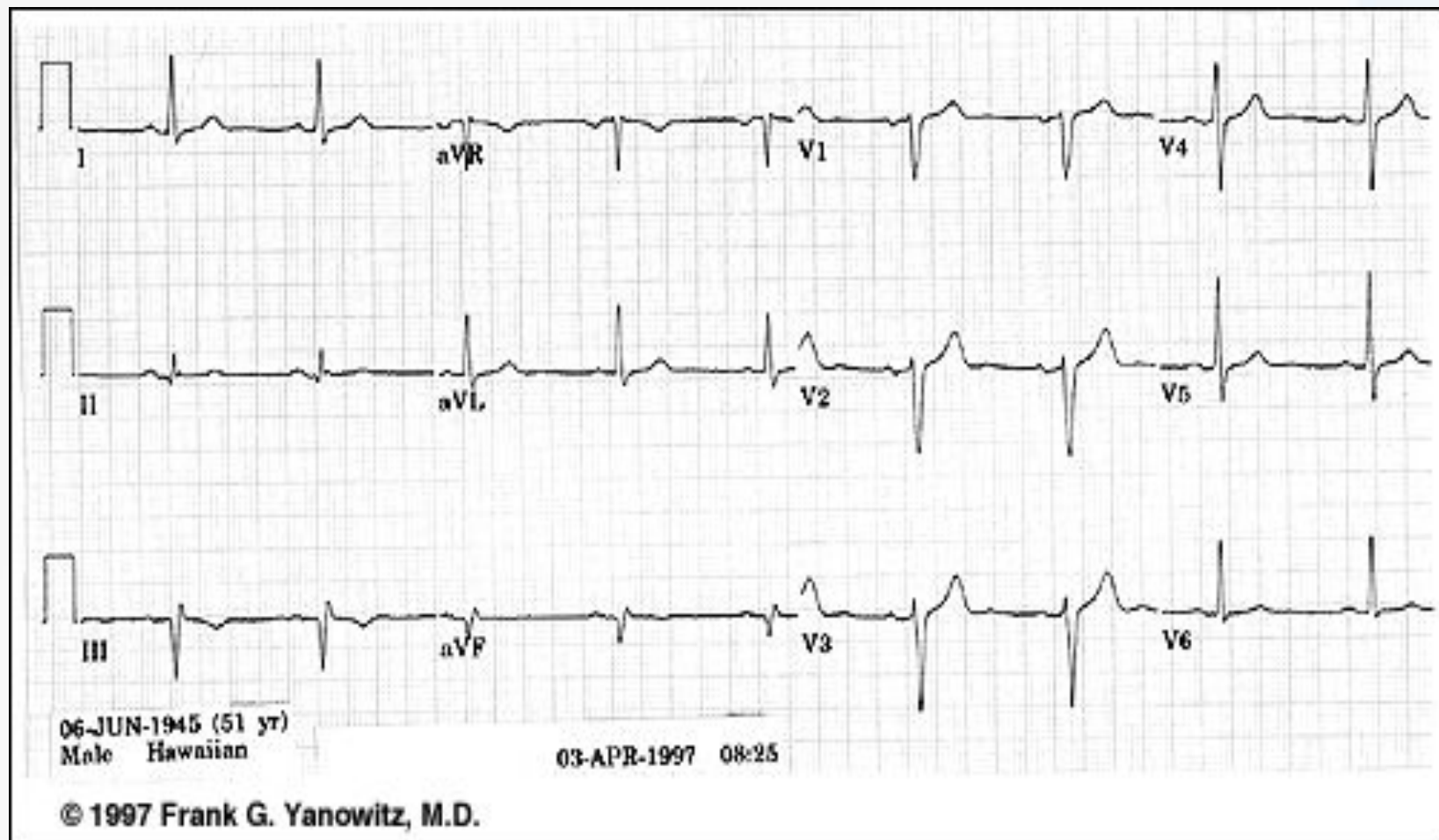
- V1
- V2
- V3
- V4
- V5
- V6



EINTHOVENS TRIANGLE

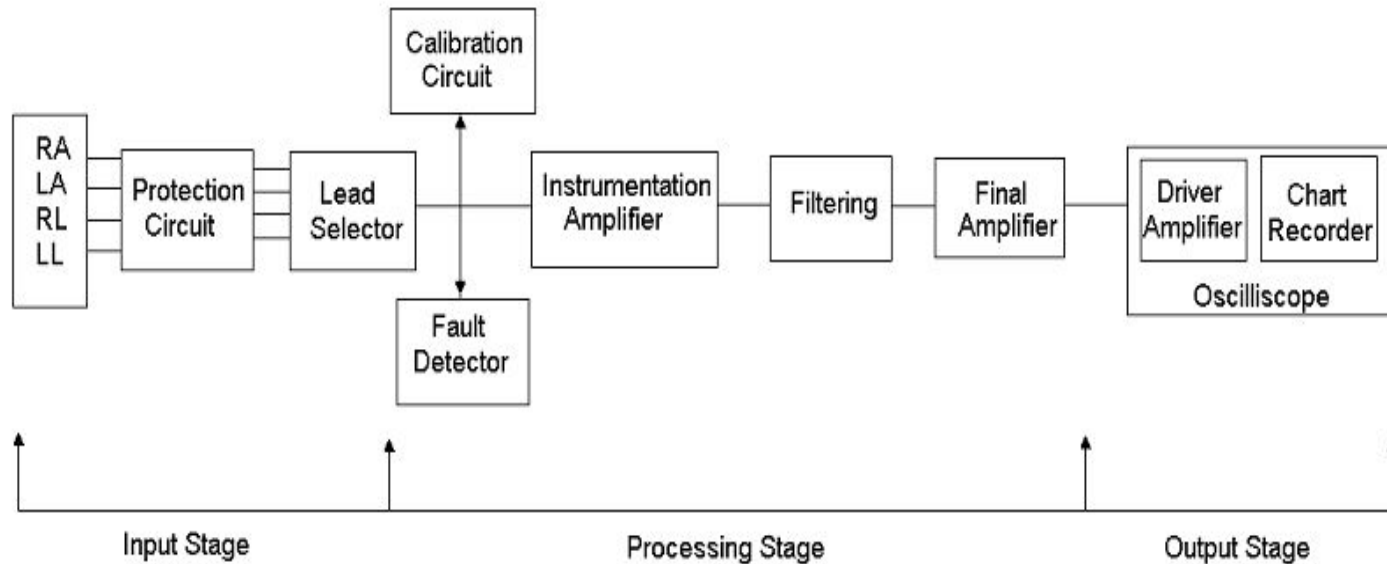


12-LEAD ECG LAYOUT





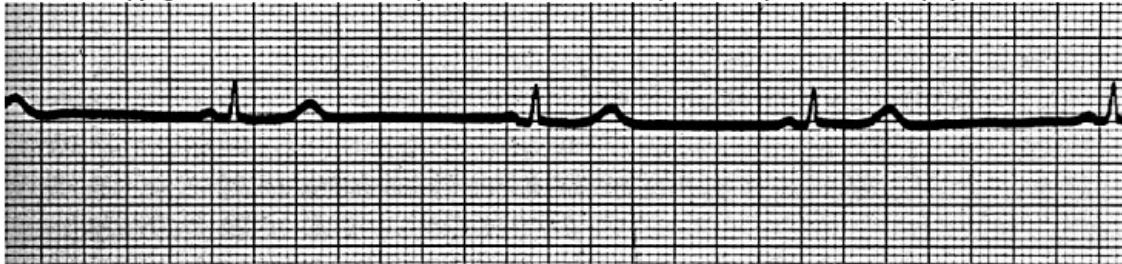
ECG Block Diagram



Critical values on ECG

- Arrhythmias are abnormal heart rhythms
 - Heart rate $<60/\text{min}$ is bradycardia
 - $>100/\text{min}$ is tachycardia

