SNS COLLEGE OF PHYSIOTHERAPY

Affiliated To The Tamil Nadu Dr. MGR Medical University, Chennai
Coimbatore– 641035

COURSE NAME: ELECTROTHERAPHY I

SUBJECT CODE: 6281

TOPIC: BASIC CONCEPTS IN ELECTRICAL STIMULATION

Introduction

- Electrical stimulation affects nerve and muscle cells
- Based on electrical properties of cell membranes
- Resting membrane potential and action potential are key concepts
- Essential for understanding electrotherapy

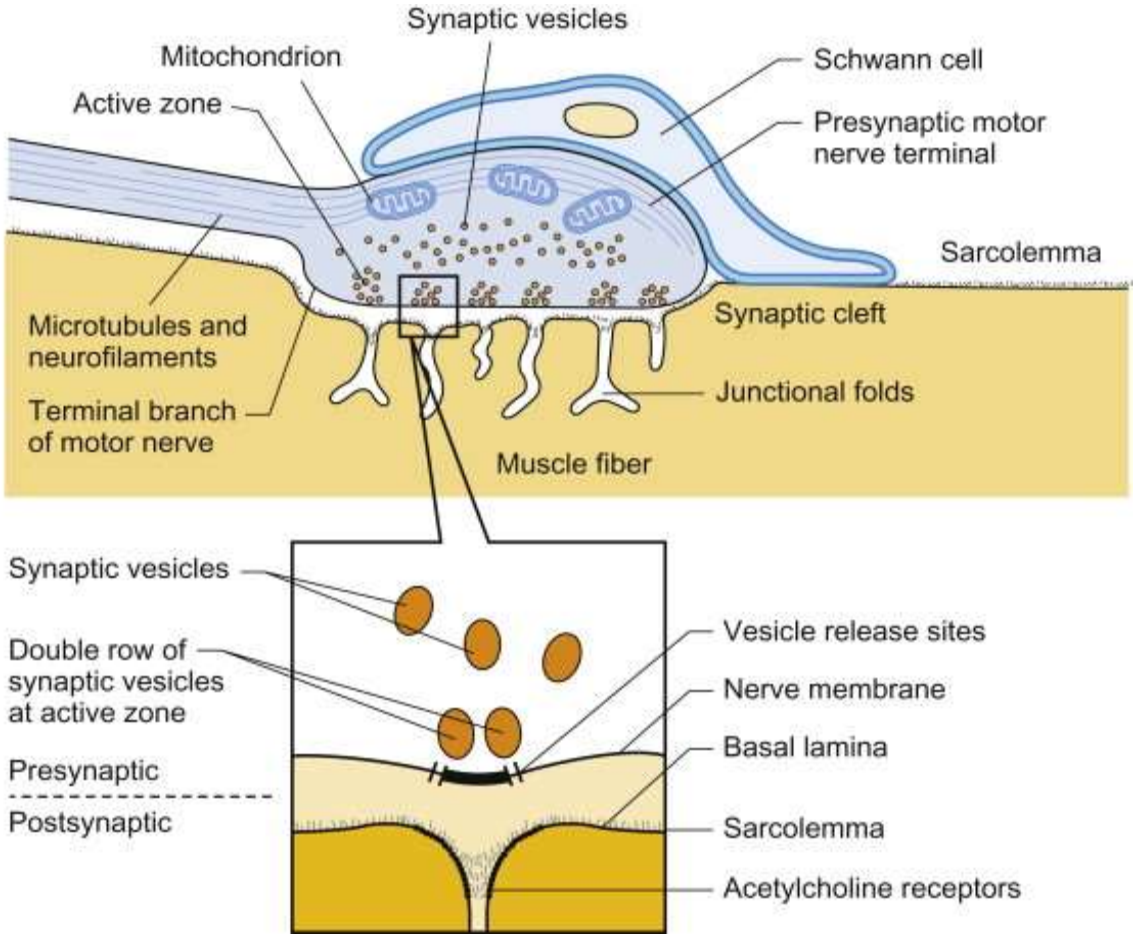
Excitable Tissues

Nerves and muscles are excitable tissues

Respond to electrical and chemical stimuli

Ability to generate electrical impulses

