

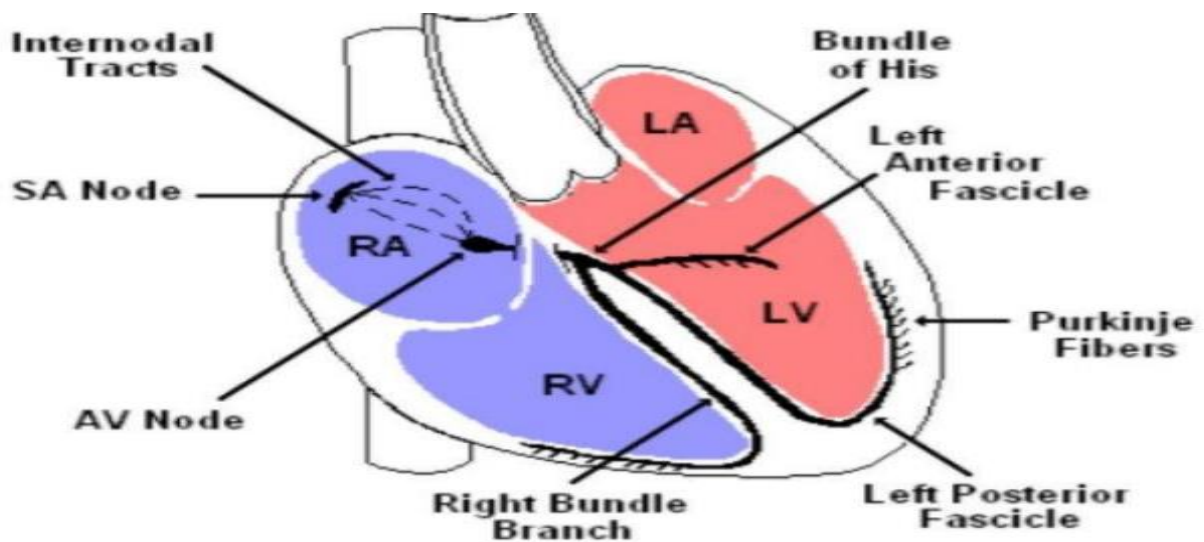


ECG

What is an ECG?

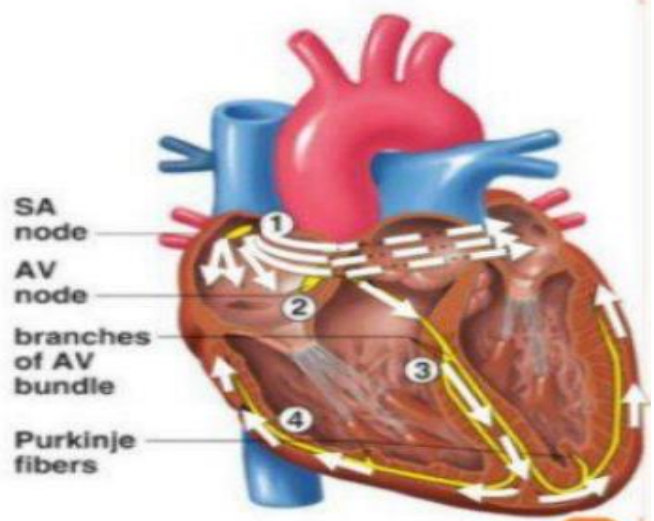
- The electrocardiogram (ECG) is a record of the sum of all electrical activity of the heart to show the heart is working properly or not .