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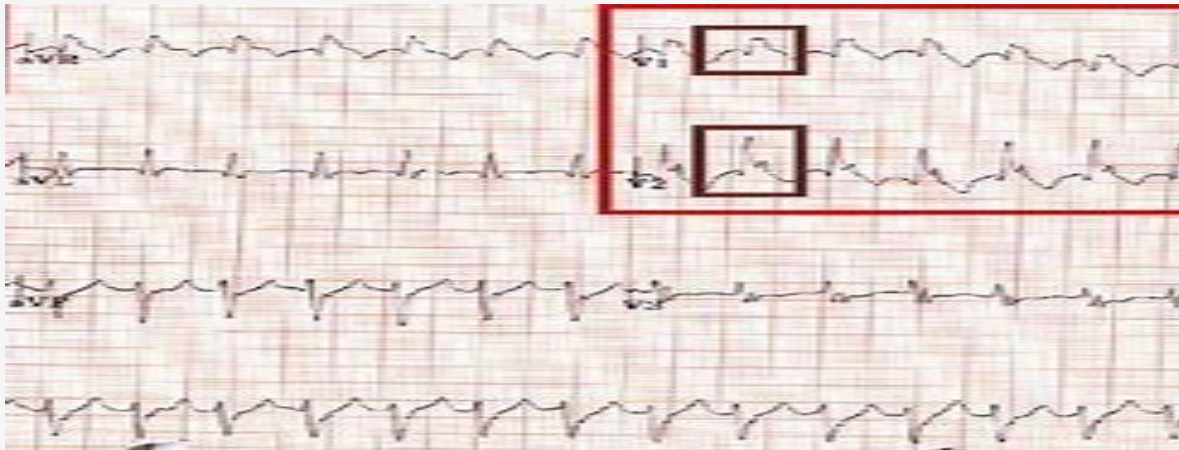


Sinus bradycardia



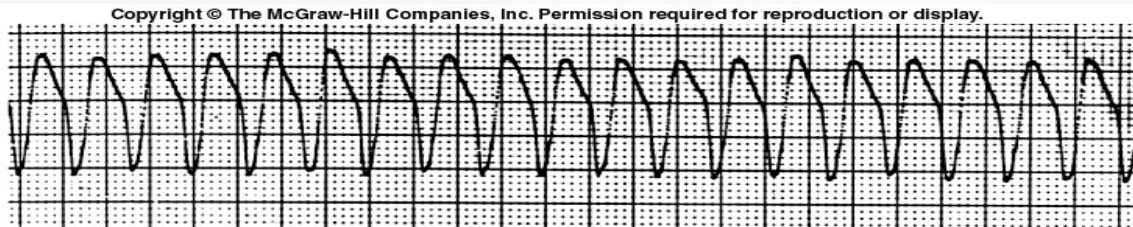
(a) Sinus tachycardia

Abnormal ECG



Arrhythmias Detected on ECG

- In flutter contraction rates can be 200-300/min
- In fibrillation contraction of myocardial cells is uncoordinated & pumping ineffective
 - Ventricular fibrillation is life-threatening
 - Electrical defibrillation resynchronizes heart by depolarizing all cells at same time



Ventricular tachycardia



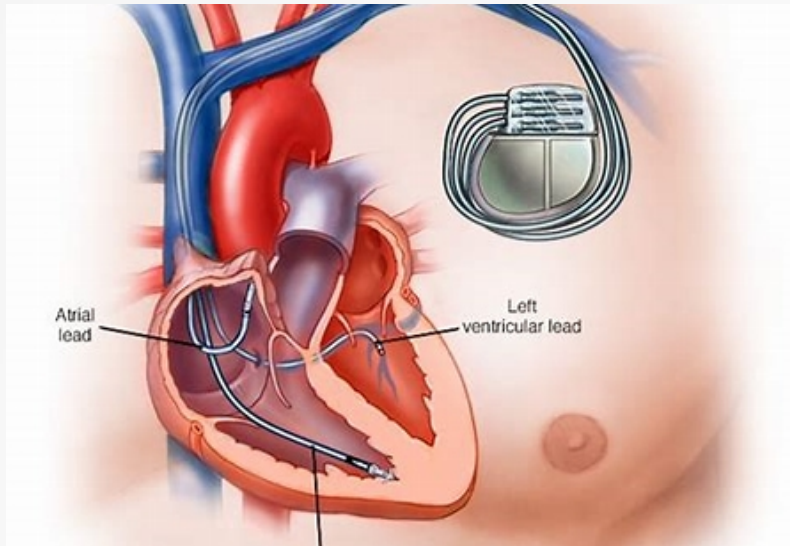
(b) Ventricular fibrillation

- **Defibrillator:** An apparatus used to **control heart fibrillation** by application of an electric current to the chest wall or heart



Artificial pacemaker

- A pacemaker is a small device that's placed (implanted) in the chest to help control the heartbeat.
- It's used to prevent the heart from **beating too slowly**
- Implanting a pacemaker in the chest requires a surgical procedure.
- A pacemaker is also called a cardiac pacing device.





Summarize

- How do we produce an excellent 12-lead ECG?
- Proper skin prep
- Correct electrode placement
- Recognize and know how to correct problems
- Recognize basic critical values

Thank You