(VII.) Electrocardiography

Physiology

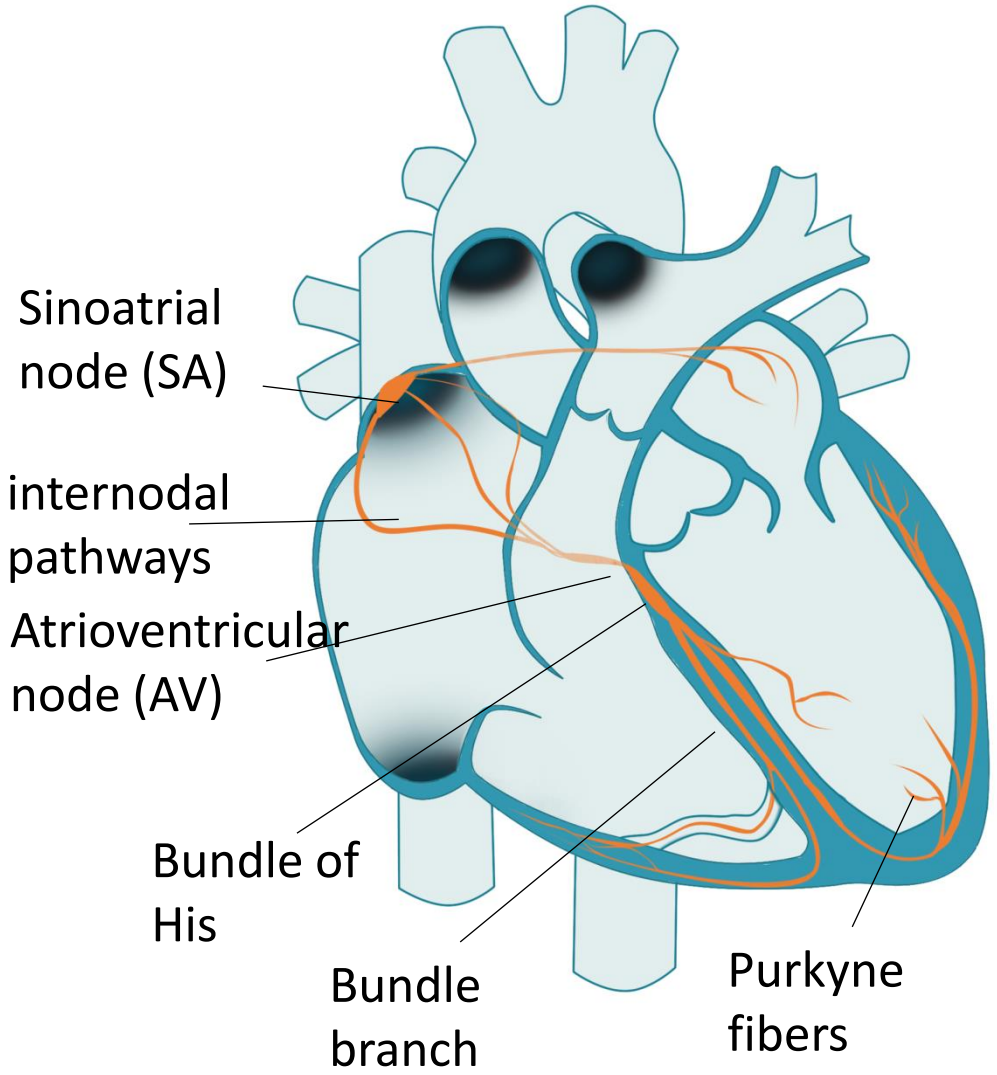
Electrocardiography

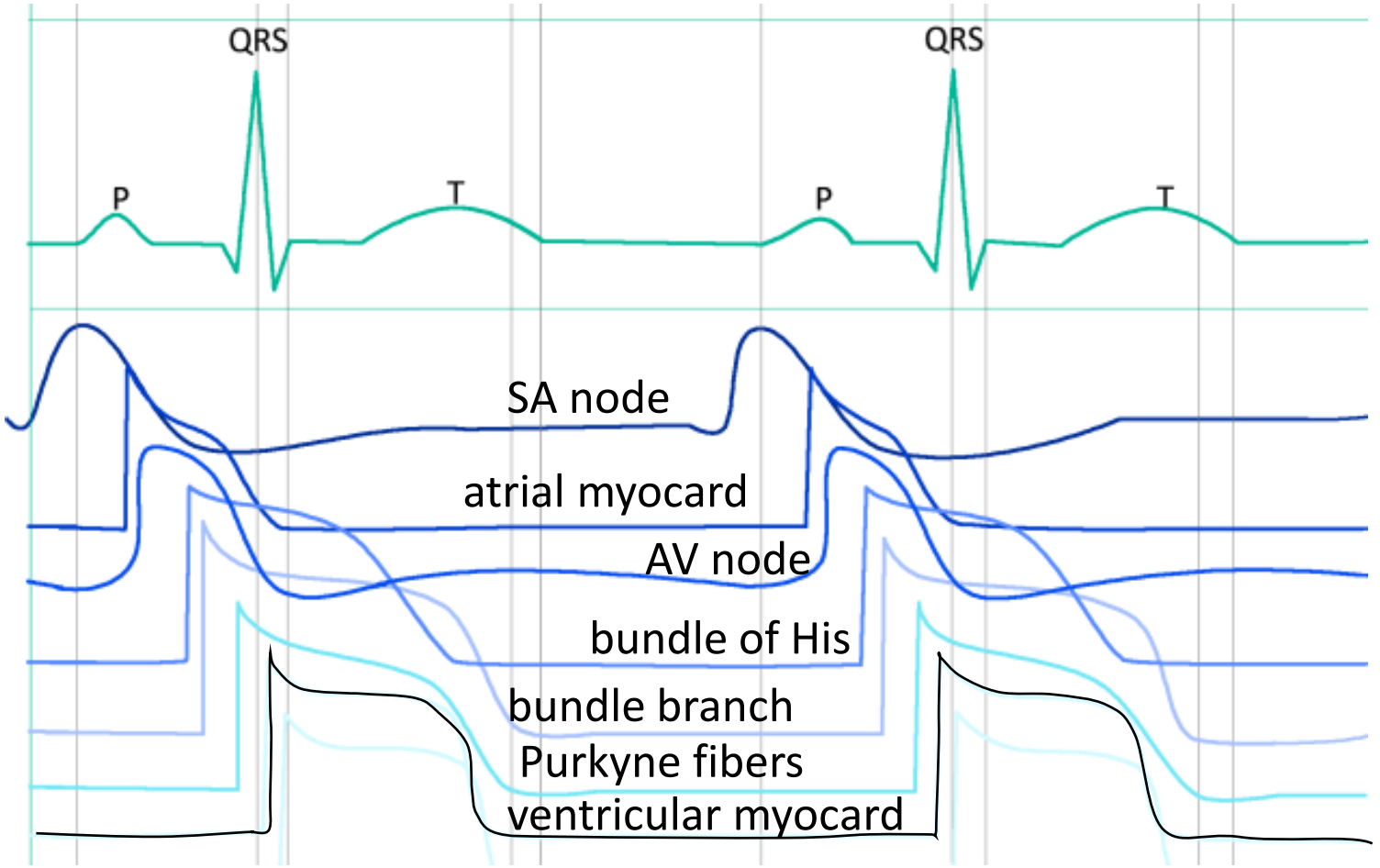
Definition: the process of recording the electrical activity of the heart

Keywords