The Normal Conduction System



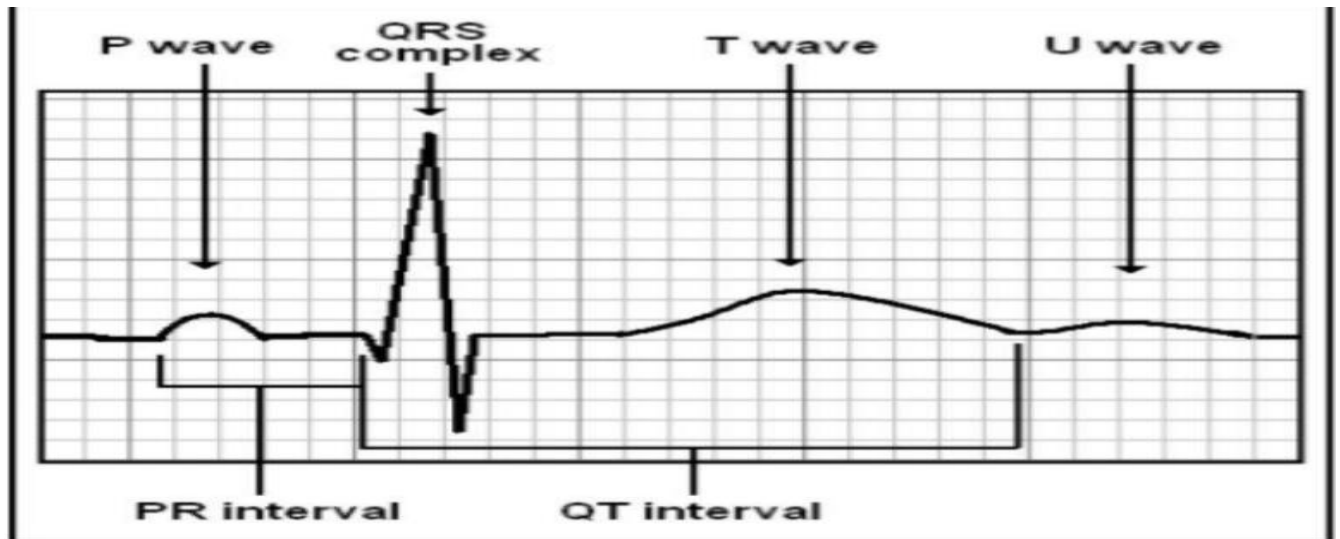
SIGNAL PROPAGATION IN HEART

1. Stimulus originates in the SA node and travels across the walls of the atria, causing them to contract.
2. Stimulus arrives at the AV node and travels along the AV bundle
3. Stimulus descends to the apex of the heart through the bundle branches
4. After stimulus reaches the Purkinje fibers, the ventricles contract.





