



# physiology lab (4)

# ELECTROCARDIOGRAM



الفريق الأكاديمي للجنة طب الأسنان



الجمعية الأكاديمية للجمعية لطب الأستنان

**In this lab I will discuss explain how we can heart rate and record the electric current produced by the heart**

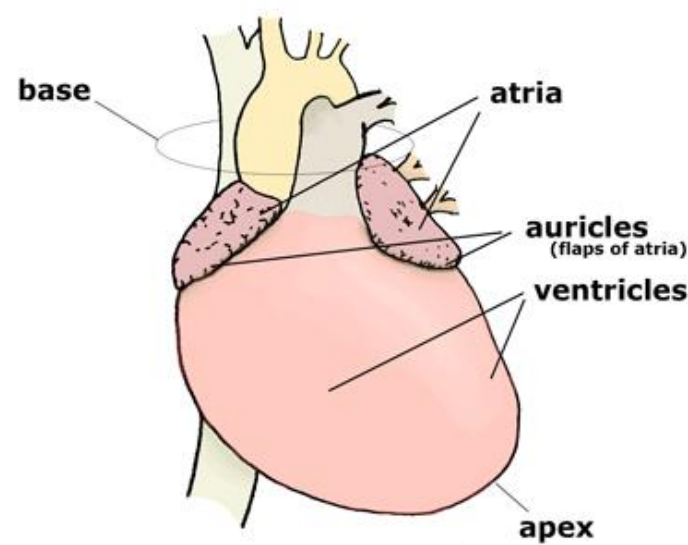
## Introduction

\*\* The main function of the heart : is to pump the blood through the body to supply the tissues by the oxygen and nutrient

\*\* The hear situated in the mediastinum near the midline, 2/3 the heart is on the lift side of the chest

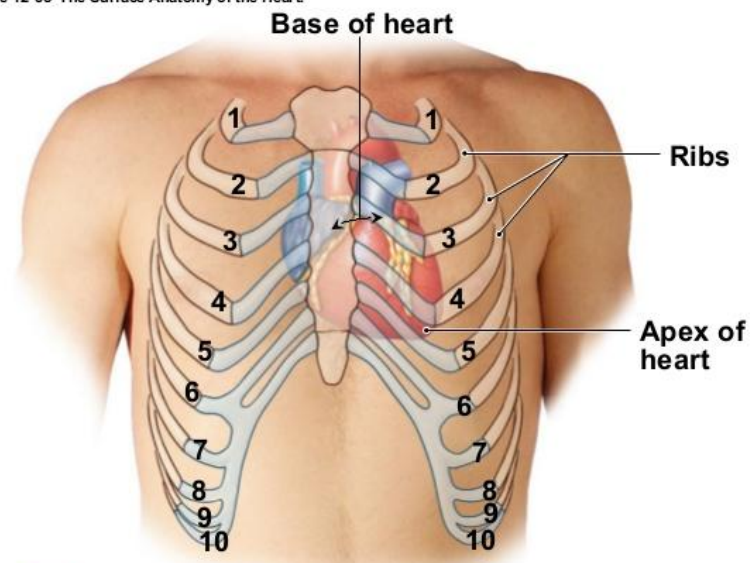
\*\* The heart has apex base and :

\*the base of the heart faces up and to the right and the apex faces down and to the lift



\*\*The apex contact with chest wall at the fifth intercostal space in the midclavicular line

Figure 12-3c The Surface Anatomy of the Heart.



**C** Heart position relative to the rib cage.

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الجمعية السعودية لطب القلب

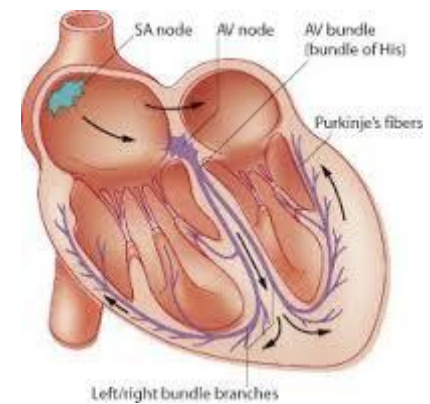
**\*\*The heart has four chamber :**

**\*The Right atrium and right ventricle:** their function is to supply the deoxygenated blood from the body to the lung

**\*The left atrium and left ventricle :** their function is to supply oxygenated blood from the lung to the body

The component of the conduction system are:

- 1- Senatorial node (pacemaker)
- 2- Atrioventricular node
- 3- Atrioventricular bundle (bundle of His)
- 4- Right and left branch
- 5- Purkinje fiber



**\*\*The Electrocardiogram:**

Is a recording of electric current produced by the heart and conduct through body fluid and reach the skin.