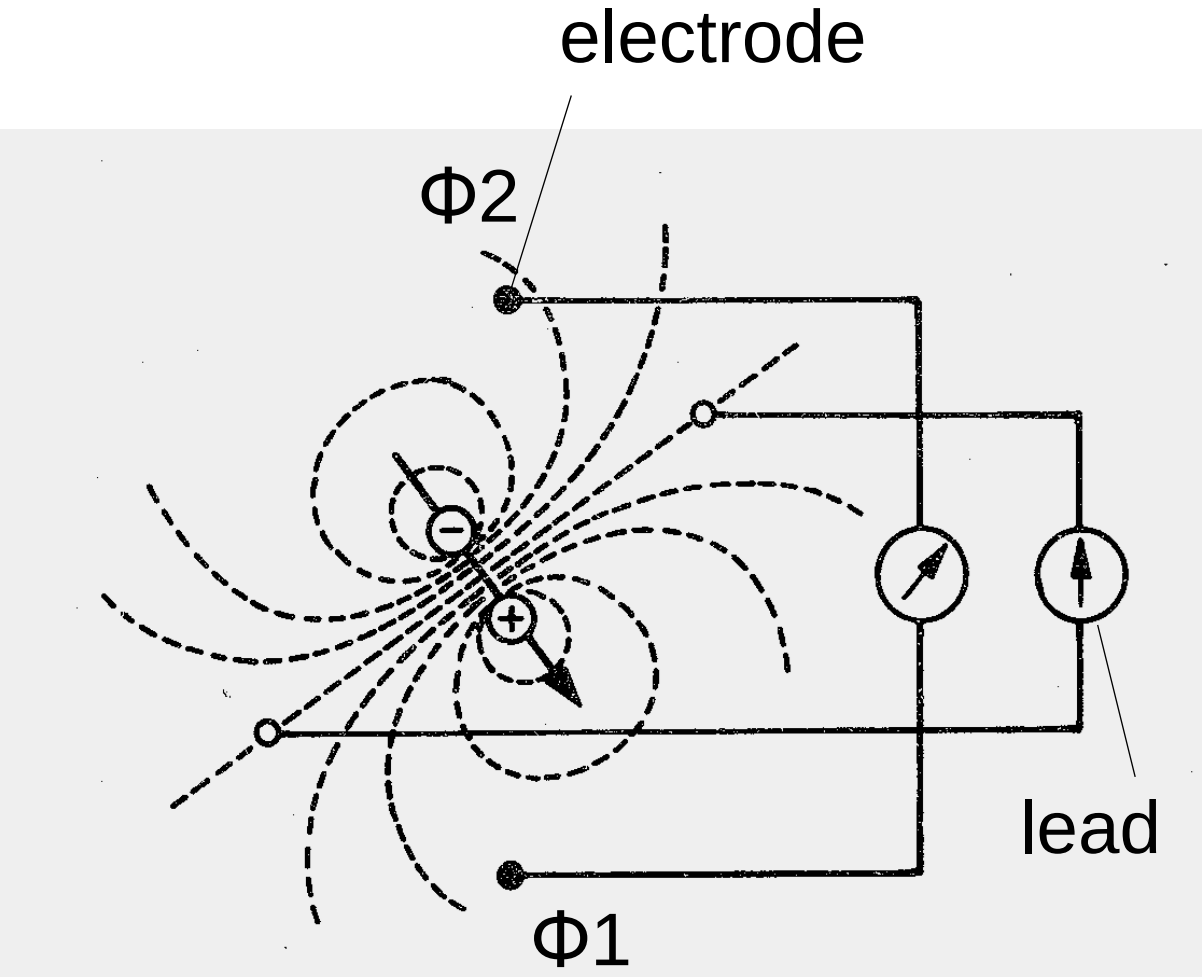
- Specialized excitatory and conductive system of the heart
- equipment for ECG recording
- limb and chest leads
- unipolar and bipolar leads
- heart vector, electrical axis of the heart