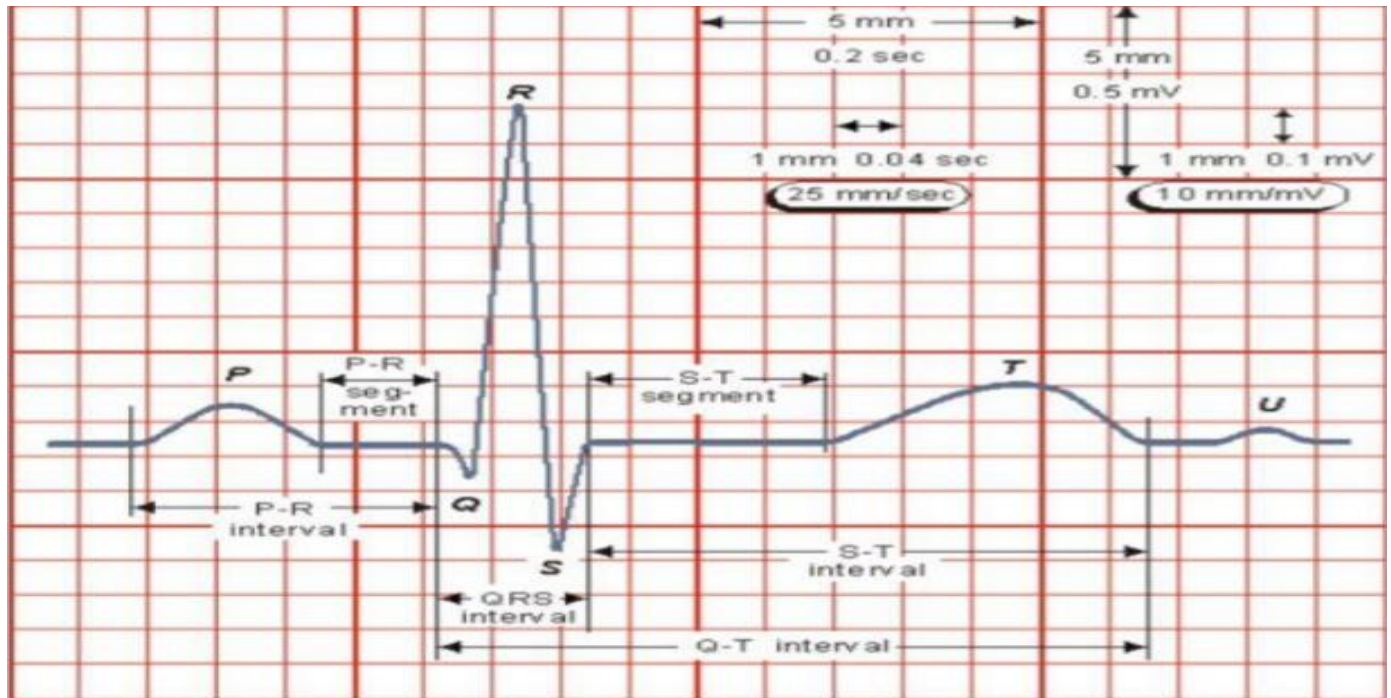
Waveforms and Intervals



Normal ECG

5 waves : P, Q, R, S, T

- ❖ P wave : caused by atrial depolarization [Less than 2.5 small square (H&V)]
- ❖ QRS complex: caused by ventricular depolarization [< 2.5 small square]
- ❖ T wave :caused by ventricular repolarization
- ❖ Intervals :
 - ✓ P-R interval = 0.12 -0.2s (3-5 ss)
 - ✓ QT-interval = At normal HR: $QT \leq 11$ small square .



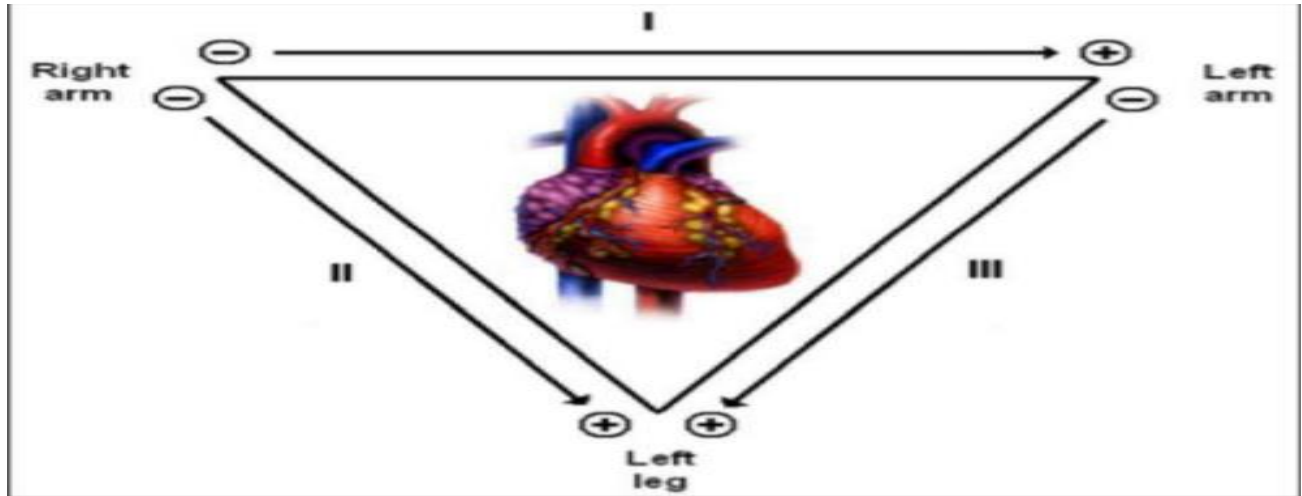
EKG Leads

- The standard EKG has 12 leads:
- 3 Standard Limb Leads
- 3 Augmented Limb Leads
- 6 Precordial Leads

