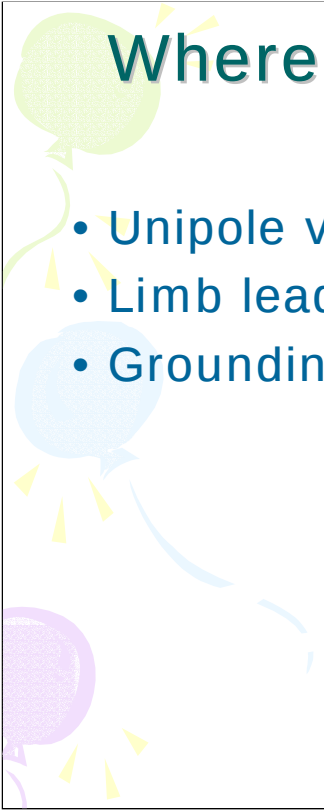




ECG

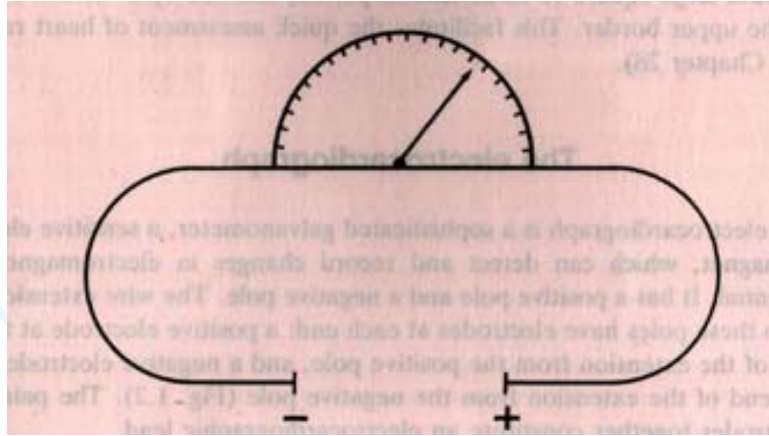
From cell to bedside



Where are the leads come from?

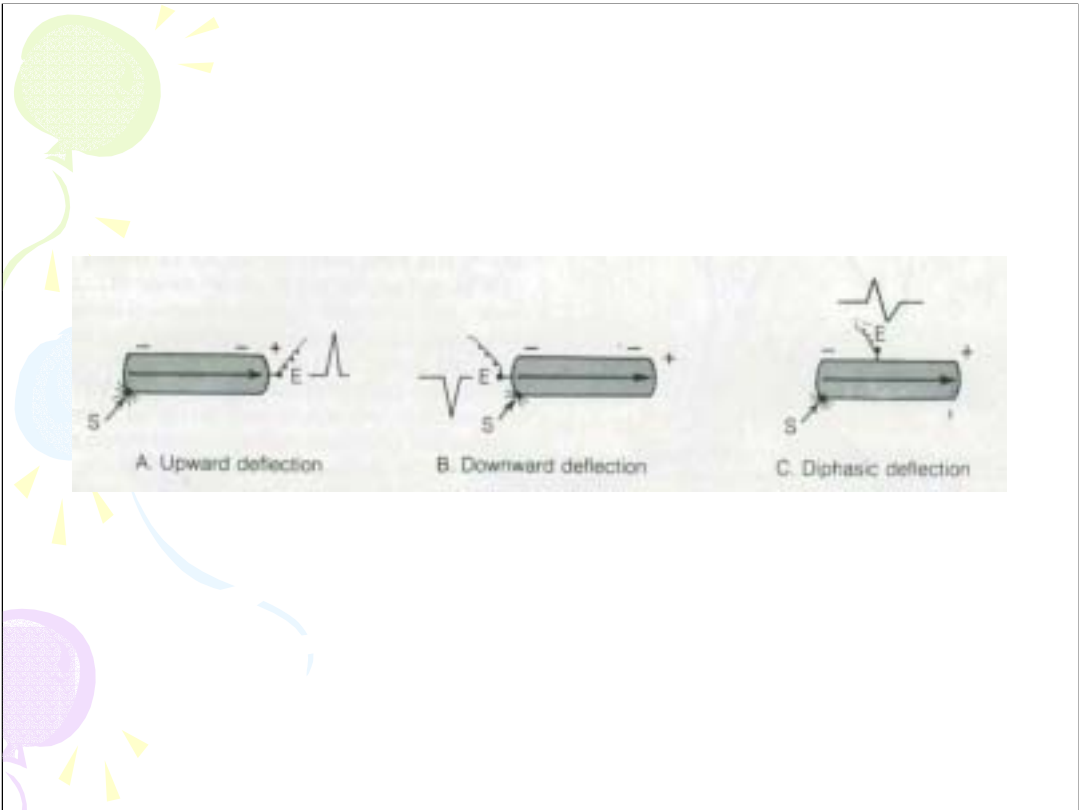
- Unipole vs Bipole
- Limb leads vs a Leads vs V leads
- Grounding vs central terminal