Basis for therapeutic electrical stimulation



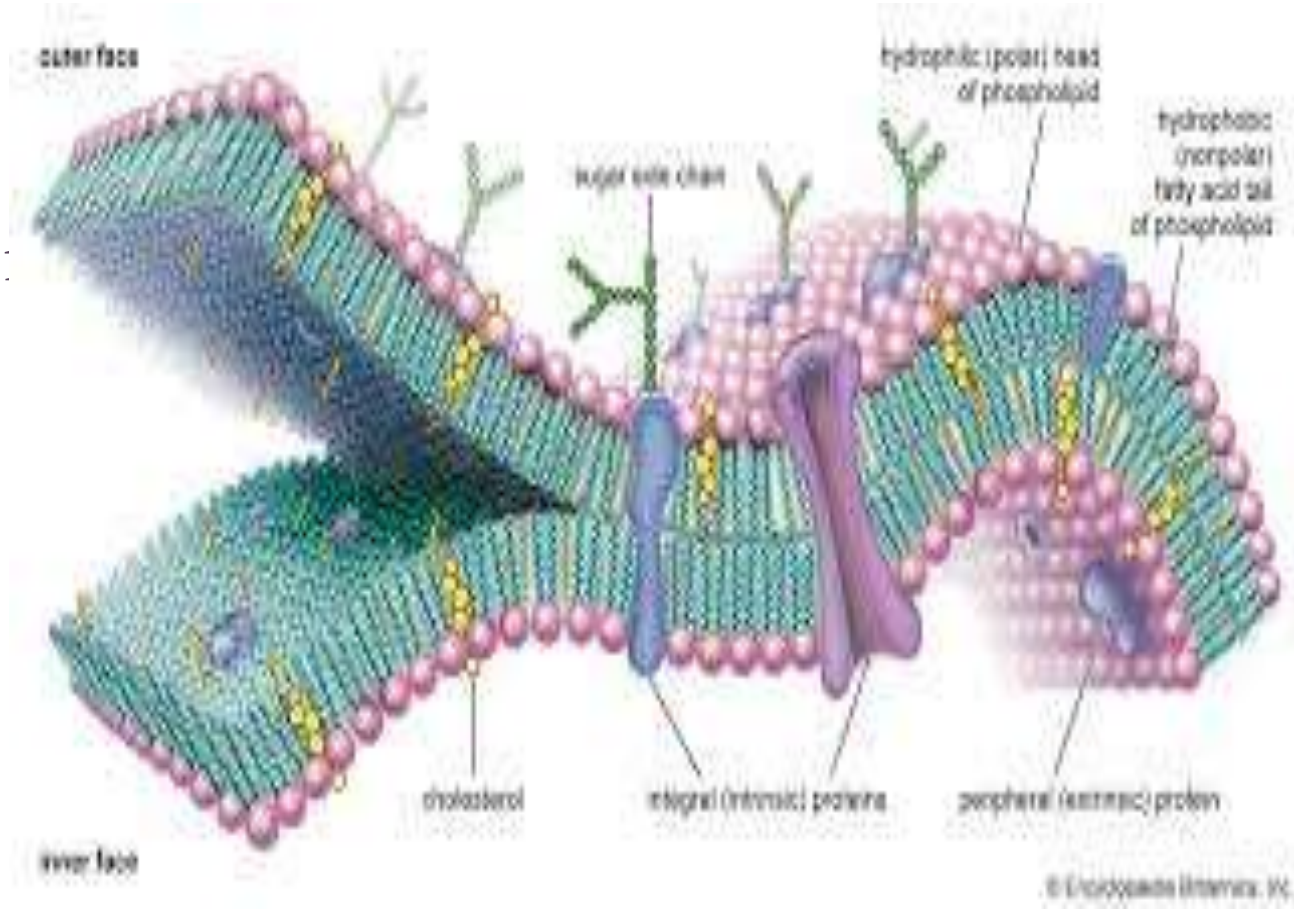
Cell Membrane Structure

Cell membrane is semi-permeable

Separates intracellular and extracellular

Contains ion channels and pumps

Maintains electrical potential difference



Ions Involved in Electrical Activity

Sodium (Na^+)

Potassium (K^+)

Calcium (Ca^{2+})

Chloride (Cl^-)

Unequal distribution creates electrical charge

Resting Membrane Potential (RMP)

Electrical potential difference across cell membrane at rest

Inside of cell is negative compared to outside

Normal value ≈ –70 mV (nerve)