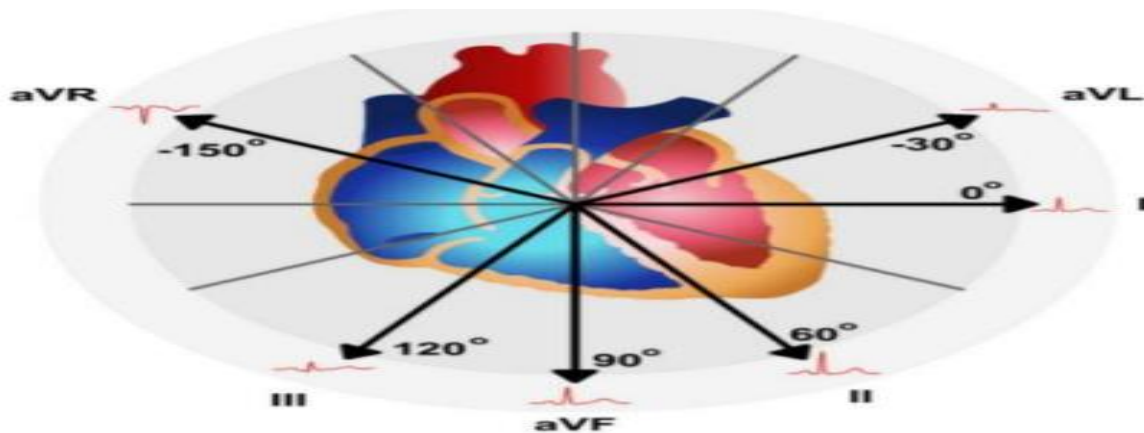
The axis of a particular lead represents the viewpoint from which it looks at the heart.



