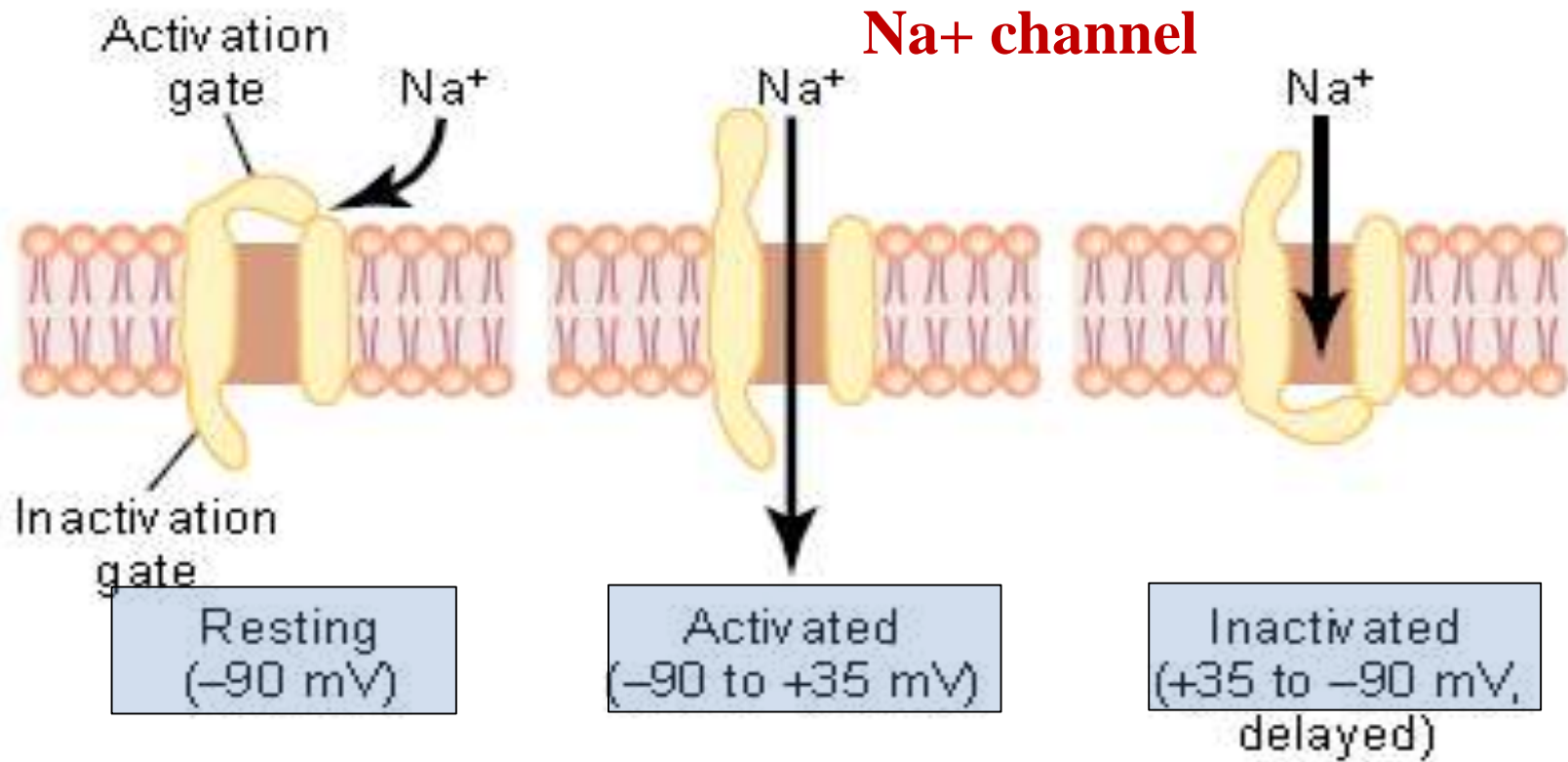
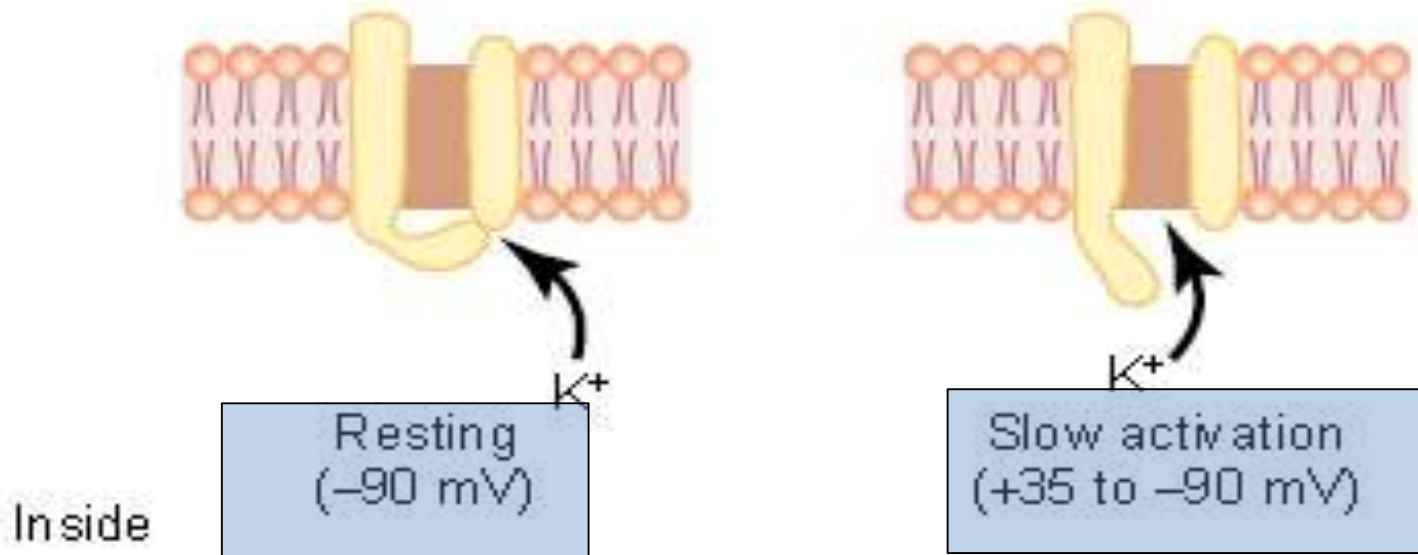


