



Introduction to Electrocardiography

Pioneers of Electrocardiography

1791: Galvani (Italy)—first showed electromotor activity in the leg muscle of the frog.

1820: Hans Christian Orsted (Danish physicist)—discovered the phenomenon of electromagnetism.

1840: Carlo Matteucci—demonstrated that every beat of a frog's heart generates electricity which was the first steps towards electrocardiography.

1957: Norman Holter—invented the dynamic ECG (Holter ECG) portable device for continuous monitoring of various electrical activities of the cardiovascular system for 24 hours.

1872: Gabriel Lippmann (French physicist) invented the capillary electrometer.

1876: Etienne-Jules Marey (French physiologist)—used the Lippmann electrometer to record electrical activity in an exposed heart of a frog. It was the true beginning of modern electrocardiography.

1882: John Burdon-Sanderson—while working with frogs he coined the term isoelectric interval.

1899: Karel Frederik Wenckebach (Dutch scholar)—he worked on irregular pulse and impairment of atrioventricular conduction which leads to progressive lengthening and blockage of atrioventricular conduction in frogs (Wenckebach block: Mobitz type I).

1888–1979: Bernard A Robinson—to the early development of the electrocardiograph.

Alexander Muirhead

- Born on 26th May 1848 in Scotland.
- Electrical engineer by profession.
- He invented the first human electrocardiogram.
- He died on 13th December 1920 in Short lands, Kent.

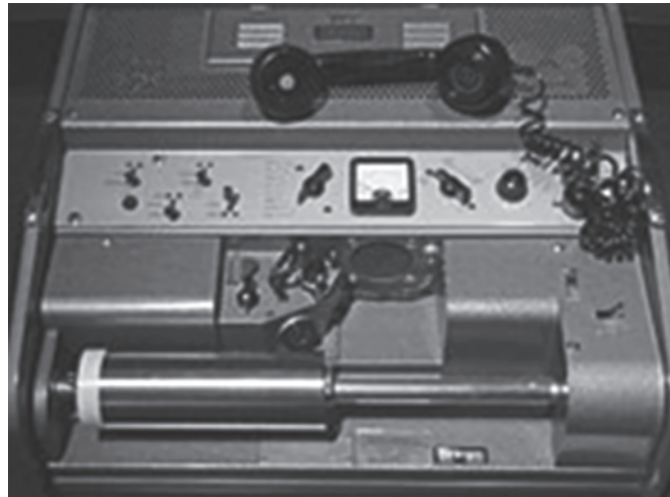


Fig. 1.1: Muirhead fax machine

Augustus Desire Waller

- Born on 18 July 1856
- He was a British physiologist.
- In 1887, he used a capillary electrometer to record the first human electrocardiogram.
- He created the first practical ECG machine with surface electrodes.
- He died on 11 March 1922.

**Willem Einthoven**

- Born on 21 May 1860
- In 1903, he invented the first practical electrocardiogram.
- He assigned letters P, Q, R, S and T to various deflections.



- Einthoven's triangle—imaginary inverted equilateral triangle centered on the chest and the points being the standard leads on the arms and leg.
- He described the electrocardiographic features of a number of cardiovascular disorders.
- In 1924, he was awarded with the Nobel Prize in Medicine for inventing the first practical system of electrocardiography used in medical diagnosis.
- He died on 29 September 1927.

Taro Takemi

- Born on 7th August 1904.
- In 1937, he built the first portable electrocardiograph.
- He was honored with Italian Order of Merit and Silver Medal from Pope Paul VI.
- Died on 29th December 1983.



Introduction to Electrocardiogram

- Electrocardiography is a Greek word.
- Electro—electrical activity, kardia—heart, graph—to write.
- It is a sophisticated galvanometer, a sensitive electromagnet.
- A process of recording the electrical activity of the heart is known as electrocardiogram (ECG or EKG).
- Electrodes detect the electrical changes on the skin that arise from the heart muscle's depolarization during heartbeat.
- Goal of ECG—to obtain information of structure and function of the heart.
- Continuous ECG monitoring
 - to monitor critically ill patients
 - general anesthesia
 - cardiac dysrhythmia
- Clinical cardiac electrophysiology
 - to measure the electrical activity
 - catheter is inserted through the femoral vein
 - Electrodes record the direction of electrical activity of heart.



Fig. 1.2: ECG machine

- ECG voltages measures hundreds of microvolts up to 1 millivolt (the small square on a standard ECG is 100 microvolts).

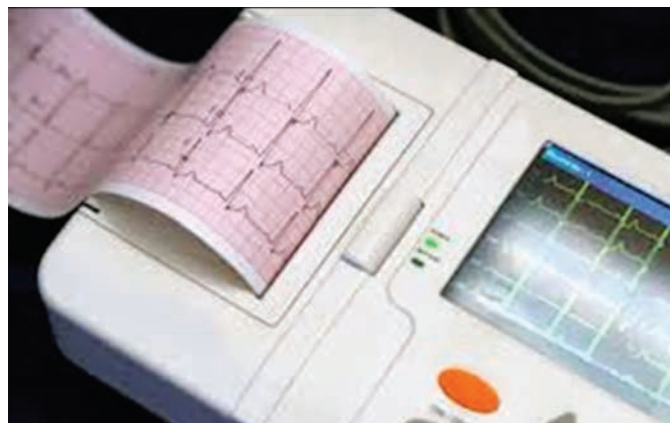


Fig. 1.3: ECG machine

Electrophysiology of ECG

- Cardiac stimulus is generated in the sinoatrial (SA) node.
- SA node is located in right atrium.
- Stimulus then spread through right atrium to left atrium
- Then it spreads through atrioventricular node and the bundle of His (AV junction).

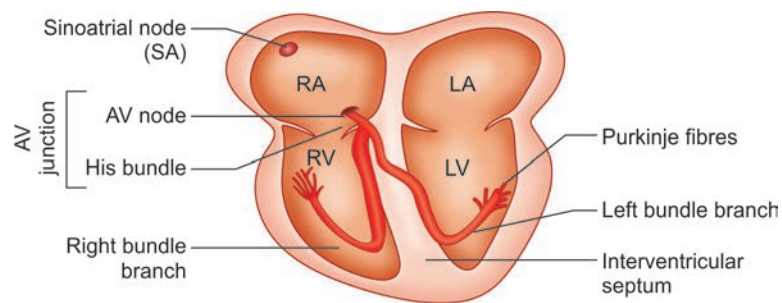


Fig. 1.4: Cardiac chambers

- Stimulus then passes through left and right ventricle by the way of left and right bundle branches (bundle of His).
- Finally cardiac stimulus spreads through the ventricular muscle cells through Purkinje fibres.