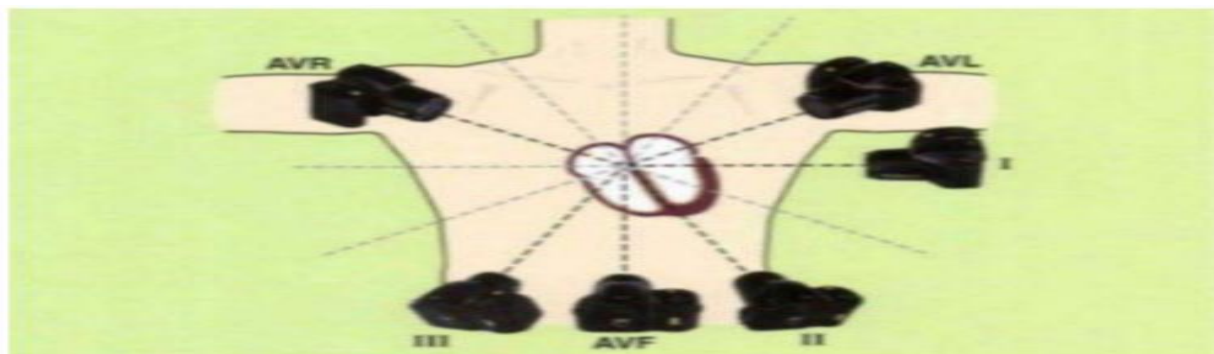
Standard Limb Leads



All Limb Leads

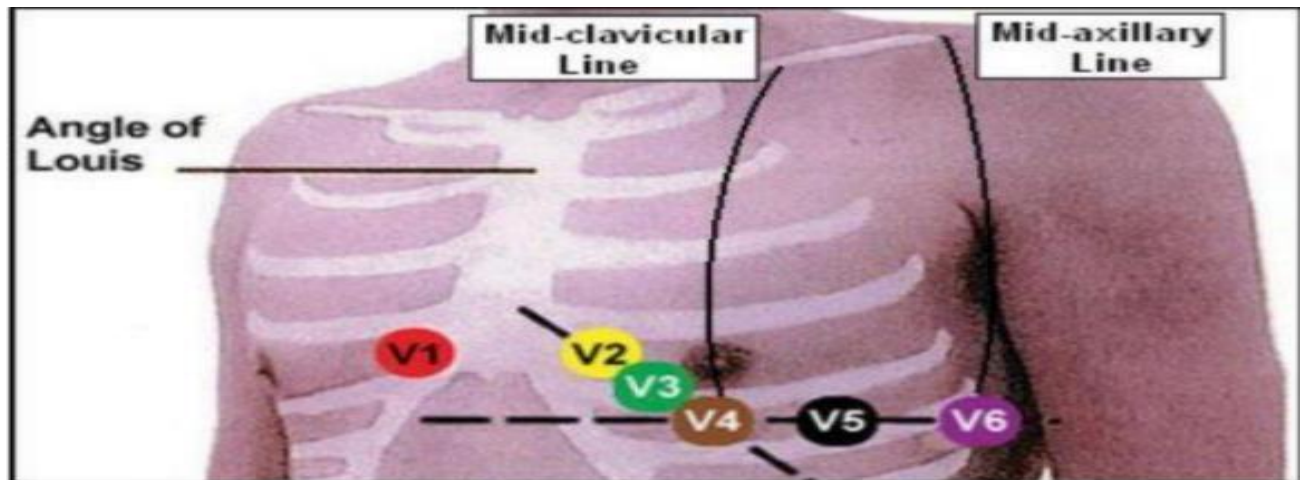








Limb leads as camera





Precordial Leads



-  **V₁** 4th intercostal space to the right of the sternum
-  **V₂** 4th intercostal space to the left of the sternum
-  **V₃** Directly between the leads V₂ and V₄.
-  **V₄** 5th intercostal space at midclavicular line
-  **V₅** Level with V₄ at left anterior axillary line
-  **V₆** Level with V₅ at midaxillary line
(directly under the midpoint of the armpit)

4 Limb electrodes

- | | |
|-----------|--------|
| Right Arm | Red |
| Left Arm | Yellow |
| Left Leg | Green |
| Right Leg | Black |