Specialized excitatory and conductive system of the heart





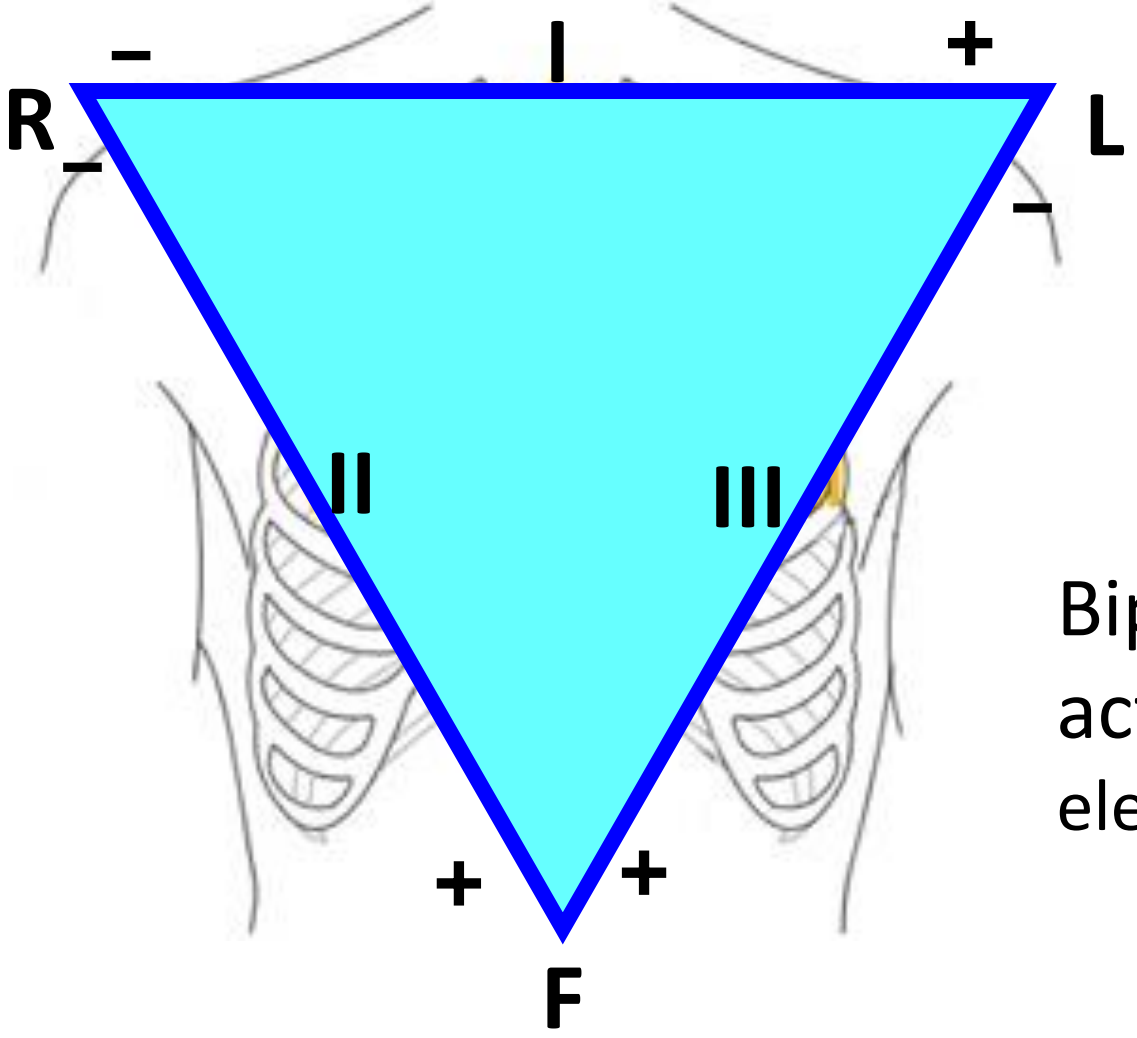
Electric dipole



Electrode: records electrical potential (Φ)
Elektric lead: connection of two electrodes