As simple as this



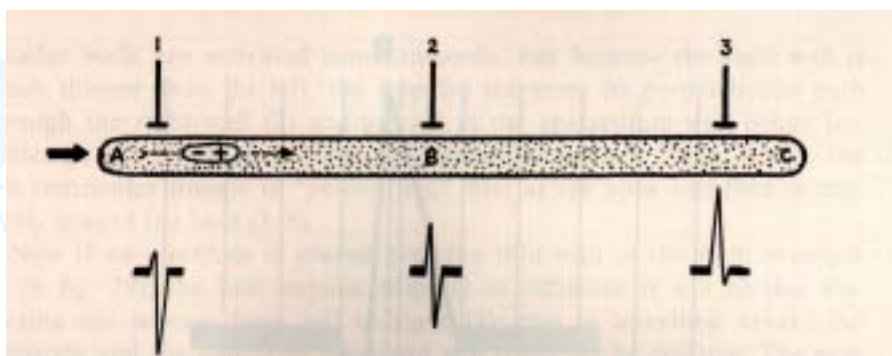
Italian Anatomist Luigi Galvani notes that a dissected frog's leg twitches when touched with a metal scalpel. "I had dissected and prepared a frog in the usual way and while I was attending to something else I laid it on a table on which stood an electrical machine at some distance from its conductor and separated from it by a considerable space. Now when one of the persons present touched accidentally and lightly the inner crural nerves of the frog with the point of a scalpel, all the muscles of the legs seemed to contract again and again as if they were affected by powerful cramps."

He later showed that direct contact with the electrical generator or the ground through an electrical conductor would lead to a muscle contraction. Galvani also used brass hooks that attached to the frog's spinal cord and were suspended from an iron railing in a part of his garden. He noticed that the frogs' legs twitched during lightening storms and also when the weather was fine. He interpreted these results in terms of "animal electricity" or the preservation in the animal of "nerveo-electrical fluid" similar to that of an electric eel. Galvani's name is given to the 'galvanometer' which is an instrument for measuring (and recording) electricity - this is essentially what an ECG is; a sensitive galvanometer.



This is convention. No one can argue against these.

Genesis



ABC is a piece of muscle

A dipole travels from A to C

1,2,3 are three +ve pole put at point A, B, C of the muscle

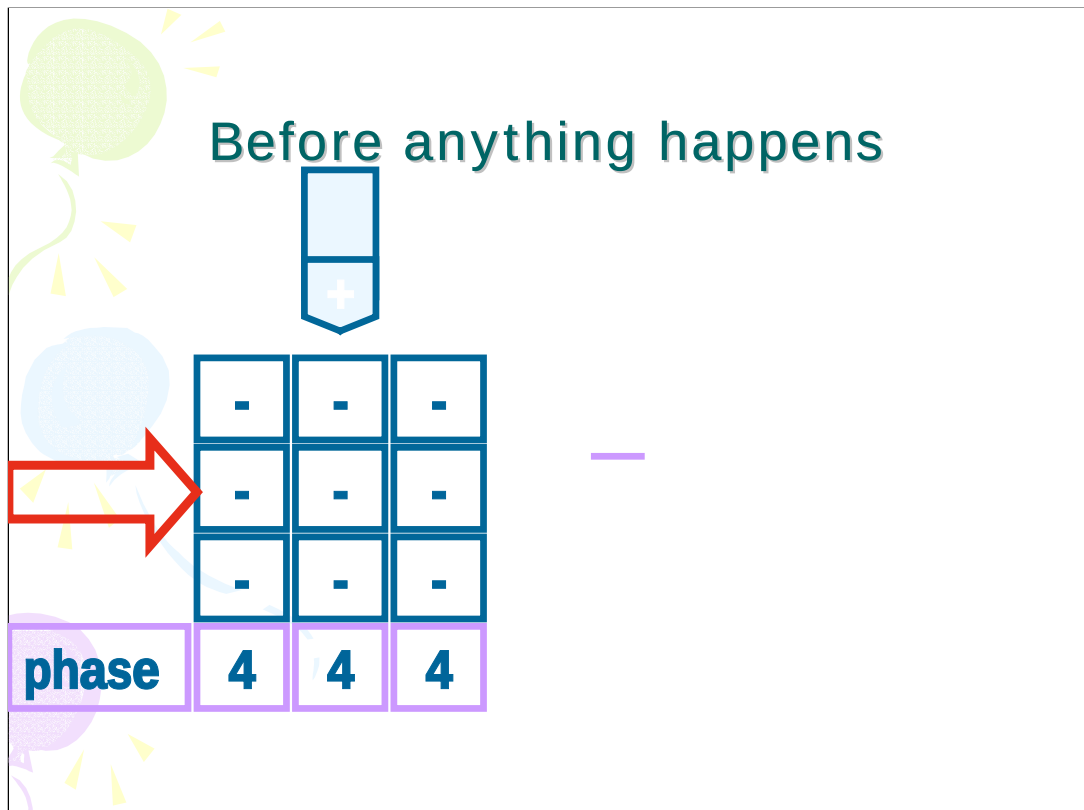
At point A, since most of the time it is facing the -ve pole, the electrode will record a predominantly -ve complex