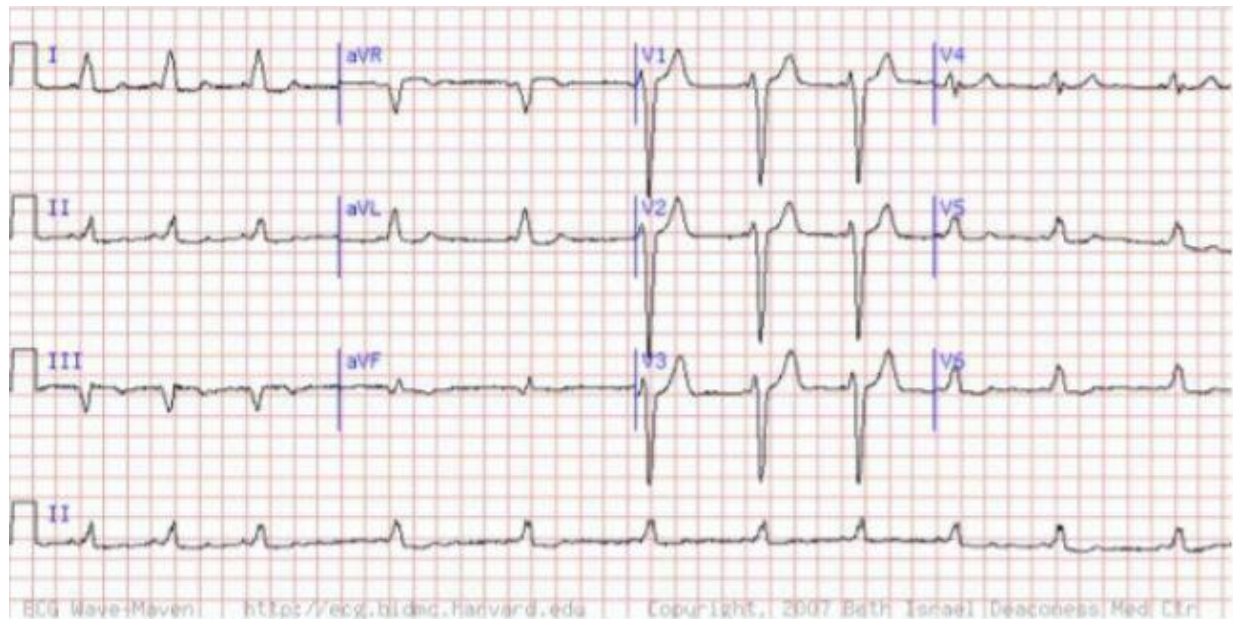




Summary of Leads

| | Limb Leads | Precordial Leads |
|-----------------|--|------------------|
| Bipolar | I, II, III (standard limb leads) | - |
| Unipolar | aVR, aVL, aVF (augmented limb leads) | V1-V6 |

ECG paper





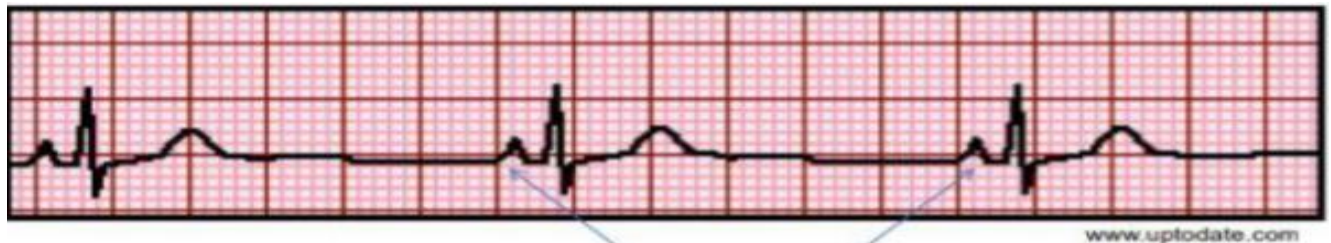
Determining the Heart Rate

- ❖ Rule of 300 for regular rhythm
- ❖ 10 Second Rule for irregular rhythm

Rule of 300

- Take the number of “big boxes” between neighboring QRS complexes, and divide this into 300. The result will be approximately equal to the rate
- Although fast, this method only works for regular rhythms

What is the heart rate?



$(300 / 6) = 50 \text{ bpm} = \text{sinus bradycardia}$

Normal heart rate = 60 – 100 bpm

The Rule of 300

- ✚ It may be easiest to memorize the following table:



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 Title of the lab 8:- ECG
 Dr.Amasii Felah Jabbar
 M.S.c : Hanna abdukkareem hussein



| # of big boxes | Rate |
|----------------|------|
| 1 | 300 |
| 2 | 150 |
| 3 | 100 |
| 4 | 75 |
| 5 | 60 |
| 6 | 50 |

10 second Rule

- As most ECGs record 10 seconds of rhythm per page, one can simply count the number of beats present on the ECG and multiply by 6 to get the number of beats per 60 seconds.
- This method works well for irregular rhythms .



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Summary

How to read an ECG (the official version)

- Step 1: Rhythm
- Step 2: Rate
- Step 3: Conduction (PQ, QRS, QT)
- Step 4: Heart axis
- Step 5: P wave morphology
- Step 6: QRS morphology
- Step 7: ST morphology
- Step 7+1: Compare the current ECG with a previous one