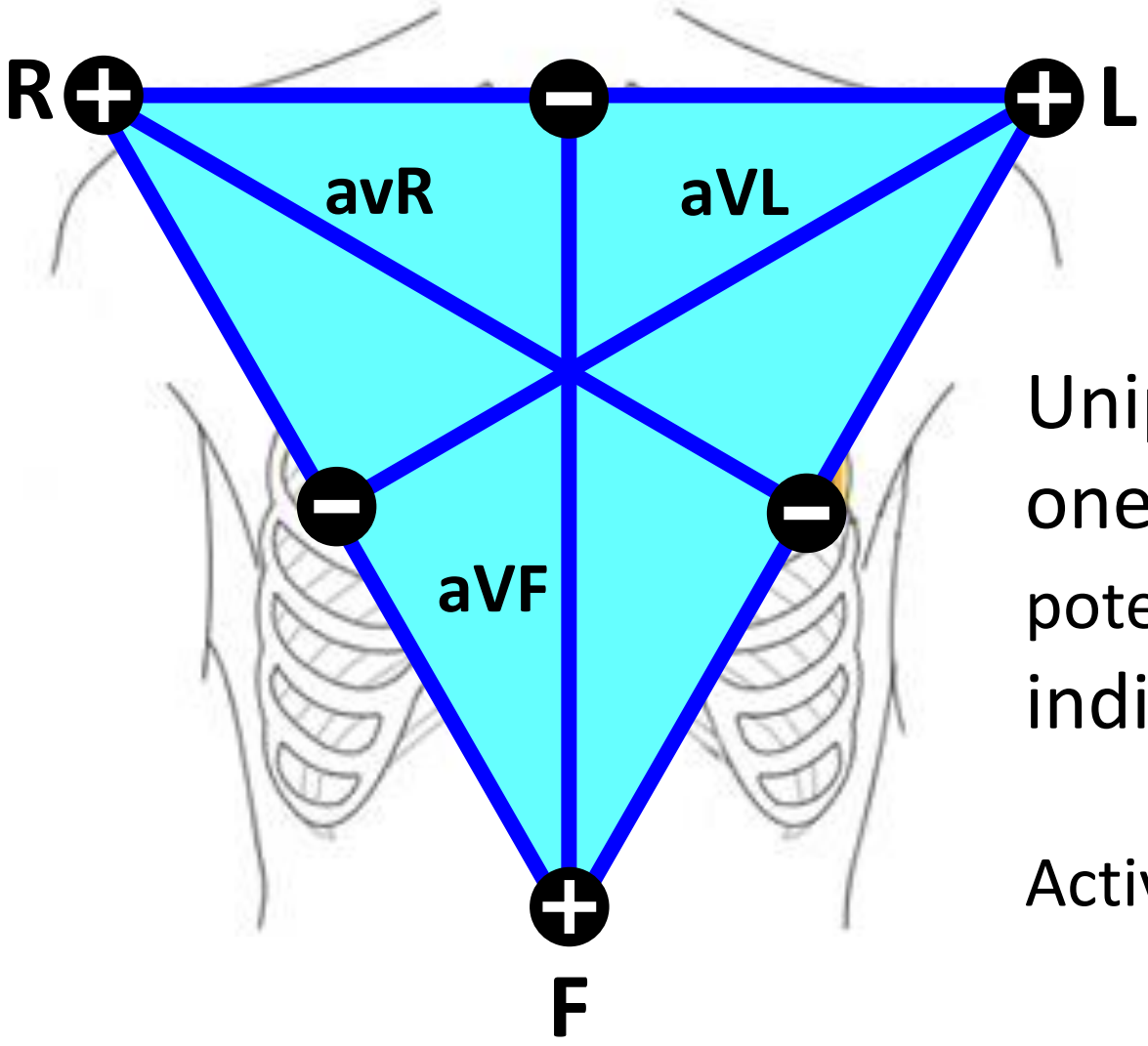
- Recordes voltage between electrodes
- Voltage: difference between el. potentials (V= Φ1- Φ2)

Einthoven´s triangle
(standard, limb, bipolar leads)



Bipolar leads: both electrodes are active (variable potential en electrodes)

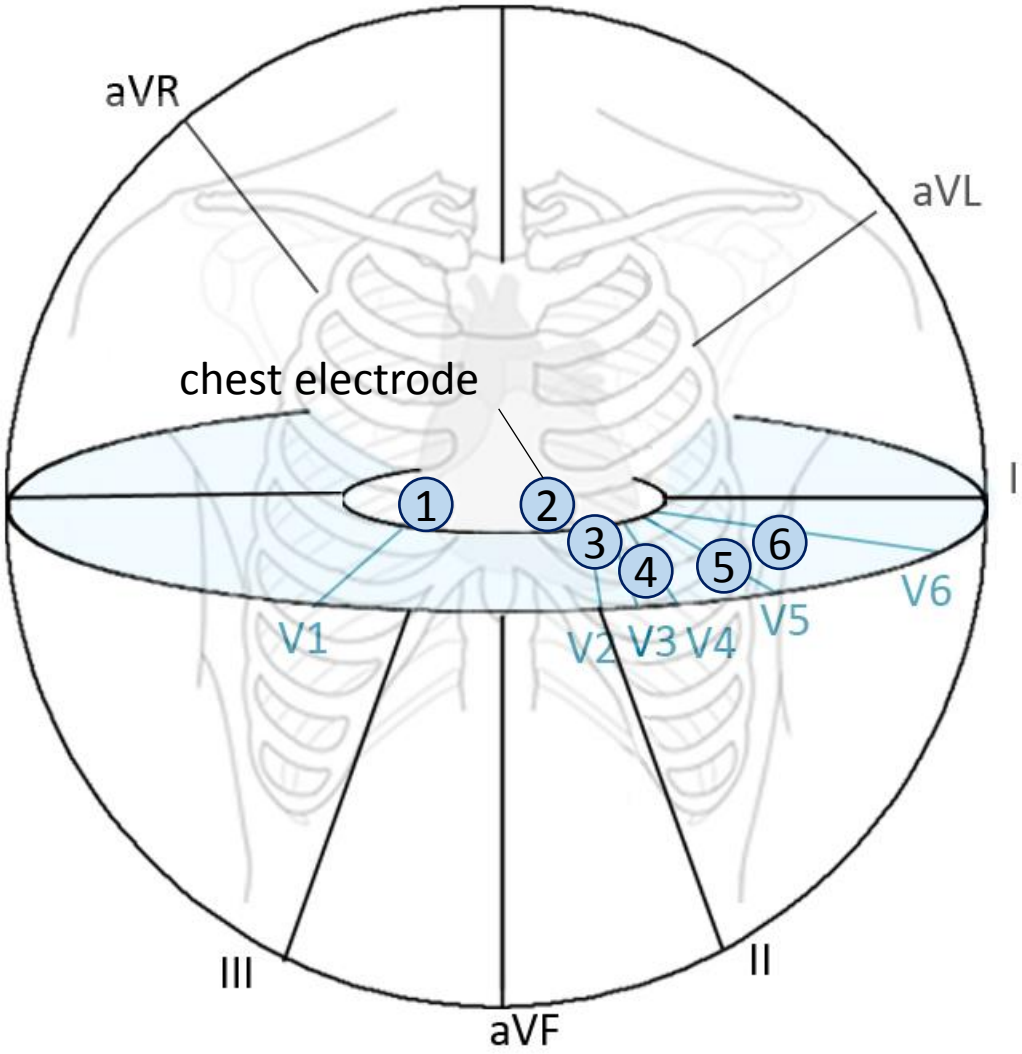
Augmented leads
(Goldberger´s, limb, unipolar leads)