At point B, the dipole is travel toward it half the time and away from it during the remaining half of the same period of the time. So, the complex is equiphasic (or isoelectric – see appendix of the Notes on ECG for the difference)

At point C, the dipole is travel toward it all the time, so it will record a predominantly +ve complexes.

In clinical terms

- Q wave implies origin of the depolarization
- Equiphasic/Isoelectric QRS implies the electrode is perpendicular to the depolarization wavefront
- R wave implies viable, at least electrically, myocardium underneath.



If slide 6 to 15 is too difficult to you, forget about them. They will not affect your clinical practice.

+VE IS COMMING



+	-	-
+	-	-
+	-	-

phase

0

4

4

+ve under your feet



+	+	-
+	+	-
+	+	-

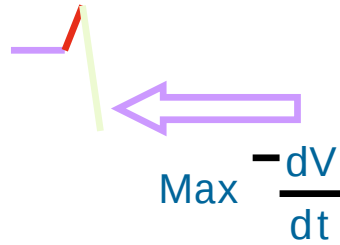


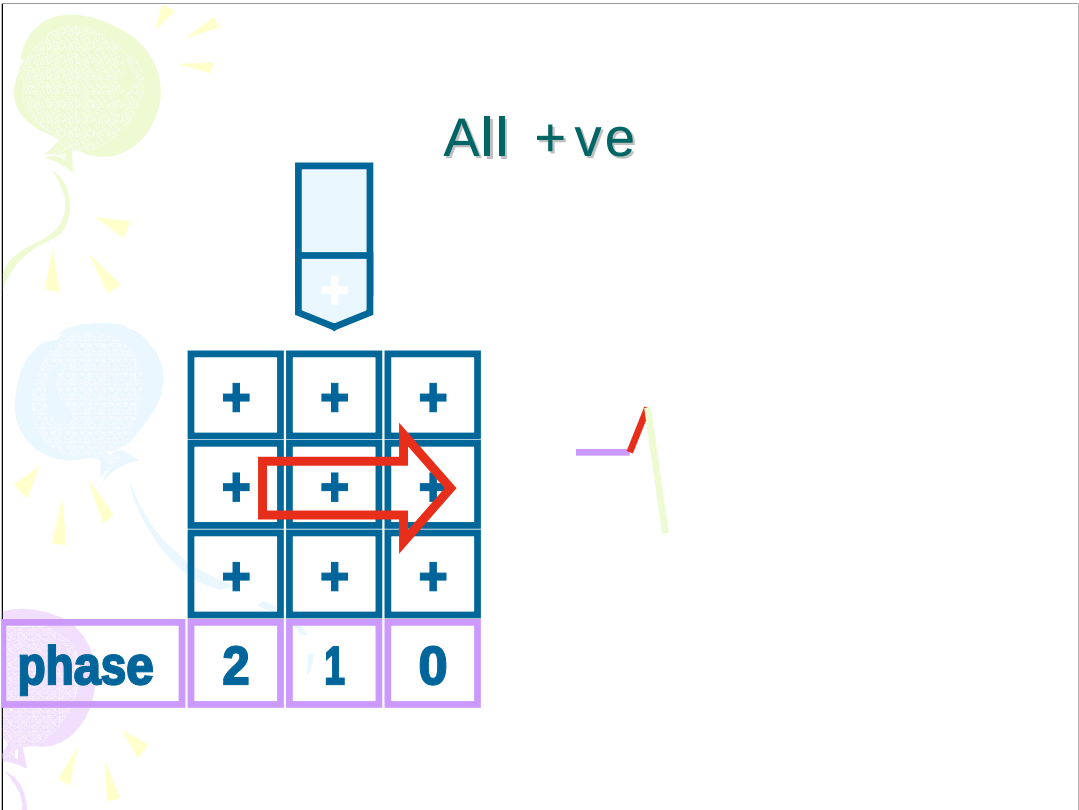
phase

1

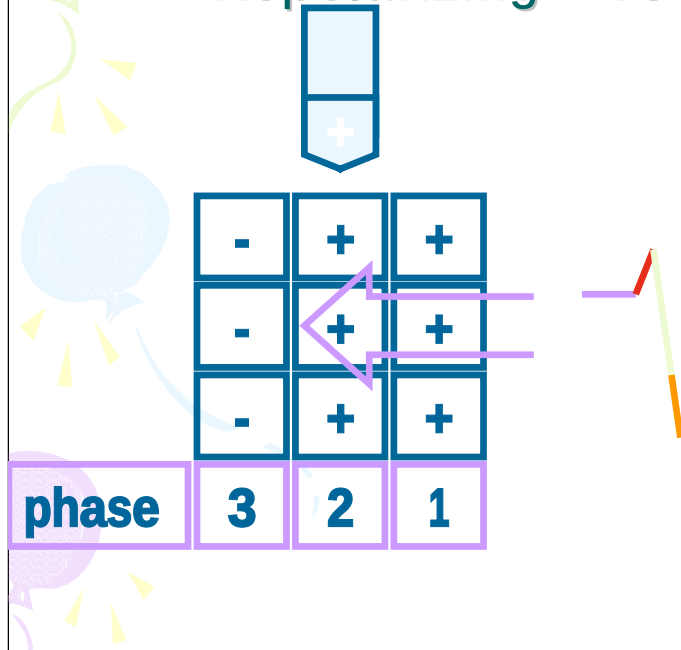
0

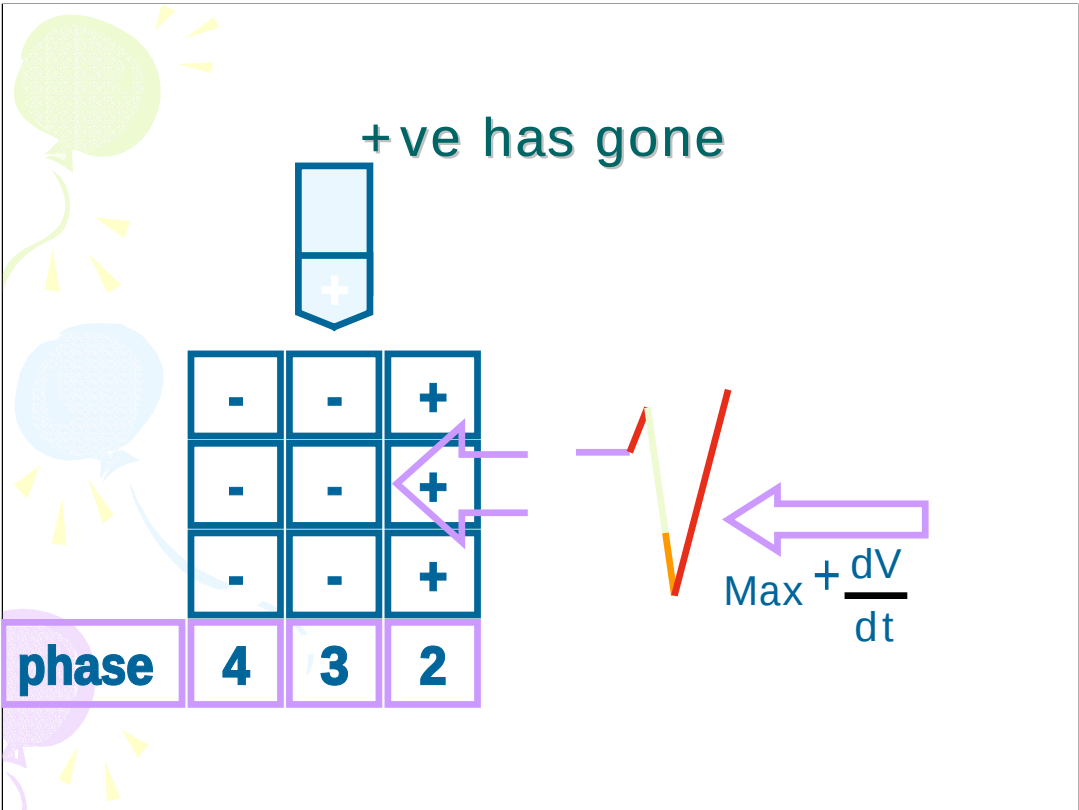
4



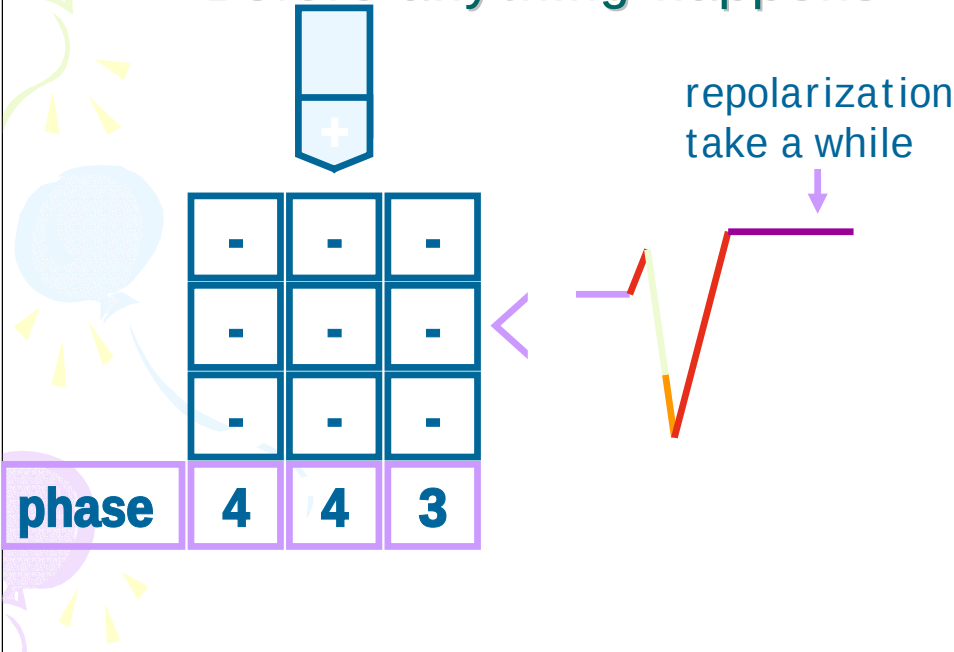


Repolarizing +ve coming





Before anything happens

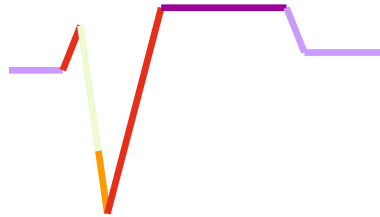


Back to square 1

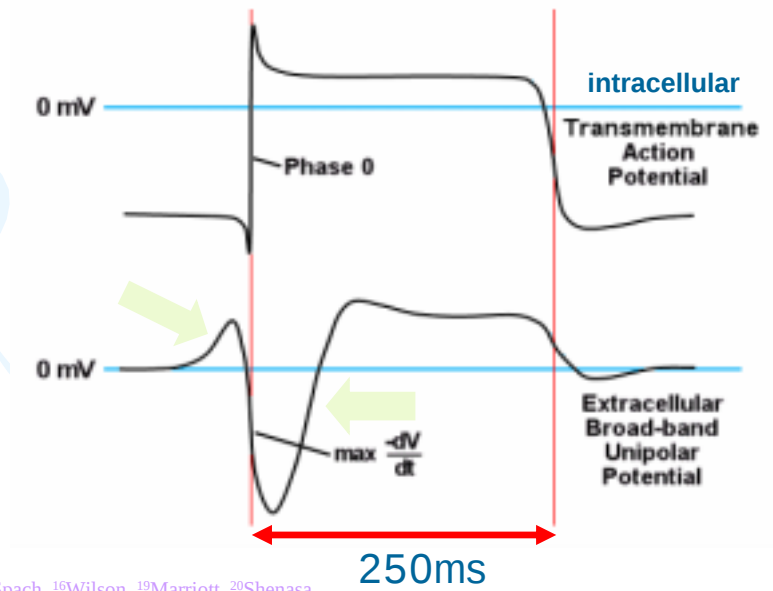