Maintained by ion distribution

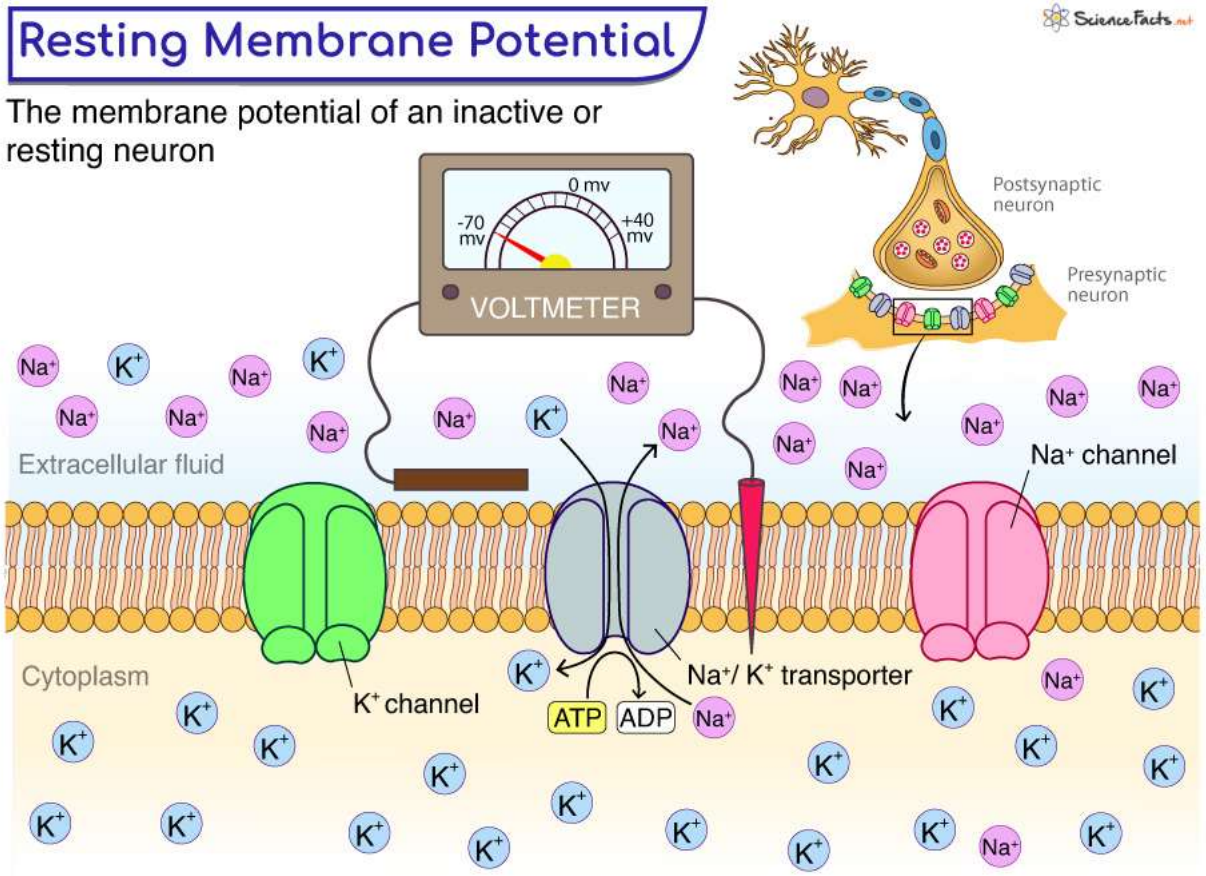
Causes of Resting Membrane Potential

Unequal ion concentration

Selective permeability of membrane

Sodium-Potassium pump

Leakage of potassium ions



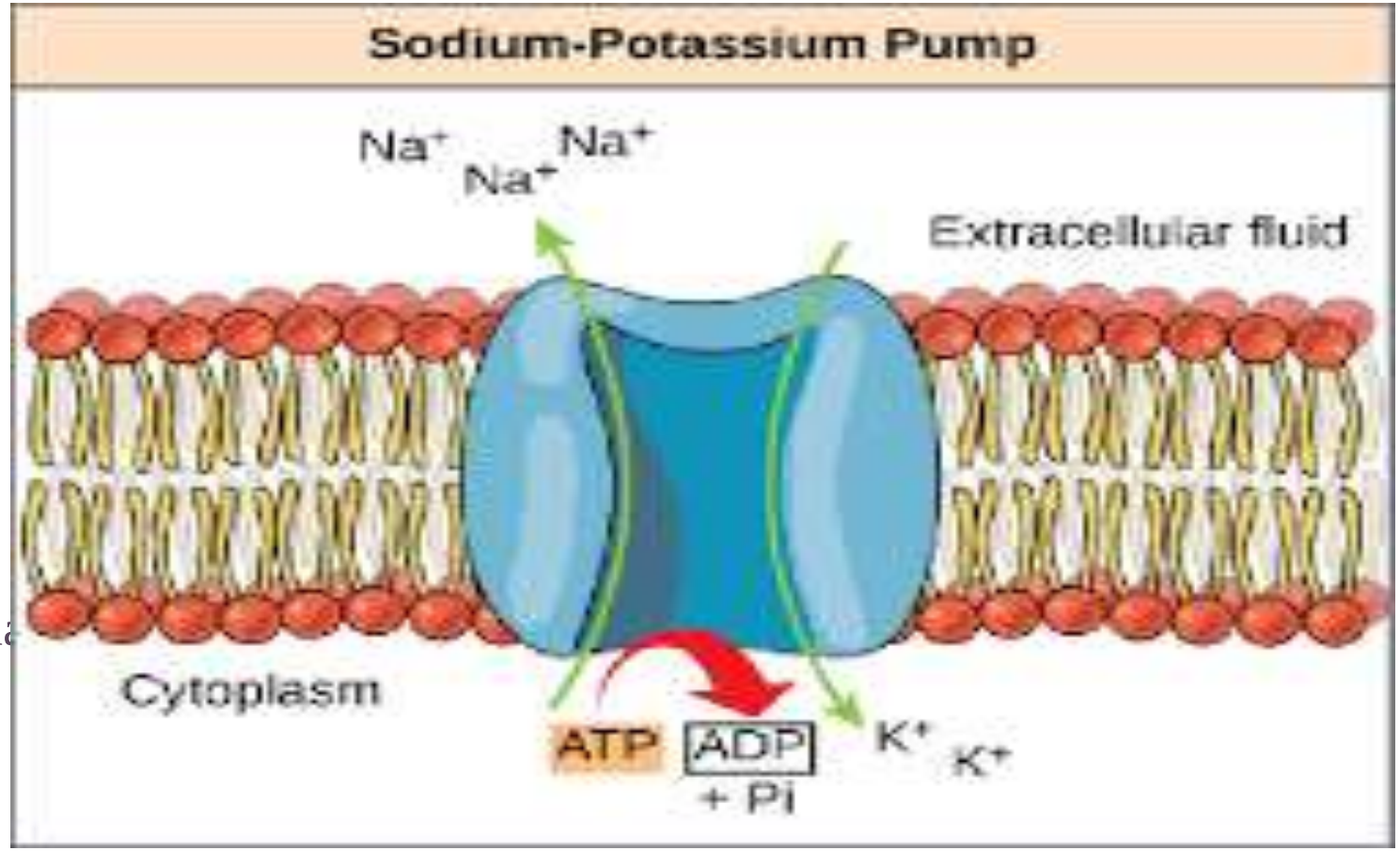
Sodium-Potassium Pump

Actively transports ions across membrane

Pumps 3 Na^+ out and 2 K^+ in

Requires ATP energy

Maintains resting membrane potentia



Importance of Resting Membrane Potential

- Keeps cell ready to respond to stimulus
- Essential for nerve conduction
- Necessary for muscle contraction
- Loss of RMP leads to cell dysfunction

