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# Ekgs / Ecgs (Quick Study: Academic)



**EKGs / ECGs**

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### Basics

- The information EKGs contain from the cardiac muscle (myocardium), both PDC and DCU can be used to assess "electrocardiogram" (ECG) cells by and throughout the graph
- An EKG is a recording of the heart's electrical activity; this activity is produced by cardiac cells
- There are two basic types of cardiac cells: myocardial cells and specialized cells
  - Myocardial cells are the working myocardium of the heart and comprise the majority of heart tissue. They form the muscular layer of the atria and ventricles walls.
  - Myocytes divide these cells side together causing the cells to contract
  - Specialized cells are the conduction system of the heart
  - Pacemaker cells generate and regulate myocardial cells. They do not contain filaments, so they cannot contract. They generate and conduct electrical impulses throughout the heart
  - Electrical conducting cells conduct impulses generated by pacemaker cells throughout the heart. They are the backbone of the heart
- In a cardiac cell resting state, the inside of the cell is negatively charged when compared to the outside of the cell. The electrochemical inside the cell is maintained by ion pumps at the cell membrane
  - These pumps control the distribution of electrolytes, such as potassium, sodium, chloride, and calcium ions, which are vital to maintaining the negative polarity inside the cell
  - The measurement of the difference in electrical charge on either side of a cell membrane is called **action potential**
  - The exchange of electrolytes through the cardiac cell membrane produces the electrical activity
  - When cardiac cells lose their negative polarity, depolarization occurs. **Depolarization** is an electrical event caused by positively charged ions entering the cell membrane
  - Depolarization is transmitted from cell to cell, producing a wave of electrical activity across the heart, which can be recorded by electrodes placed on a patient's skin. Depolarization initiates the cycle of cardiac contraction
  - Repolarization is followed by a reversal of the flow of ions across the cell membrane called **repolarization**, which is the restoration of negative polarity inside the cell
    - Repolarization initiates the relaxation phase of cardiac muscle, which is also detected by electrodes placed on the chest

### Conduction Pathway

- The path of excitation begins at the **sinoatrial (SA) node**, or **sinus node**, whose job it is to pace the heart; generally, the sinoatrial pacemaker cells are found in the SA node
  - These cells have the fastest firing rate (approx. 100-110 bpm) but can vary tremendously based on the demands placed on the heart, such as exercise
  - The signal is then sent to the **atrioventricular (AV) node**, located in the lower area of the right atrium
  - The main function of the AV node is to delay the electrical signal, this allows for the atria to contract and ventricles to fill before they contract
  - The impulse is then transmitted through the **bundle of His**, located in the upper part of the septum that separates the ventricles
  - The **bundle of His** has pacemaker cells that can transmit at a rate of 40-60 bpm
  - The area connects the AV node with the right and left bundle branches - are areas called the **AV junction**
  - The right bundle branch sends messages to the right ventricle; the left bundle branches divide and supply transmission to the left ventricle
  - The right and left bundle branches divide into smaller branches and connect to the **Purkinje fibers**, which penetrate the ventricular muscle, where electrical impulses are sent through the Purkinje fibers, this causes ventricle contraction
  - These fibers have pacemaker cells that have an intrinsic pace of 30-40 bpm

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### Electrocardiogram

- An EKG is recorded by electrodes (leads) adhere to pads that are placed on the patient's chest
- Several electrodes are placed on the chest to view the heart from different angles; a **lead** is a view of the heart from a particular angle
- A single EKG can be seen with three electrode leads: lead I, lead II, and lead III
- An EKG records the electrical activity between the electrodes
- The electrodes are often color coded (black, white, and red)
- The electrode is negative; the second is negative and the third is the "ground" which measures electrical interference from other sources
- When electricity flows toward the positive electrode, the pattern on the graph will be upright
- Consequently, when electricity flows away from the positive electrode, the pattern will appear downward



### 12-Lead EKG

- Provides many angles of the heart because it utilizes 12 leads: I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, and V6
- The 12 leads are taken from 10 electrodes
- Five electrodes are placed on each arm and each leg
- Two precordial electrodes (V1, V6) are placed on the chest horizontally

### Precordial Electrodes

- V1 is placed in the 4th intercostal space to the right of the sternum and low over the right ventricle
- V2 is placed in the 4th intercostal space to the left of the sternum
- V3 is placed between V2 and V4, which is located at the 5th intercostal space midclavicular line
- V4 is placed between V3 and V6, which is located at the 5th intercostal space midaxillary line
- V5 is placed at the 5th intercostal space midclavicular line

### Augmented Leads

- There are three augmented limb leads, which are created by making one electrode positive and the others negative, for example:
  - Lead aVR** is created by making the left arm positive and the other leads negative
  - Lead aVL** is created by making the right arm positive and the other leads negative
  - Lead aVF** is created by making the left leg positive and the other leads negative
- The anterior part of the heart is viewed in leads I, II, V1, and V4
- The inferior part of the heart is viewed in leads II, III, and aVF
- The left lateral side of the heart is viewed in leads I, aVL, V5, and V6
- The right ventricular part of the heart is viewed in leads V1R and V1L

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### Lead I Monitoring

- The positive electrode is placed on the left upper arm of the chest just below the clavicle; the negative electrode is placed below the right clavicle
- The flow of electricity is from the negative to the positive electrode
- This creates the reflection, or **QRS complex**, on the graph
- Lead I receives information on the lateral wall of the heart

### Lead II Monitoring

- The positive electrode is placed on the left side of the chest below the pectoral muscle; the negative electrode is placed below the right clavicle
- This is the most common lead for cardiac monitoring because it resembles the normal pathway of electrical depolarization across the heart
- Lead II receives information on the anterior wall of the heart

### Lead III Monitoring


- The positive electrode is placed on the left side of the chest below the pectoral muscle; the negative electrode is placed on the left side also but below the clavicle
- Lead III receives information on the inferior wall of the heart

### Lead aVL Monitoring

- aVL, = modified chest lead
- The negative electrode is on the left side of the chest below the clavicle; the positive electrode is on the right side of the chest in the 5th intercostal space
- Lead aVL, receives information on the anterior wall of the heart

### EKG Paper

- In order to assess waveforms, it is necessary to understand EKG graph paper
- The graph paper is made out of small and large squares
  - Each small square represents approx. 0.20 second
  - There are five small squares in a large square; each large square represents 1.00 second
  - Five large squares equal 5 seconds
  - The standard rate or speed of an EKG is 25 mm per second
  - The vertical lines on EKG paper measure the voltage, or amplitude, which is the strength of the electrical current
  - A strong current will form a greater deflection on a number of squares
  - When calibrated correctly, one small square is 0.1 mV, five small squares is 0.5 mV, and one large square is 1 mV



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## Synopsis

The newest edition to BarChartsâ™ line of medical guides is an essential companion for anyone studying EKGs/ECGs or working in the medical field. This guide features an introduction to EKGs and how they work and also includes detailed sections covering the main types of arrhythmias, such as sinus rhythms, atrial rhythms, junctional rhythms, ventricular rhythms, and heart blocks. Helpful illustrations, along with the rate, rhythm, P wave, PR interval, and QRS complex, of each rhythm covered are also included to help with identification.

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A good reference.

Great study guide!

Perfect for school

I used this to practice over my EKG basics before I took my certification exam and passed with flying colors...

Nice review of the heart and explanation of the EKG waves and rhythms. Helpful reference for

medical personnel and students.

Great chart

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