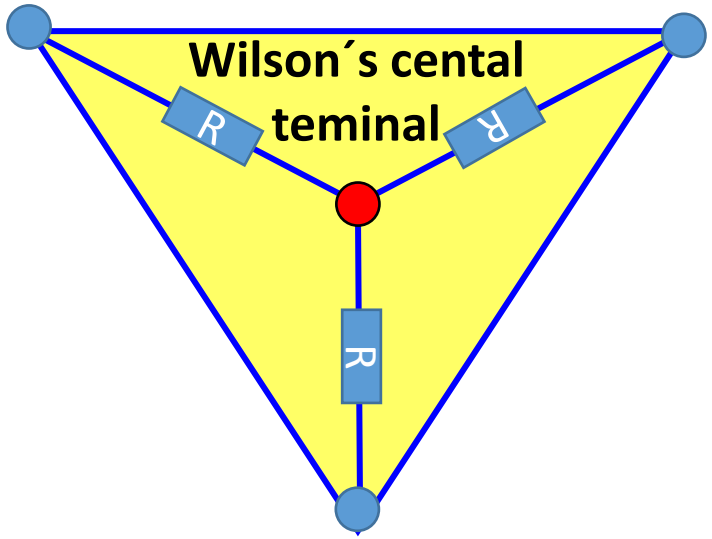


Unipolar leads:
one electrode is active (variable el. potential) and the second one is indifferent (constant el. potential)