**\*\* The mechanism of The Electrocardiogram:**

Because the body fluids contain electrolyte, The electrical activity can conduct through to reach to the skin .then, To detect the electricity of the heart, placing the electrode on the skin of the chest and the machine used for this is

## Electrocardiograph.

**Electrode :** harmless device with wires that lead to a recording machine.

**A lead is :** Is a pair of electrode placed on the skin in specific locations and connect to an ECG recorder or oscilloscope . Each lead has positive and negative pole.



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There are 12 lead :

1-Three of them are **Bipolar** : they record the electric activity between two different points (one positive and one negative).

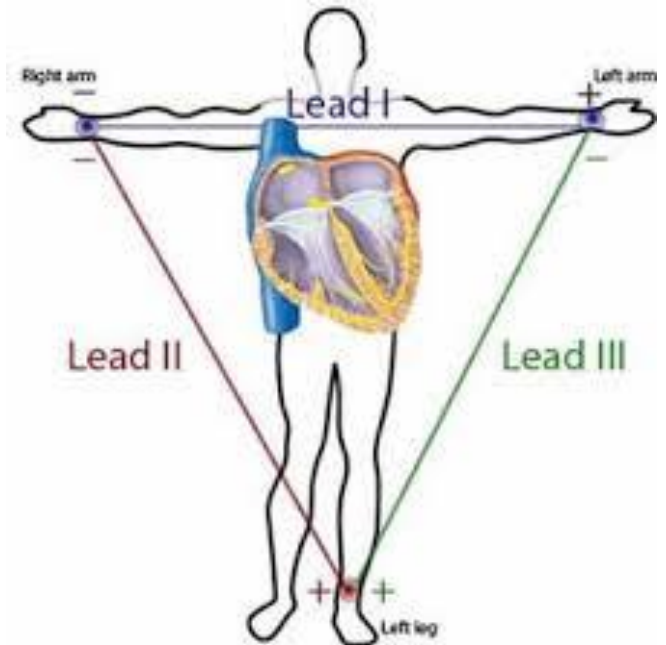
2- Nine of them are **Unipolar** : they record the electric potential at one point by means of a single exploring activity.

**\*\* We have two planes can using in the recording of ECG; the frontal plane and the transverse plane.**

a-frontal plane leads: are

1. Standard bipolar limb leads :

- \*Lead I: left arm (+) & right arm(-)
- \* Lead II : right arm (-) & left leg(+)
- \* Lead III : left arm (-) & left leg(+)

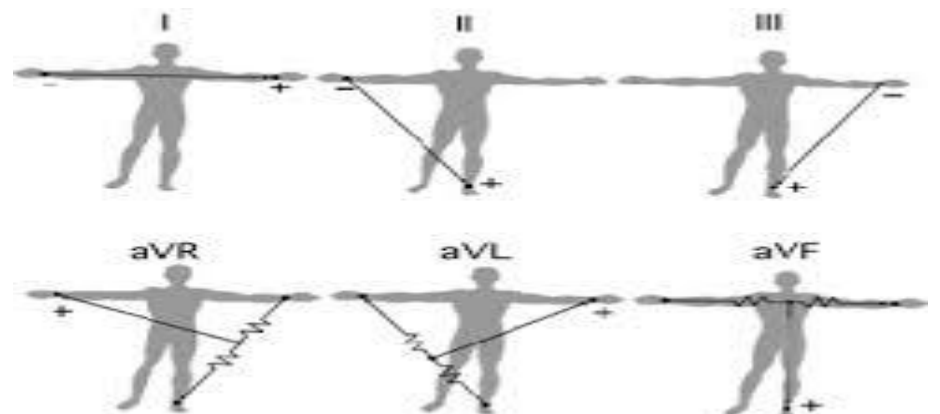


2. Augmented unipolar leads :

- \* aVR: Augmented voltage of right arm
- \* aVL: Augmented voltage of left arm
- \* aVF: Augmented voltage of left

b- Transverse or horizontal plane leads:

There are six unipolar leads record in this plane. These are termed the chest leads and they provide information on how the instantaneous cardiac vector are directed interiorly or posteriorly.





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The standard chest lead positions are as follow :

1. **V1** Forth intercostal space ,right sternal space.
2. **V2** Fourth intercostal space ,left sternal space.
3. **V4** Fifth intercostal space in the midclavicular line.
4. **V3** located in the middle between the second and fourth electrode.
5. **V5** lies on the fifth rib in the anterior axillary line.
6. **V6** On an imaginary horizontal line with **V5** in the mid-axillary line.

The electrocardiograph record The electric current produced by the heart. then ,convert it to the line called "waveform".

## \*\*The ECG composed of :

### 1- p wave:

Is the wave of the atrial depolarization and show up in the ECG

- In a patient the **P wave** has these characteristic:

- \*smooth and rounded
- \*not more than 3 mm tall
- \*upright in the leads (I , II , aVF )

### 2- PR interval ( p wave + Q wave):

-includes the **p wave** and the space up until the beginning of the **QRS complex**.