Action potential

Na⁺ channel



K⁺ channel



DEFINITION OF AP

- **SYNONYMS: Nerve Impulse**
- **The brief sequence of changes which occur in the RMP of excitable tissue following a threshold stimulus**

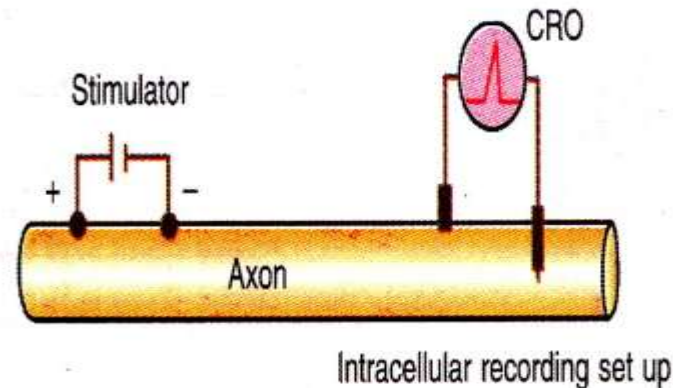
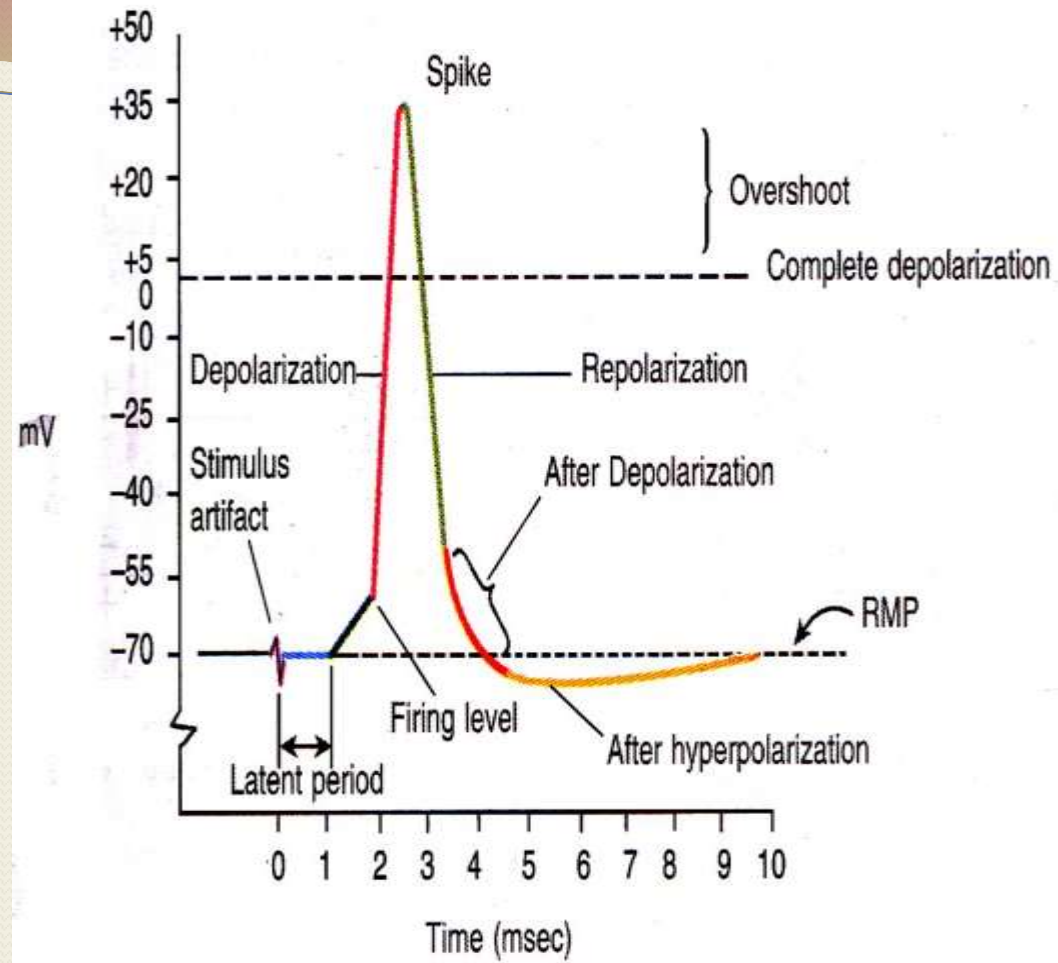
Action potential of a NERVE

- **Stimulus artifact**
- **Latent period**
- **PHASE OF DEPOLARIZATION**
 - Slow
 - Rapid
- **PHASE OF REPOLARIZATION**
 - Rapid
 - Slow
- **PHASE OF AFTER HYPERPOLARIZATION**

Phases:

□ Stimulus artifact:

