CHAPTER-I

Electrophysiology of heart

by

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Definition

- **Action Potential**: The change in electrical potential associated with the passage of an impulse along the membrane of a muscle cell or nerve cell.

- **Membrane potential** (also transmembrane potential or membrane voltage) is the difference in **electrical potential** between the interior and the exterior of a biological cell.
• **Refractory period**, the amount of time it takes for an excitable membrane to be ready for a second stimulus once it returns to its resting state following excitation in the areas of biology, physiology, and cardiology.

• **The threshold potential** is the **membrane potential** to which a membrane must be **depolarized** to initiate an **action potential**.
Action Potential & Mechanical Contraction
Action Potential

• Phase 0
  – Stimulation of the myocardial cell
  – Influx of sodium
  – Influx of calcium
  – The cell becomes depolarize
Action Potential

• Phase 1
  – Ions
    • Influx of sodium
    • Efflux of potassium
  – Partial repolarization

• Phase 2
  – Ions
    • Influx of sodium
    • Efflux of potassium
    • Influx of calcium
  – Plateau
Action Potential

• Phase 3
  – Ions
    • Influx of sodium
    • Efflux of potassium*
    • Influx of calcium
  – Repolarization (slower process than depolarization)

• Phase 4
  – Interval between repolarization to the next action potential
  – Pumps restore ionic concentrations
ECG & Membrane Potential of Ventricular Cell

- Phase 0: Fast Na⁺-influx
- Phase 1: Transient efflux of K⁺
- Phase 2: Influx of Ca²⁺ and Na⁺
- Phase 3: Efflux of K⁺ > influx of Ca²⁺ and Na⁺

Myocardial Cell

Na⁺ 140 mM
K⁺ 4 mM
Ca²⁺ 2 mM

Extracellular fluid

(Internal - external potential) =

1mV

Overshoot

Threshold

Contraction

Tension

Absolute refractory period

Fast Na⁺-channels are closed

Relative refractory period

300 ms

Fig. 11-2

Steep phase 0 means rapid depolarisation

KMc
Electrocardiogram—ECG or EKG

EKG
Action potentials of all active cells can be detected and recorded

P wave
atrial depolarization

P to Q interval
conduction time from atrial to ventricular excitation

QRS complex
ventricular depolarization

T wave
ventricular repolarization
ECG Paper
Thank You