- present the time required by the electric impulse to travel from SA node to the ventricles

- By the end of PR interval the atrial beginning to repolarize and the ventricles are beginning to depolarize

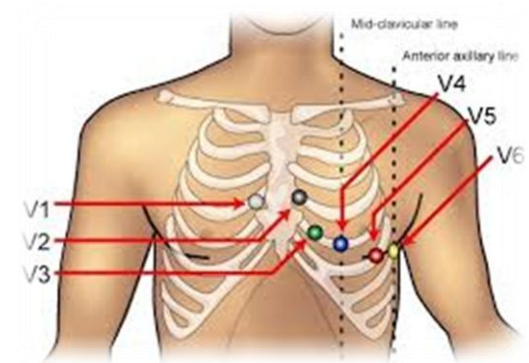
- The PR interval normal duration is (120-200)ms **OR** (.12-0.2) second.

### 3- QRS complex :

-Is the wave of ventricles depolarization.

- Technically:

- \* The Q wave is the first downward stroke
- \* The R wave is the first positive stroke
- \* The S wave is a negative stroke that follows a positive upstroke
- \* The QRS should be between (5-20)mm tall
- \* Normal QRS duration is (60 to 100) ms **OR** (.06 to 0.1 ) second







#### 4- ST segment

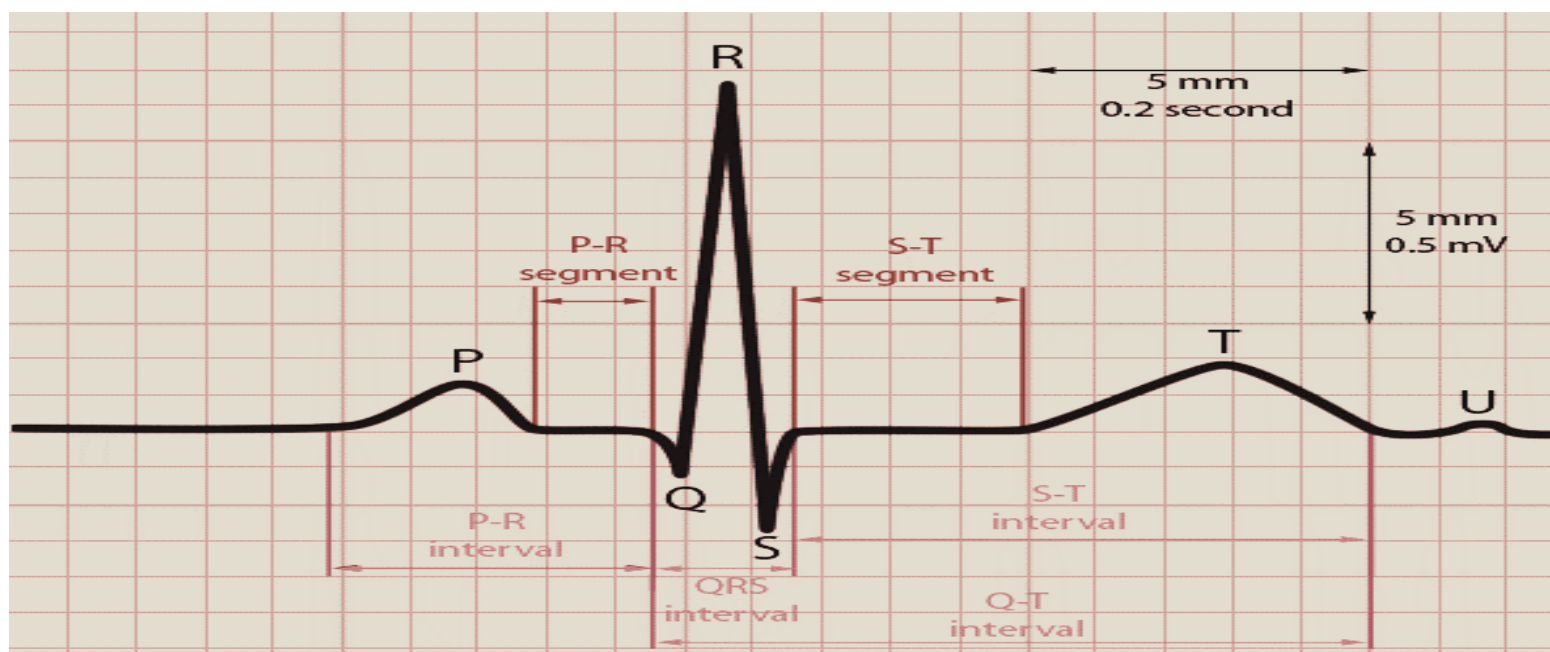
- this segment at the end of **QRS complex** to the beginning of **T wave**.
- indicates the period of the time between the ventricle depolarization and ventricle repolarization. ( **ventricle contraction and emptying** )
- the ST segment is **ISOELECTRIC** or on the **baseline**
- in normal person the ST segment don't deviate from the baseline.
- while in the person has coronary artery disease , this segment deviate from baseline ( either a depression **OR** elevation )