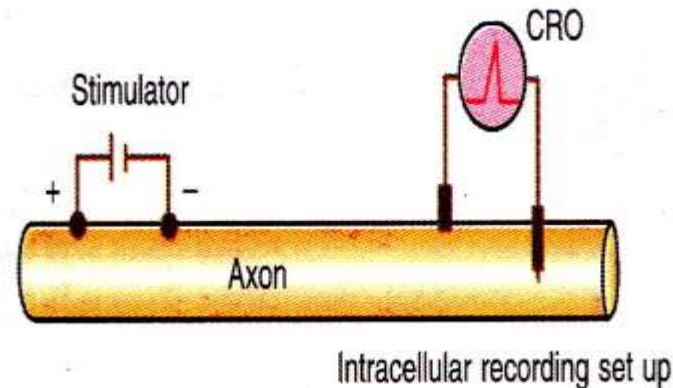
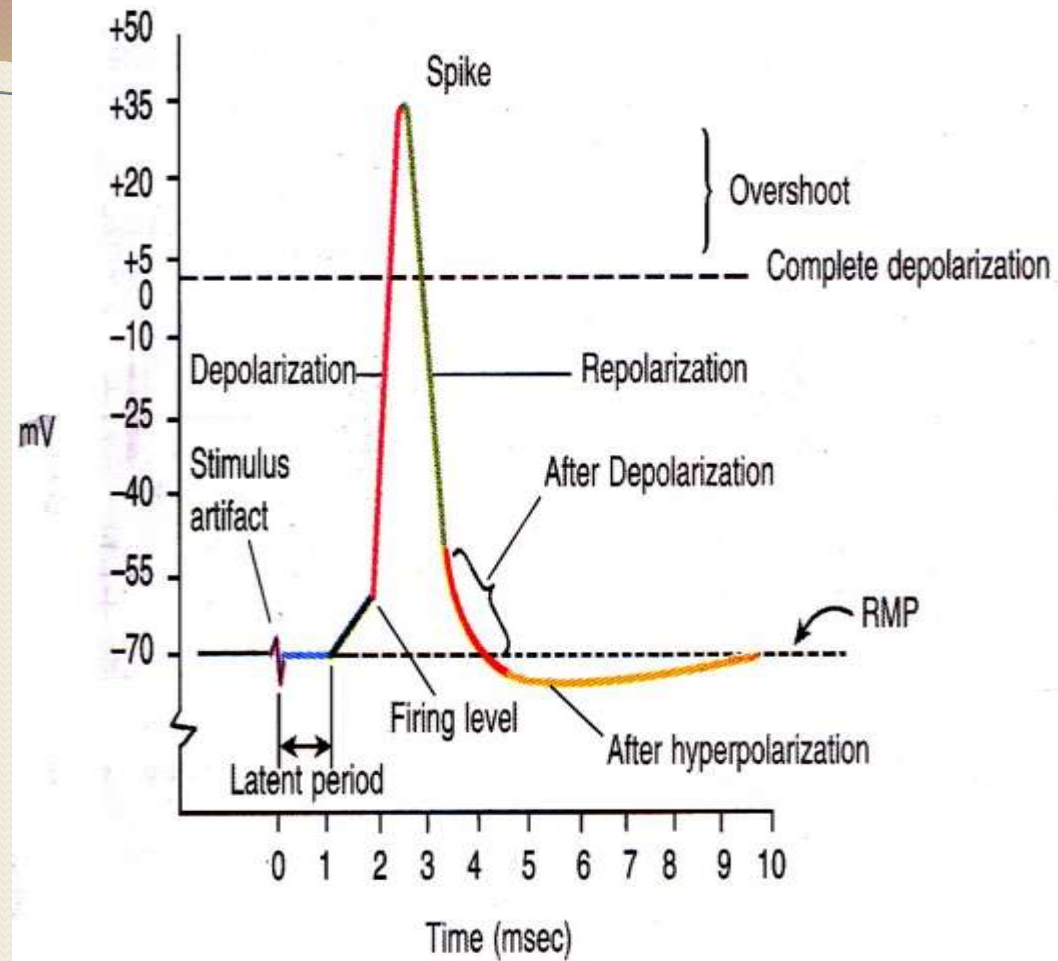
- Brief irregular deflection of the base line



Phases:

□ Latent period:

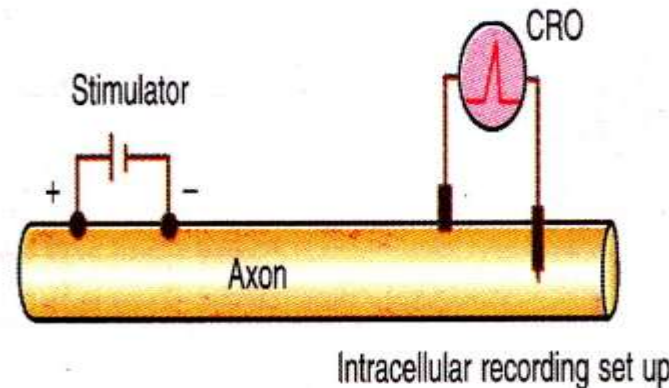
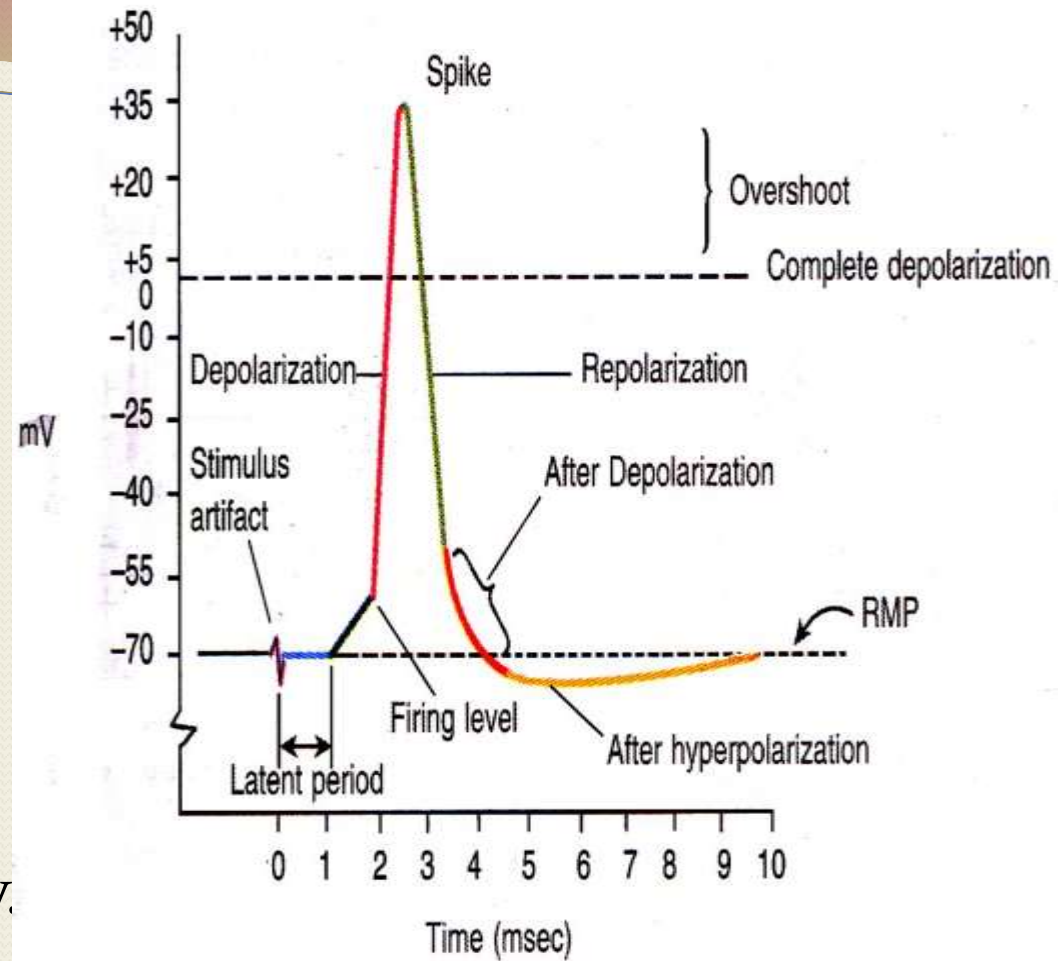
- It is an isopotential interval



Phases:

□ Depolarisation:

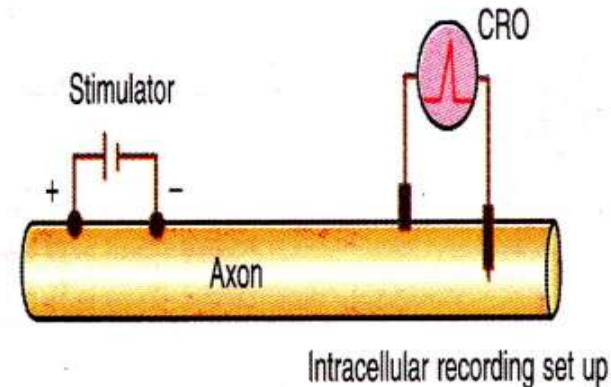
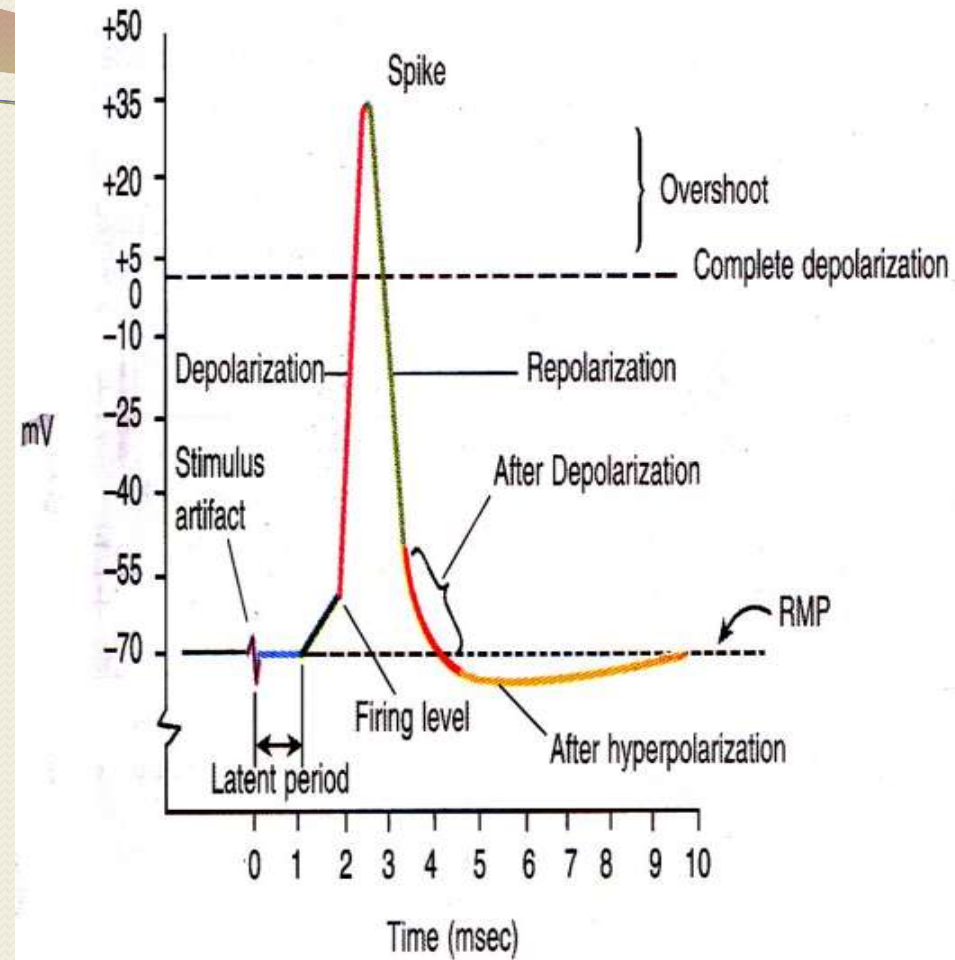
- Reversal of polarity
- Change in the membrane Potential
- Negativity → positivity.
- Slow:
- Rapid:



Phases:

□ Firing level/threshold potential:

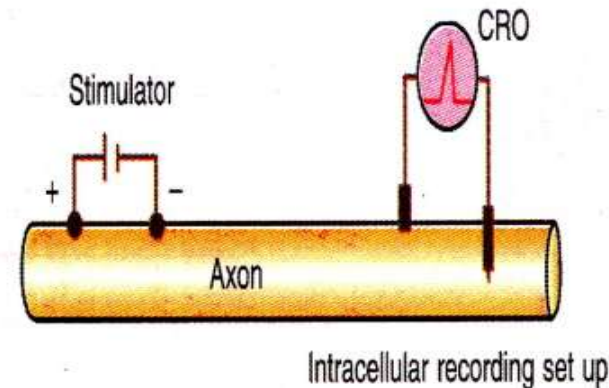
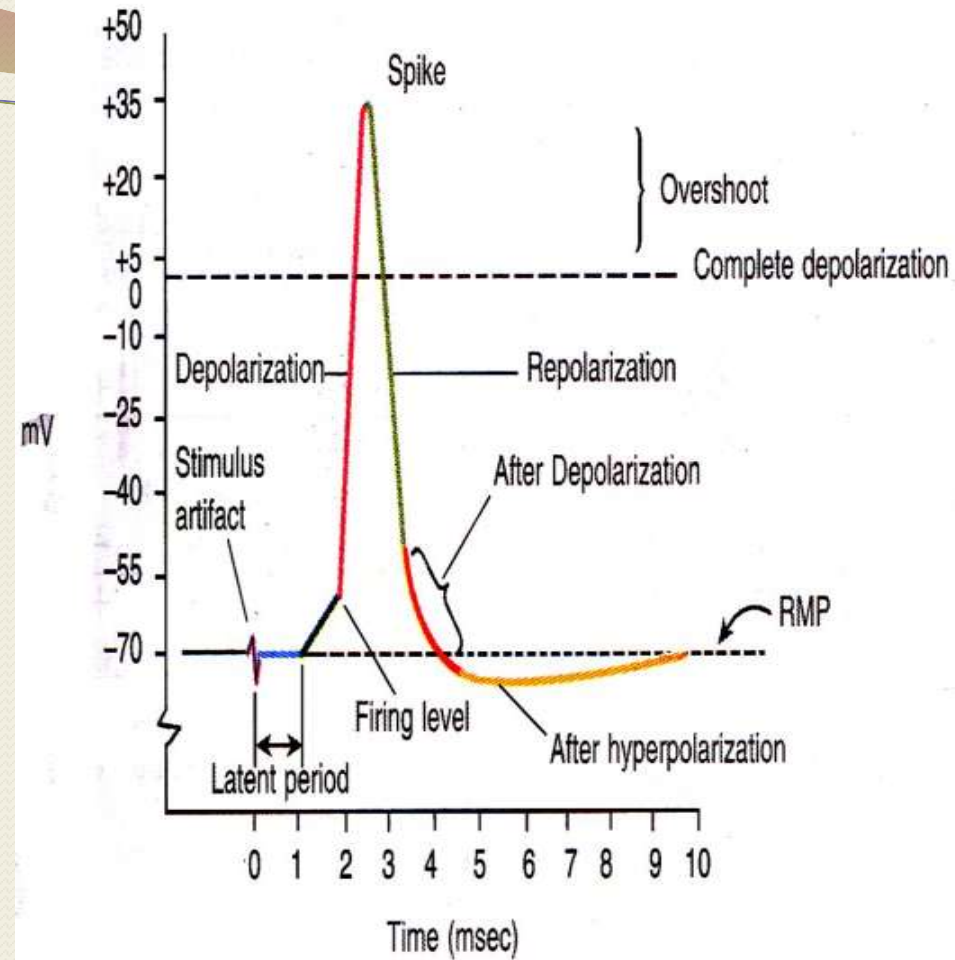
- The point at which rate of depolarization increases is called firing level



Phases:

□ Repolarization:

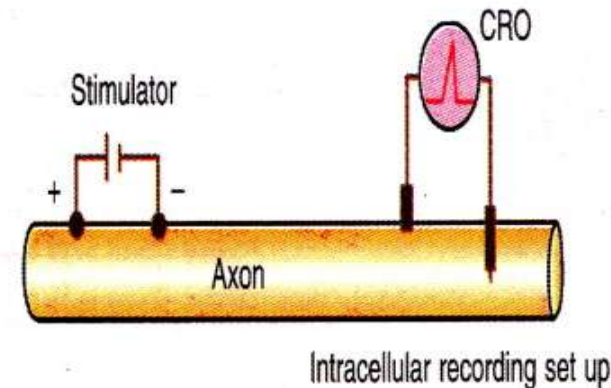
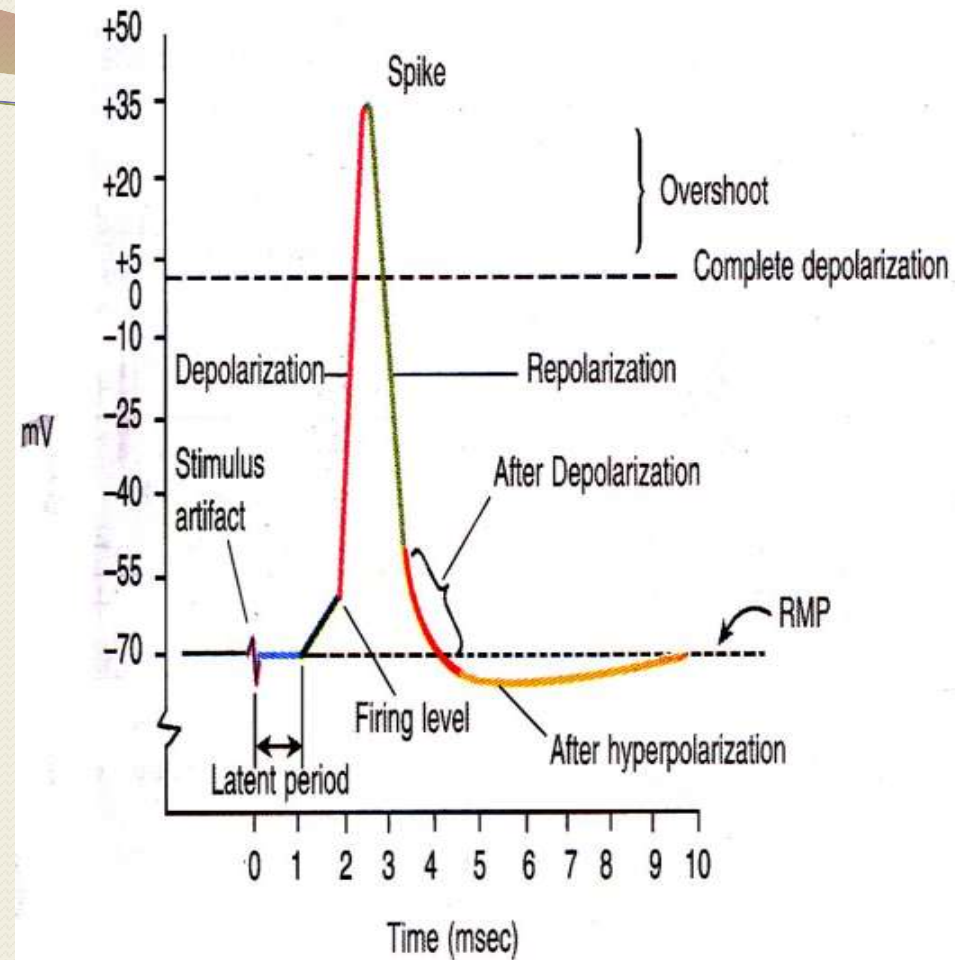
- Towards polarity
- Restoration of membrane potential
- Rapid:
- Slow /after depolarization:



Phases:

□ After hyperpolarization:

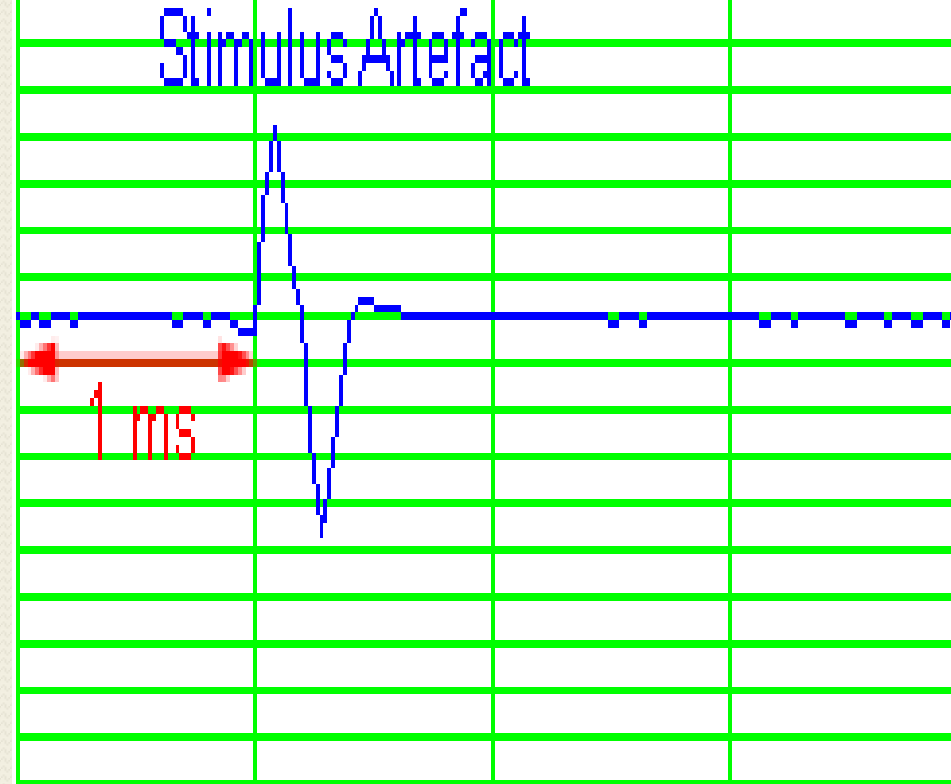
- Increase in polarity
- Increase in negativity beyond the resting level



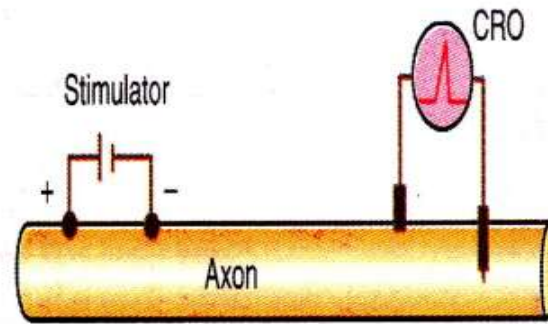
Ionic basis of A.P

□ Stimulus artifact

- Current leakage from stimulating electrode to recording electrode
- Significance: Point of stimulus