-	-	-
-	-	-
-	-	-

phase	4	4	4
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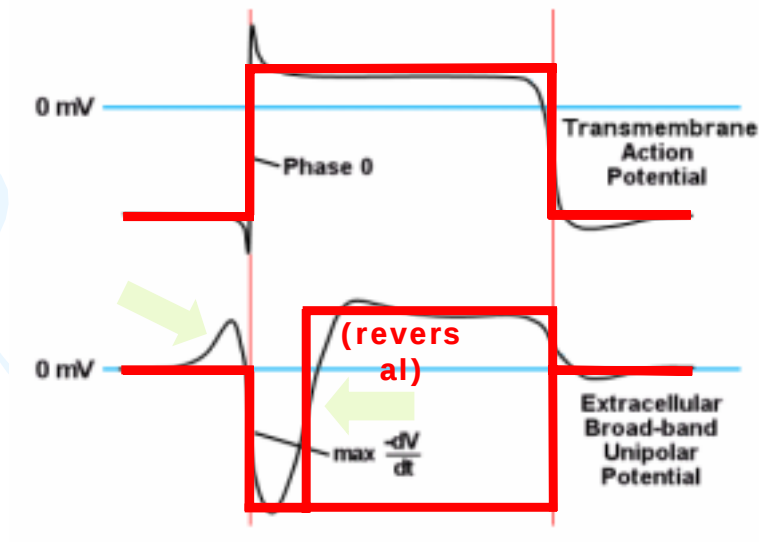
Unipolar



¹⁴Levine, ¹⁵Spach, ¹⁶Wilson, ¹⁹Marriott, ²⁰Shenasa

250ms

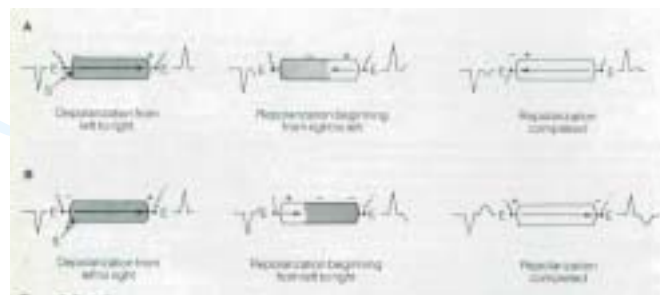
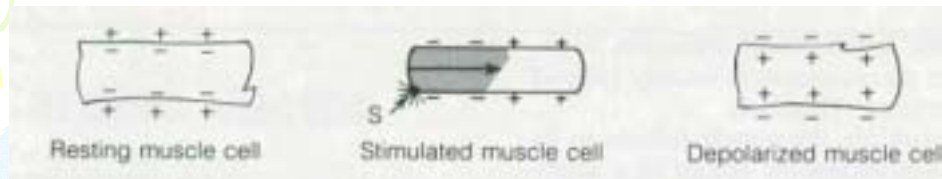
Unipolar



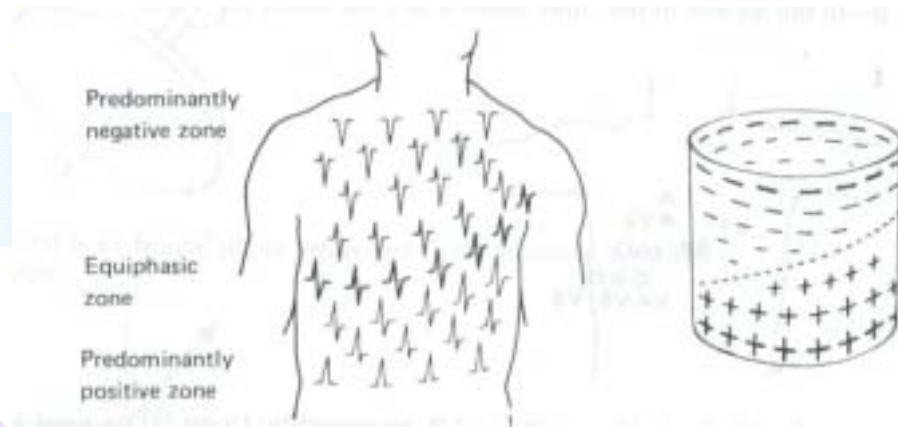
¹⁴Levine, ¹⁵Spach, ¹⁶Wilson, ¹⁹Marriott, ²⁰Shenasa