#### 5- T wave :

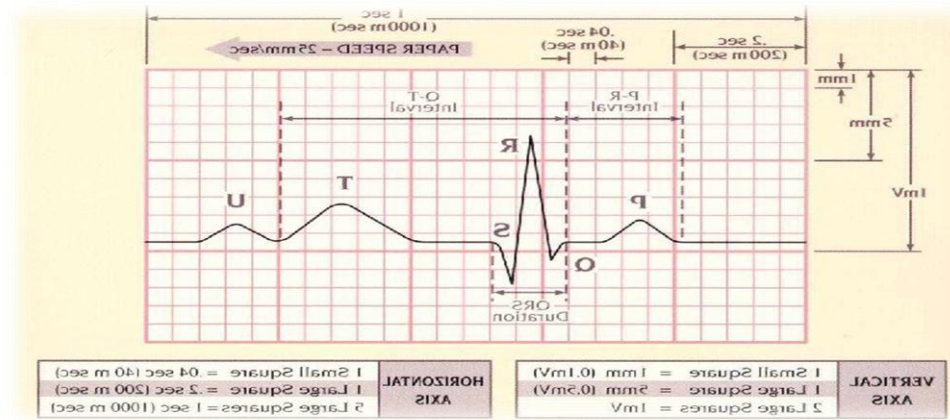
- is the wave of ventricle repolarization
- deflect in the same direction as the **QRS complex**
- should be smooth or rounded
- The period of the T wave called ( relative refractory period ). At this time , the ventricle vulnerable(weak).

#### QT interval :

- Present both ventricle depolarization and repolarization
- Normal duration (0.4-.43) second

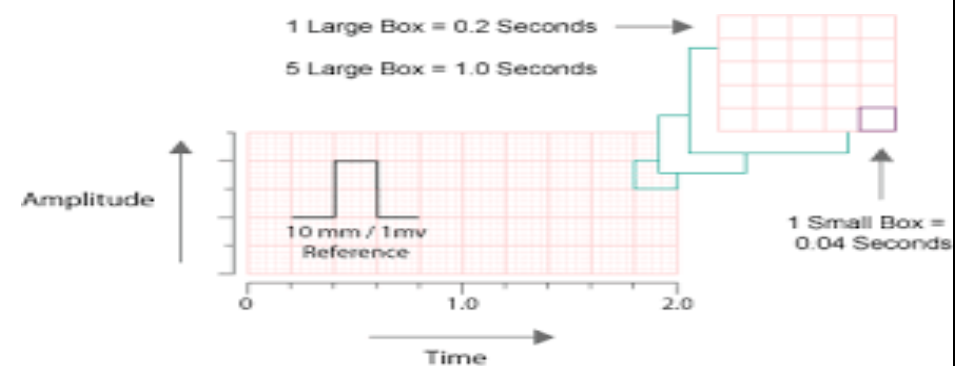


# ECG PAPER



What does it mean ?

- \* 1 mm intervals (vertical and horizontal) & small square
- \* Every 5mm (5 small squares) the line is accentuated (prominent).
- \* Each prominent line represent large square
- \* 5mm distance (large square) = 0.2sec = 200 ms
- \* 1mm distance (small square) = .04sec = 40 ms
- \* Each 1mm = .1mv
- \* **Each 5 large square ( 5 prominent line):**
  - \*\* ( 0.2sec \* 5 large square = 1second )
  - \*\* (5mm \* 5 large square = 25mm)



## ECG Interpretation:

- 1-Rate
- 2-Rhythm
- 3-Duration time for waves and intervals

## Heart rate :

Number of beat per minute

- \*normal heart rate is 60bpm ( beat per minute)
- \*Abnormal heart rate :
  - 1- Bardycardia (below normal). **Below 60**
  - 2- Tachycardia ( above normal). **Above 100**



## How calculate the heart beat using the ECG :

\* The distance between P-R,P-R represent one cycle

\*measure the distance and calculate the rate by using these equations :

**Heart rate = 1500/ number of small square**

**OR**

**Heart rate = 300 / number of large square**

1mm=small square

5mm=large square

## 2. Rhythm evaluation :

-The most difficult part of ECG interpretation.

-To assess the rhythm , one must identify the **P wave** and **QRS complex** and determine the relationship between them.

-If the distance between waves is similar ( R to R, P to P,..). this means the rhythm is normal

- Arrhythmias : are abnormal cardiac rhythms (irregular heartbeat).