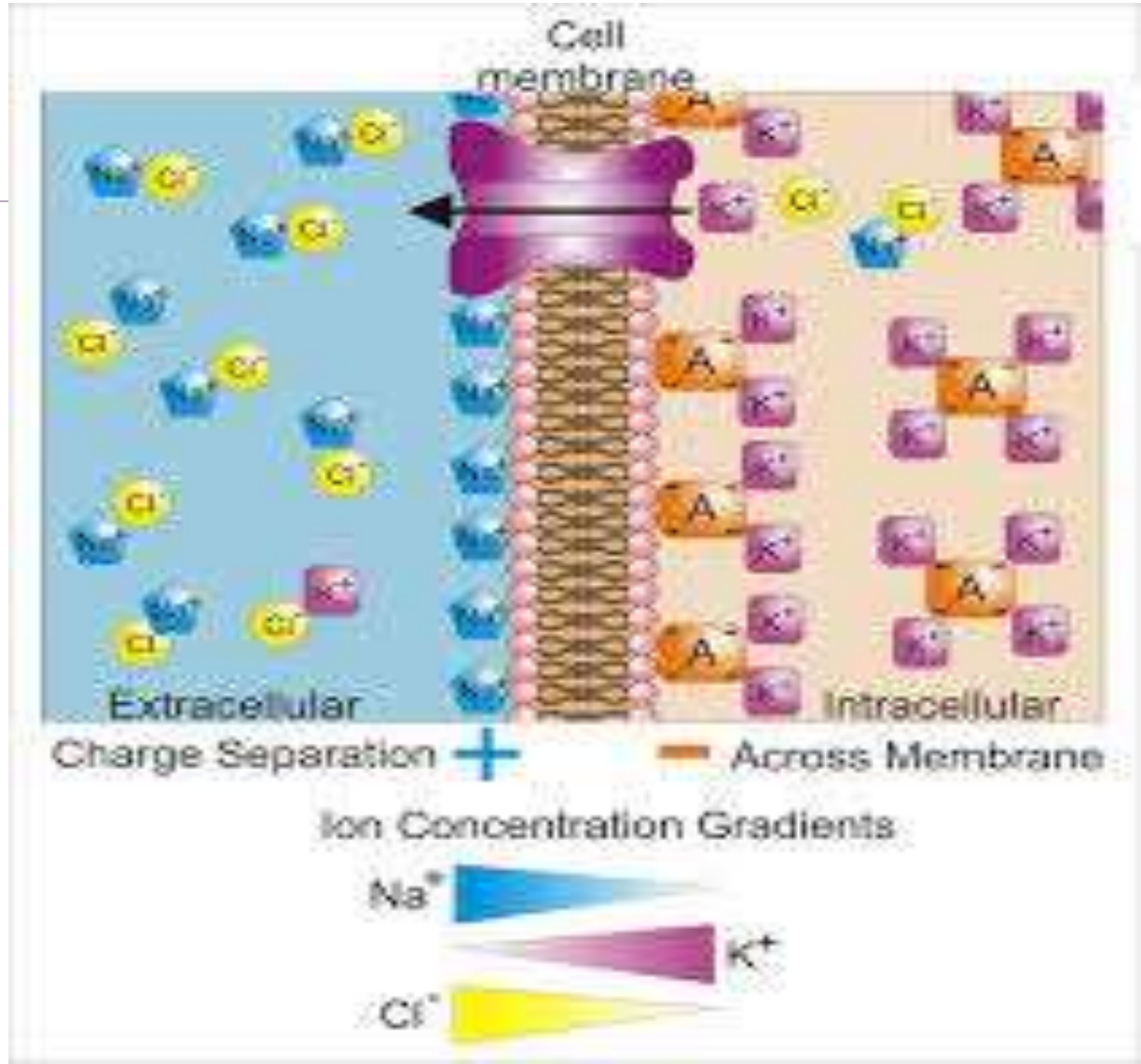
Action Potential

Rapid change in membrane potential

Occurs when stimulus