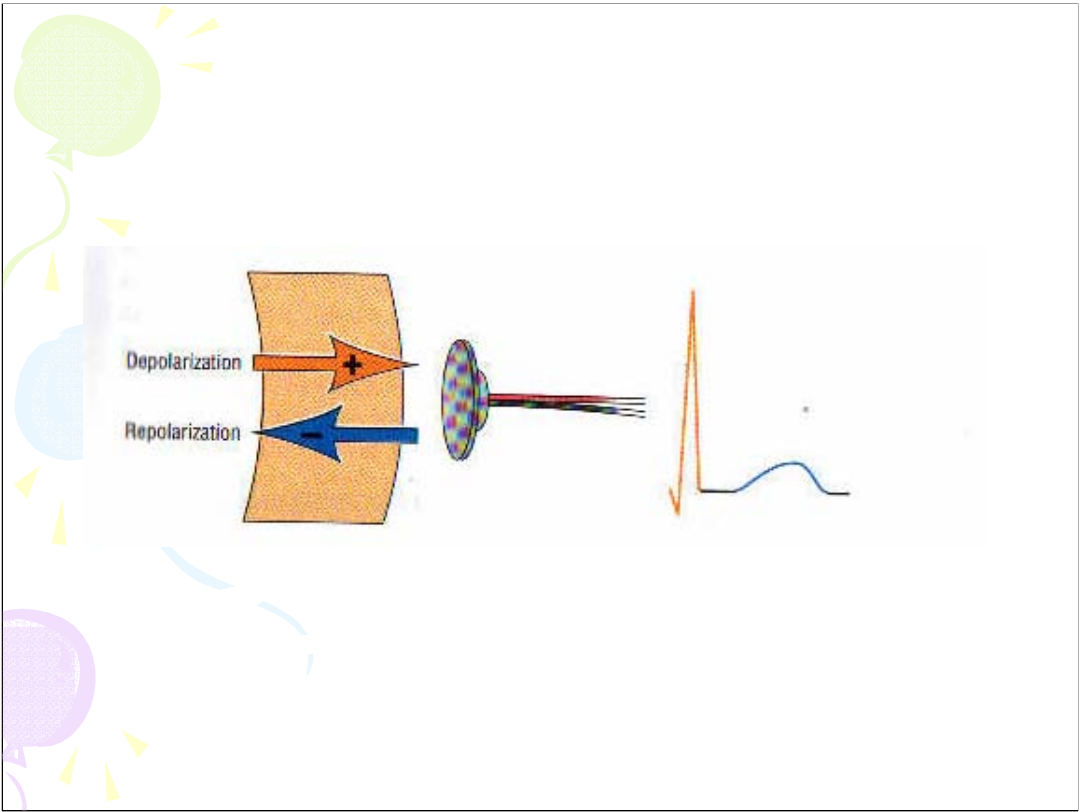
Page
Down

Dipole therapy

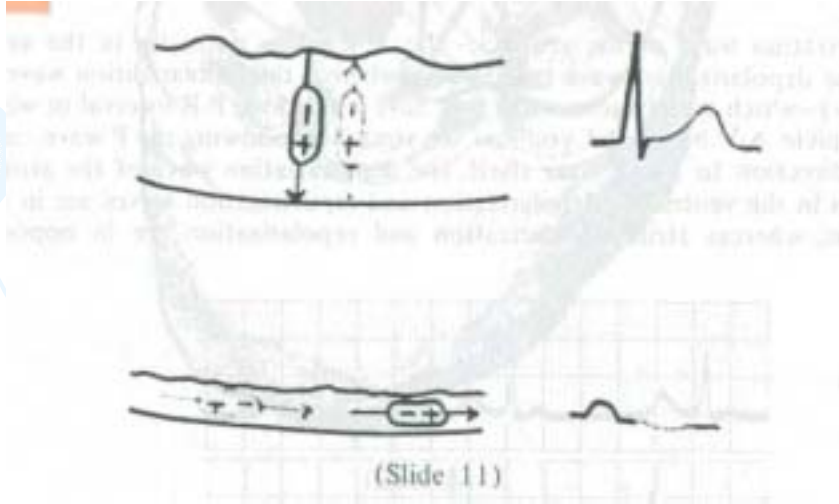


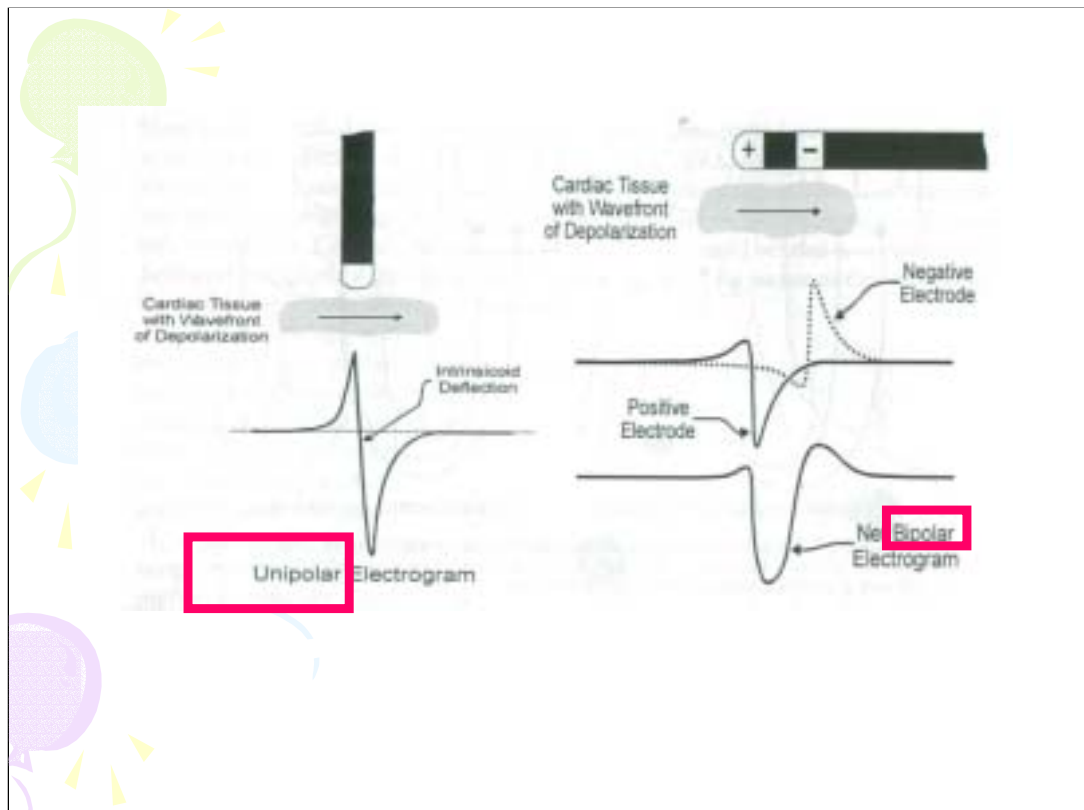
Louis Vutton





$$A \neq V$$





THIS IS AN IMPORTANT SLIDE.

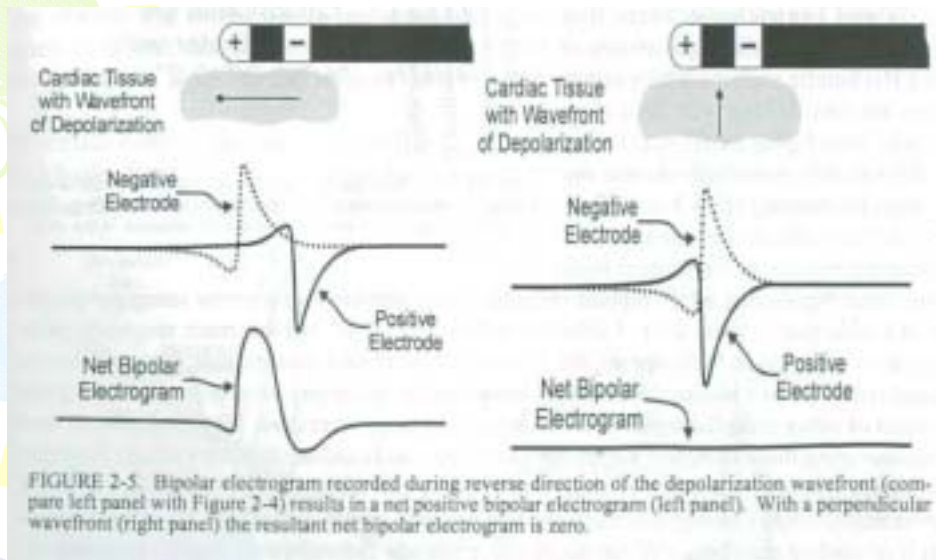
The left hand side is a unipolar electrogram. It simulate the slide 3 muscle at point B.

When the dipole travel right underneath the elctrode, the polarity suddenly change from +ve to -ve. This rapid transition from strong positive to strong negative demarks the intrinsicoid deflection.

Please note that in general, a unipolar electrogram is **directionally insensitive** because a local depolarization wavefront approaching the intracardiac unipolar electrode will, regardless of its orientation or direction, result in an initial positive deflection.

Bipolar electrogram is produced by electronically summing the signals from the positive and negative electrodes. The signal from the second negative electrode will be inverted and delayed compared to the first.

The peak negative or positive deflection is the time of local activation when the depolarization wavefront passes immediately beneath the midpoint of the bipolar pair.



Unlike unipolar recordings, bipolar recordings are **directionally sensitive**.

A bipolar signal has a net negative deflection when the wavefront is travel away from the positive electrode.

Conversely, a net positive deflection means the wavefront is travel toward the positive electrode.

If the wavefront travel perpendicular to the bipolar pair, both electrodes will record the same amplitude signal but with reverse polarity resulting in a net zero bipolar signal (true isoelectric).