Active electrode is always positive

Chest leads

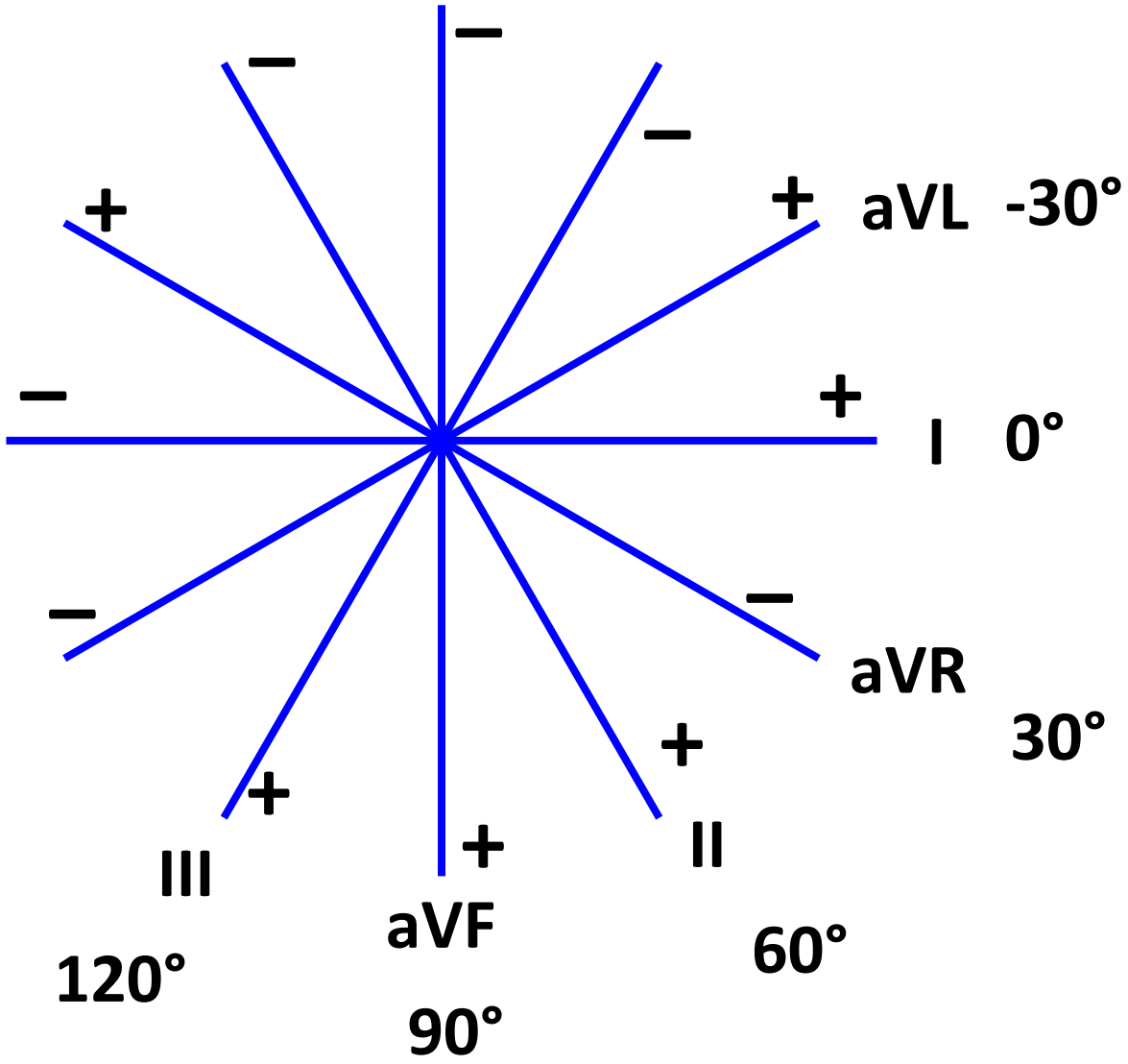


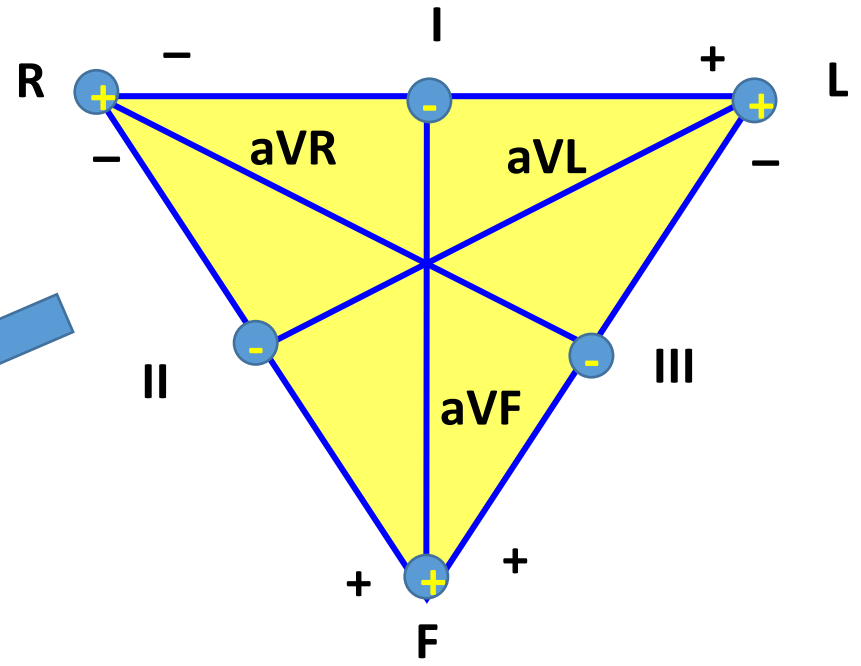


Chest electrode: connection of chest electrode and Wilson´s central terminal

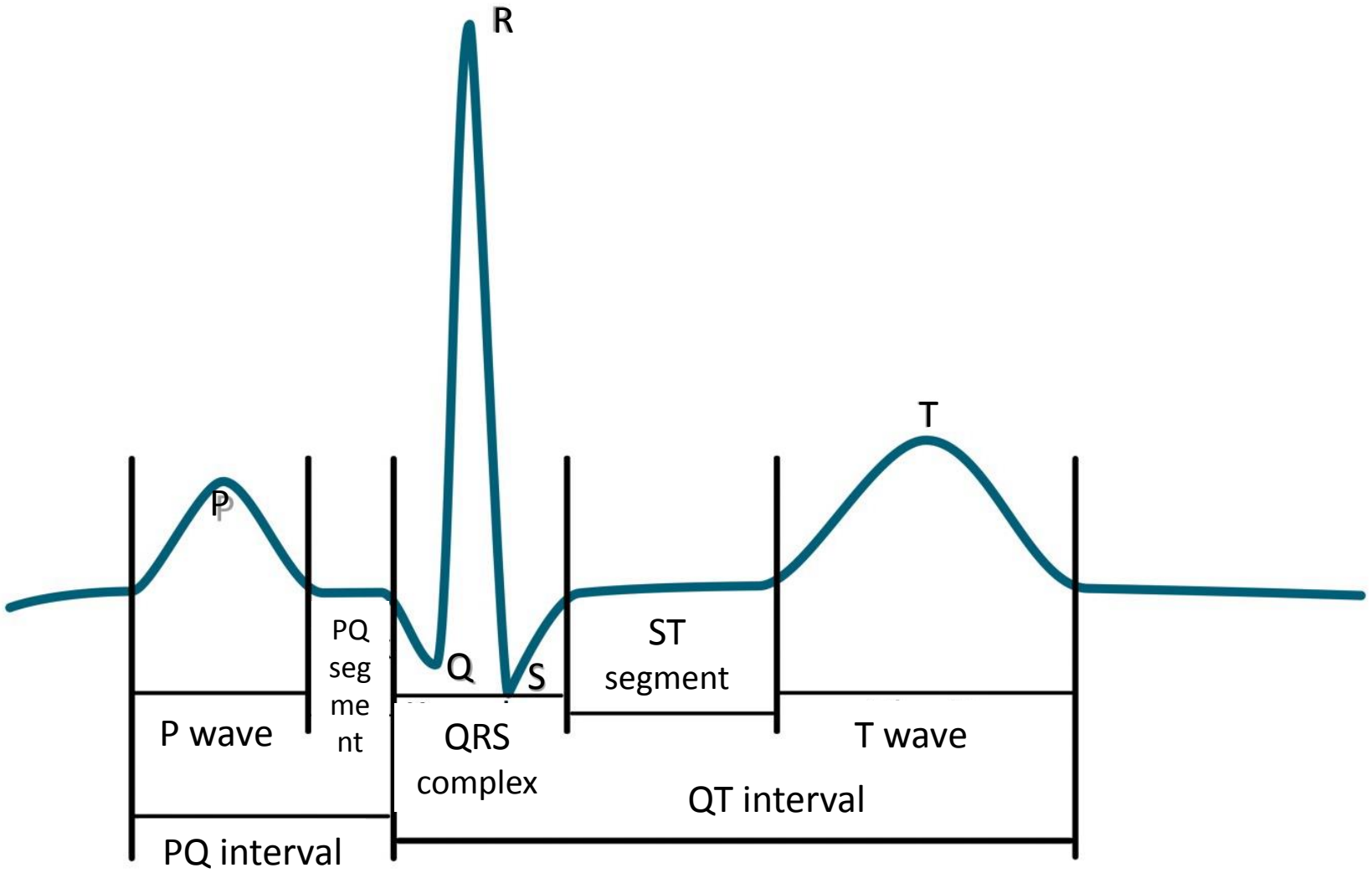
Unipolar leads:
chest electrodes are active (positive) and Wilson´s central terminal is indifferent (el. potential 0 mV, electrically centre of the heart)