reaches threshold

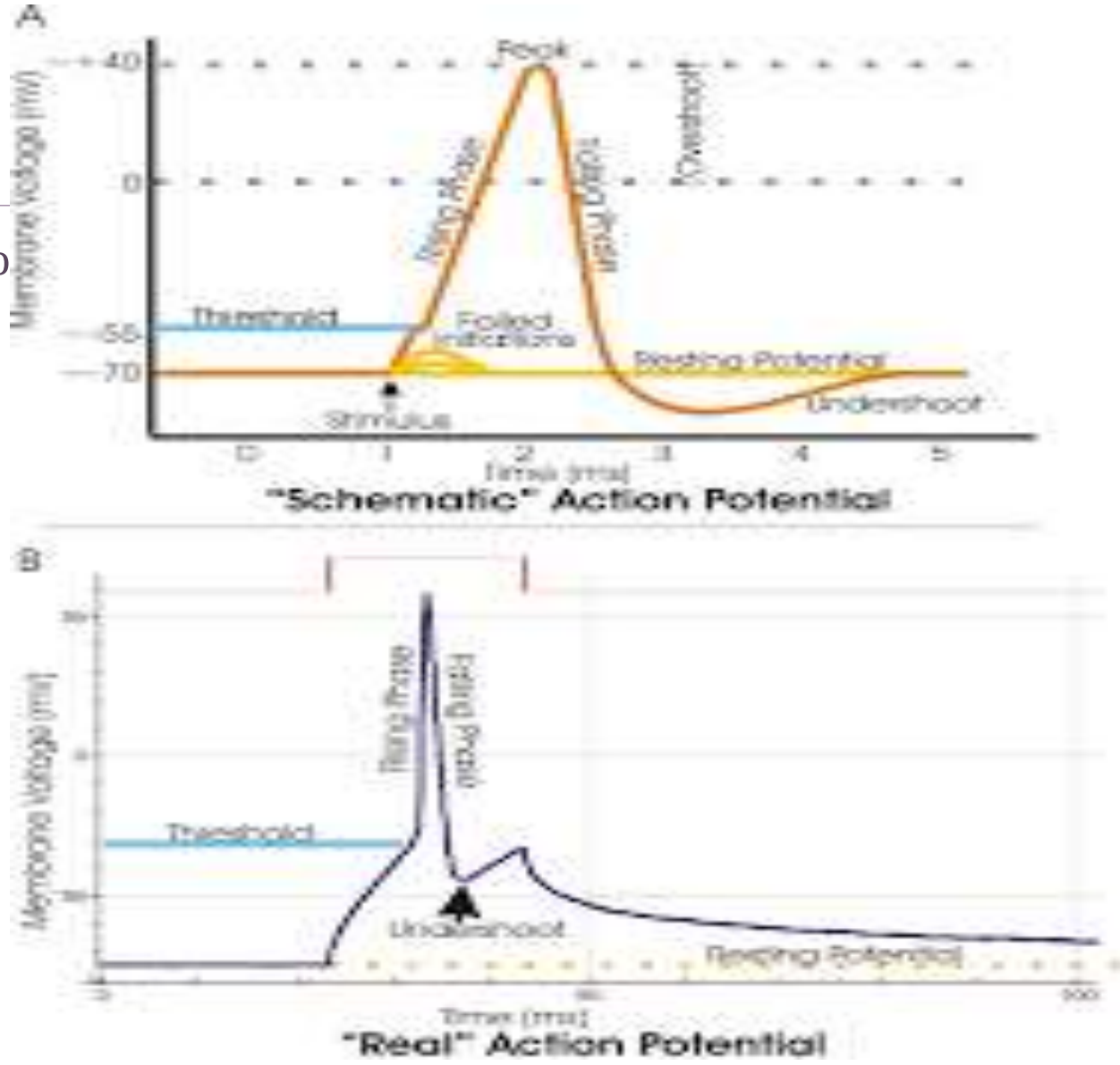
Electrical impulse travels along nerve/muscle fiber