Time (msec)

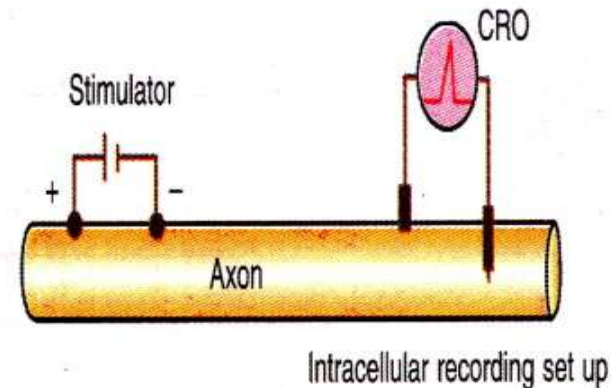
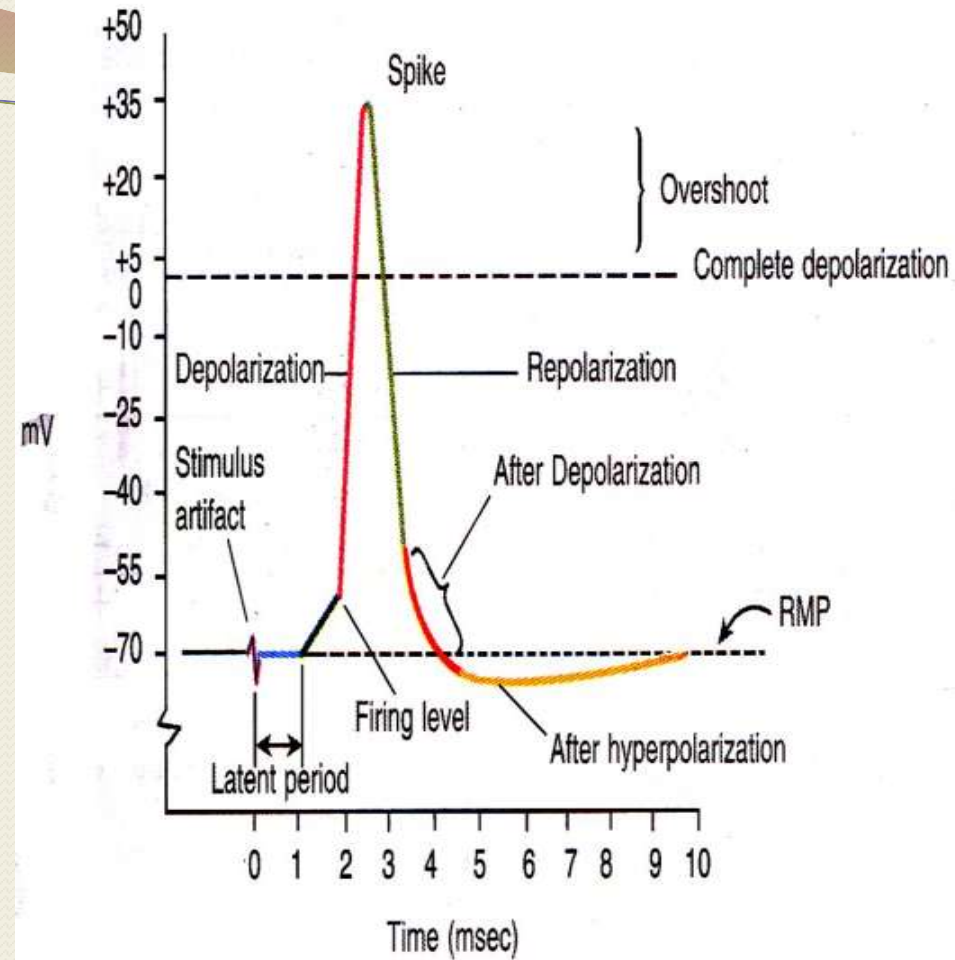


Intracellular recording set up

Ionic basis of A.P

□ Latent period/isoelectric period:

- It is the time taken by the impulse to travel from stimulating electrode to recording electrode.