Leads acording to Cabrera





ECG description



name	Norm
P wave	80 ms
Interval PQ (PR)	120-200 ms
Segment PQ (PR)	50-120 ms
Q	-
QRS	80-100ms
R	-
S	-
segment ST	80-120 ms
Interval QT	< 420ms
wave T	160 ms

formula: $QTc = \frac{QT}{\sqrt{RR}}$

ls onRR interval – correction of

Electrical axis of heart

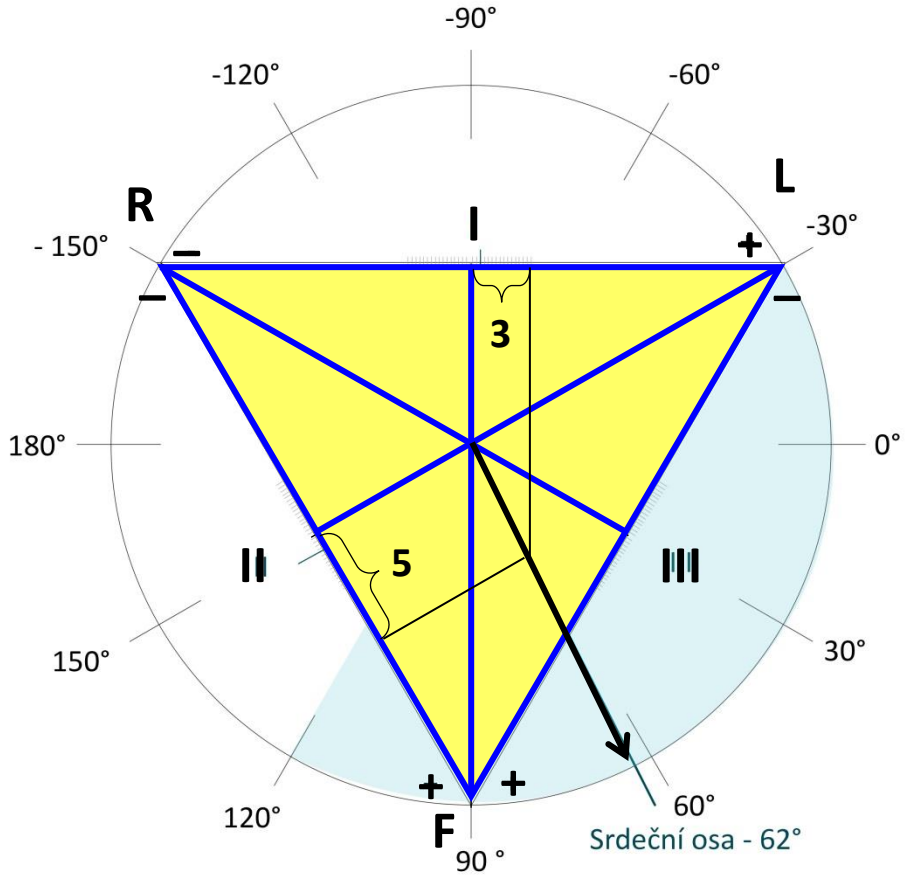
Average deviation of QRS complex in each lead