Basis of nerve and muscle activity



Threshold Potential

- Minimum stimulus required to trigger action po
- Usually around –55 mV
- Below threshold → no response
- Above threshold → action potential occurs



Phases of Action Potential

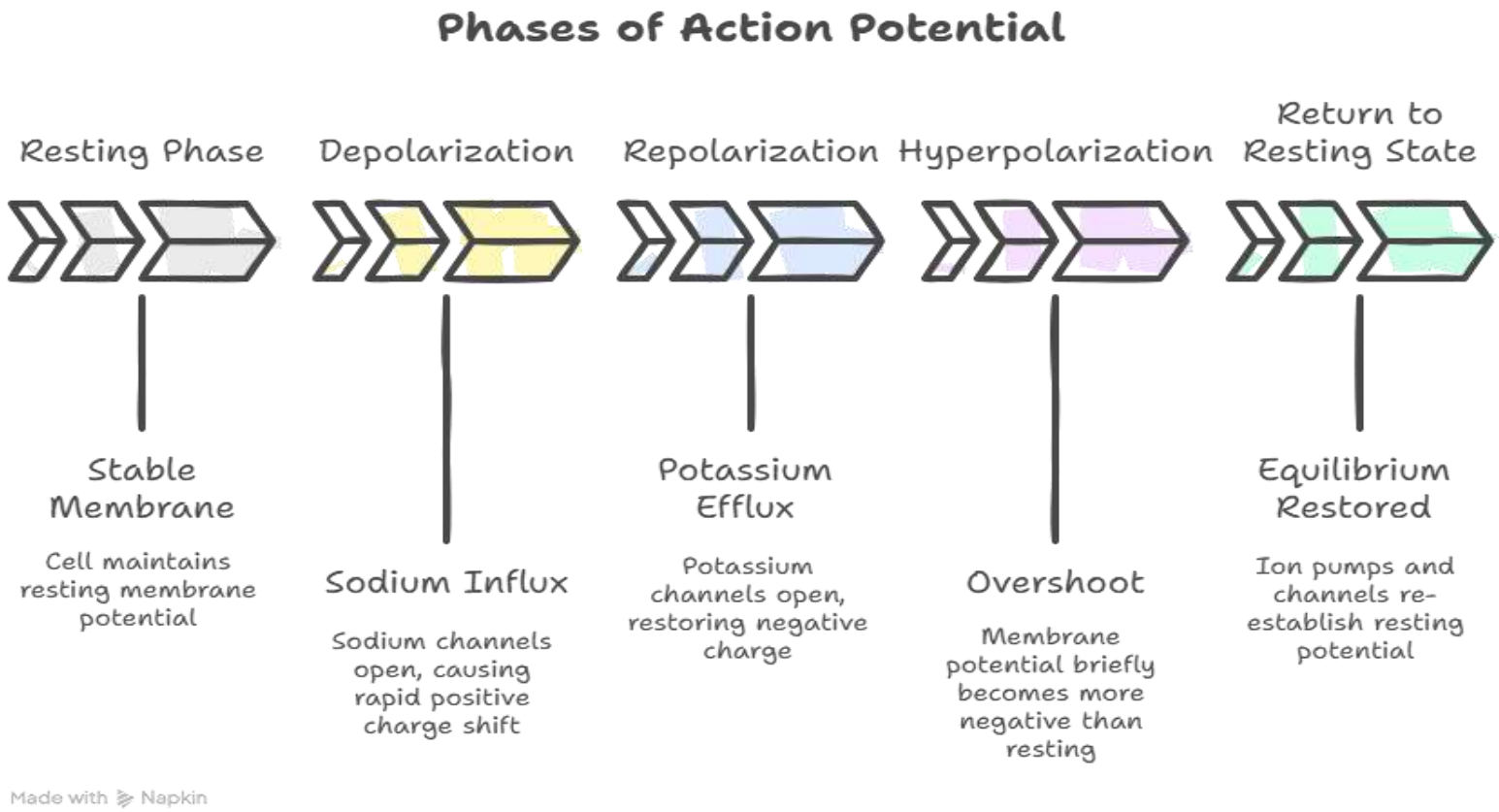
Resting phase

Depolarization

Repolarization

Hyperpolarization

Return to resting state



Depolarization Phase

- Sodium channels open
- Na^+ rushes into the cell
- Membrane potential becomes positive
- Rapid rise in voltage