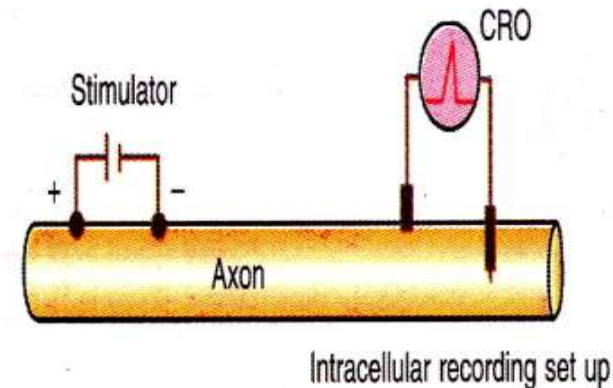
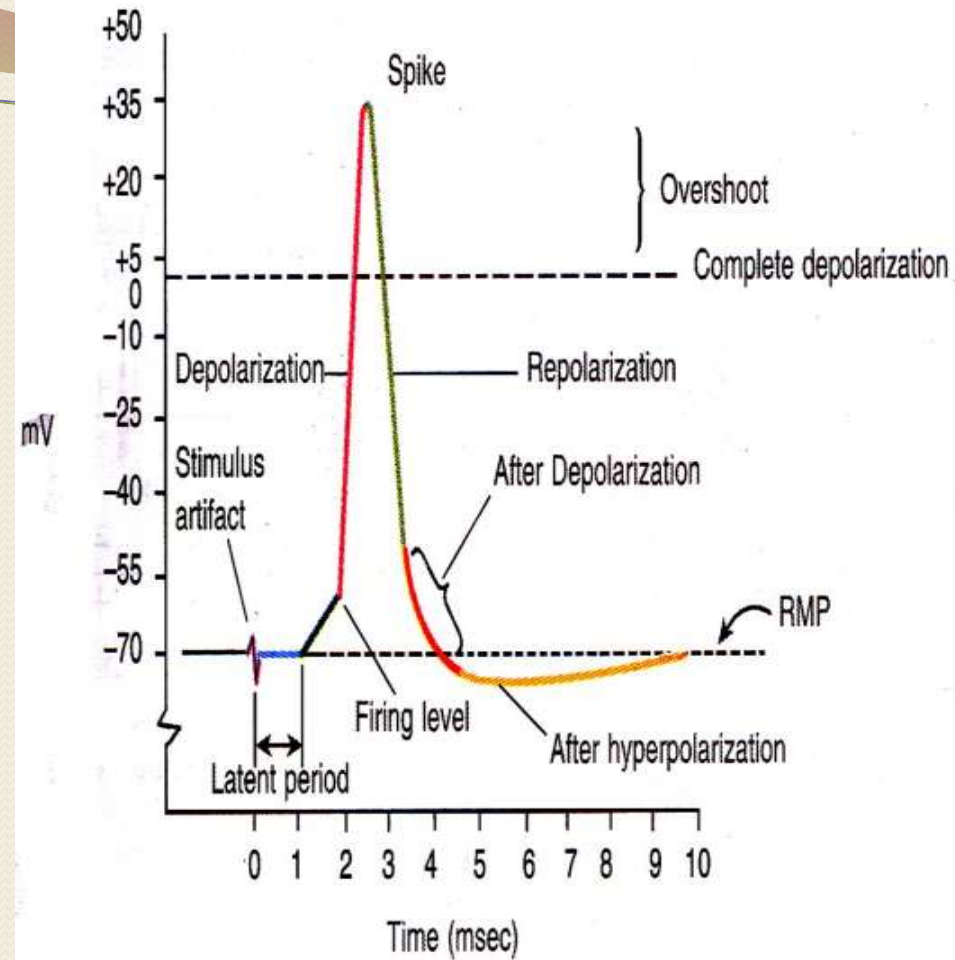
Ionic basis of A.P

□ Latent period/isoelectric period:

- Significance:

Latent period α

- ✓ Distance between stimulating & recording electrode
- ✓ Speed of conduction in the axon



Resting neuron

RMP = -70mv



Stimulus



Opening of few voltage gated Na⁺ channels



Inflow of positively charged ions



Threshold potential



RMP altered



Slow depolarisation

RMP towards positivity



-70mv → -55mv



Threshold potential

-70mv → -55mv



Opening of large number
of voltage gated sodium channels

Rapid depolarisation



Overshoot

RMP ≥ 0mv



Spike potential

RMP = +35mv

Spike potential

RMP=+35mv

Sodium channels: inactivated
Potassium channels: open.

**Repolarisation
(Towards polarity)**

potassium channels: open.

RMP=-70mv

Slow closure of K⁺ channels



Hyperpolarisation



Closure of K⁺ channels
Activation of Na⁺-K⁺ pump

RMP beyond -70mv



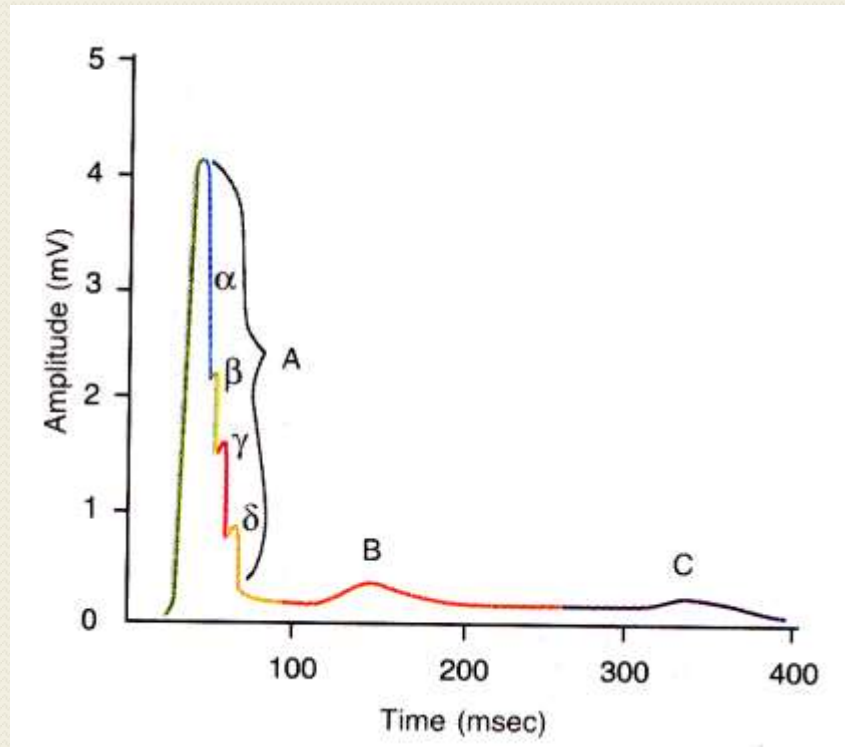
-72mv



RMP=-70mv

Compound action potential

- Multi-peaked action potential recorded from a mixed nerve bundle is called compound action potential.



Role of Ca^{2+} ions

- Ca ions binds to exterior surface of Na channel
- Positive charge of Ca^{2+} alter the electrical state of Na + channel
- It also alter the voltage level required to open the Na gate
- Hypocalcaemia: Na channel opened even at slight \uparrow in mem. Potential

CLINICAL ASPECT

- **Xylocaine :**
- blocks the opening of Na channel

- No depolarization

- No pain sensation

CLINICAL ASPECT

- Ovaries of puffer fish
- Tetrodotoxin
- Block sodium channels