1. ORS of I,II and III lead

2. Sumation of QRS complex

I	II	III
Q = -1 R = 5 S = -1	Q = - 1 R = 6 S = 0	Q = 0 R = 4 S = 0
3	5	4

3. Drawing in triangle

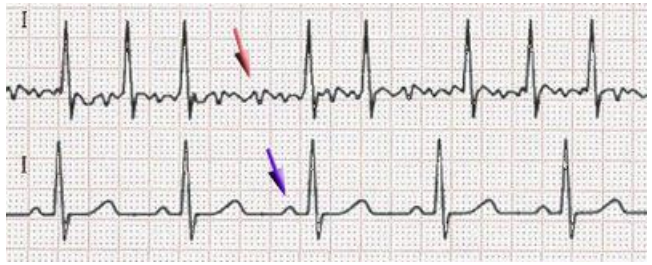


Physiological interval: -30° - 110°

Diagnostic use of ECG

Arrhytmia: irregular heartbeat

Fibrillation: is the rapid, irregular, and unsynchronized activity of cardiac muscle fibers



fibrillation

normal

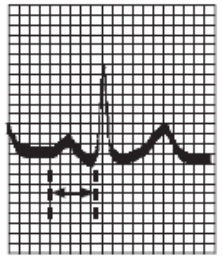
Atrial fibrillation

(absence of P, „jagged“ isolinia, irregular RR, HR 80 – 180 bpm)

Ventricular fibrillation

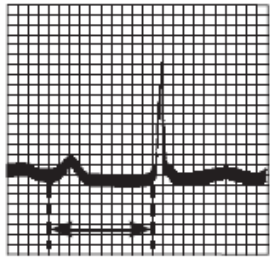
(heart cannot pump, brain damage after 3 – 5 min)

Atrioventricular block: conduction between the atria and ventricles of the heart is impaired



PR = 0.16 s

Normal complex

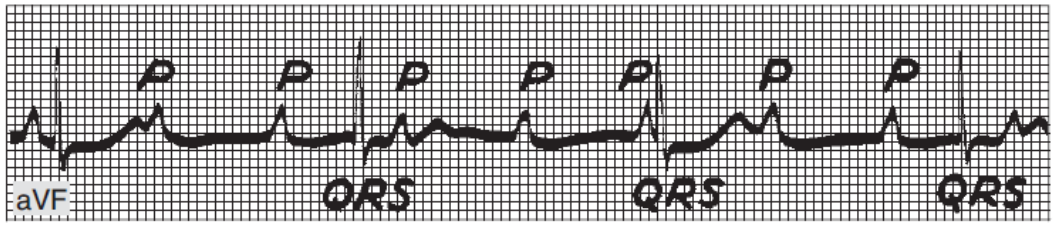


PR = 0.38 s

AV block I. degree

AV block II. degree

AV block III. degree

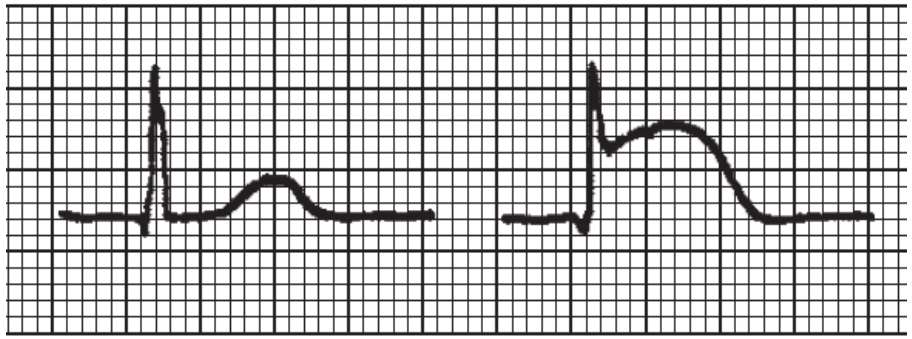


Complete heart block. Atrial rate, 107; ventricular rate, 43

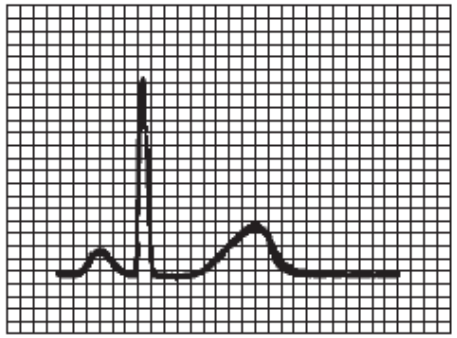
Diagnostic use of ECG

Myocardial ischemia, heart-attack

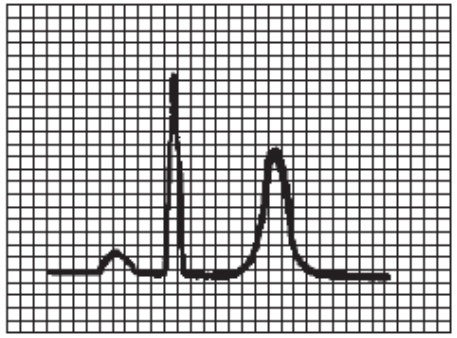
A B (ST elevation)



hyperkalaemia



Normal tracing (plasma K^+ 4–5.5 meq/L).



Hyperkalemia (plasma K^+ ±7.0 meq/L).

Diagnostic use of ECG

24-hour monitoring of ECG (Holter)