Repolarization Phase

Sodium channels close

Potassium channels open

K^+ moves out of the cell

Membrane potential returns to negative

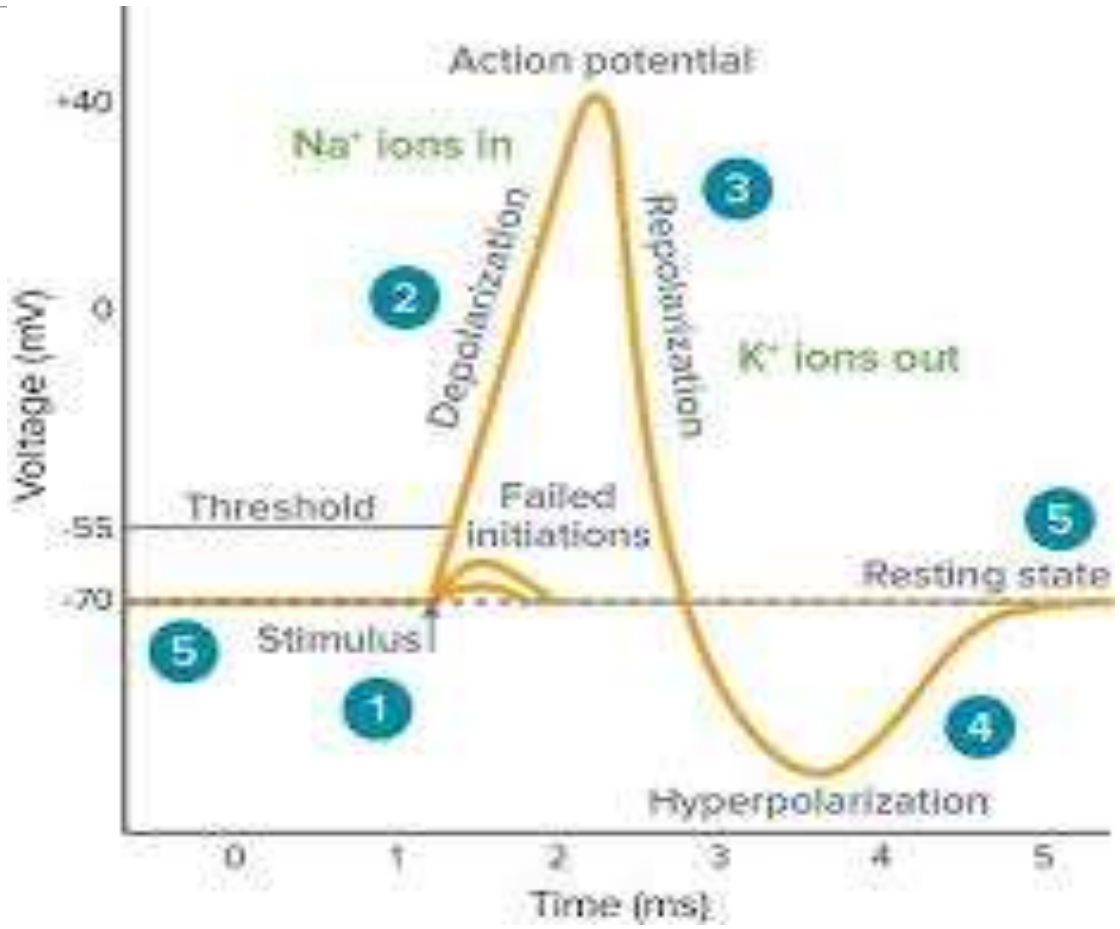
Refractory Period

Period when cell cannot respond normally

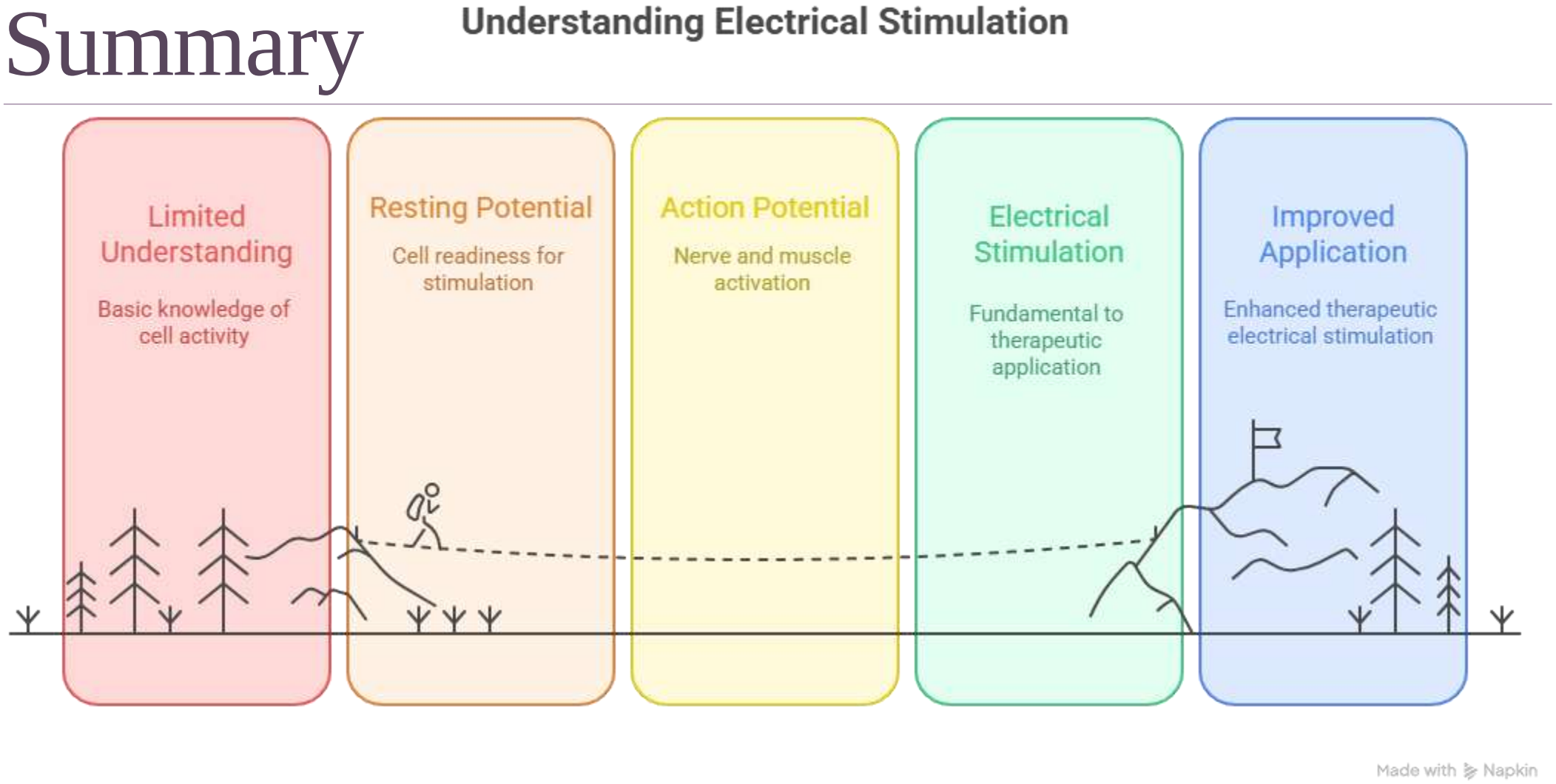
Absolute refractory period

Relative refractory period

Ensures one-way conduction of impulse



Summary


Understanding Electrical Stimulation
Limited Understanding
Basic knowledge of cell activity
Resting Potential
Cell readiness for stimulation
Action Potential
Nerve and muscle activation
Electrical Stimulation
Fundamental to therapeutic application
Improved Application
Enhanced therapeutic electrical stimulation
Made with Napkin

Thank you