

Basic Electrophysiology

Michael Eldar, M.D.
Heart Institute
Sheba Medical Center

Caesaria 2008

1. מי מהבאים יוצא דופן?

I_{ca} •

I_k •

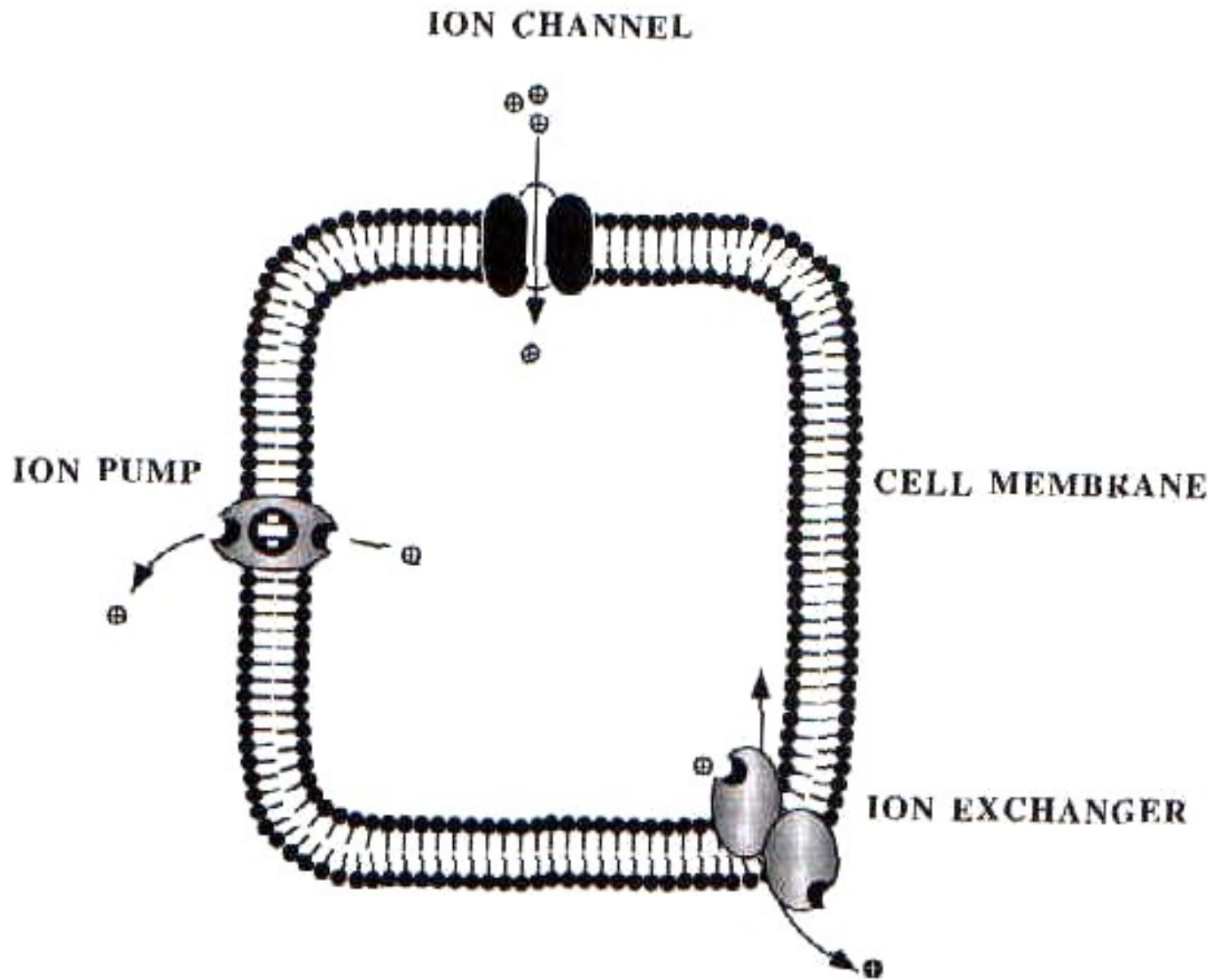
Ryanodin receptor •

Na/K ATPase pump •

Ca/Na exchanger •

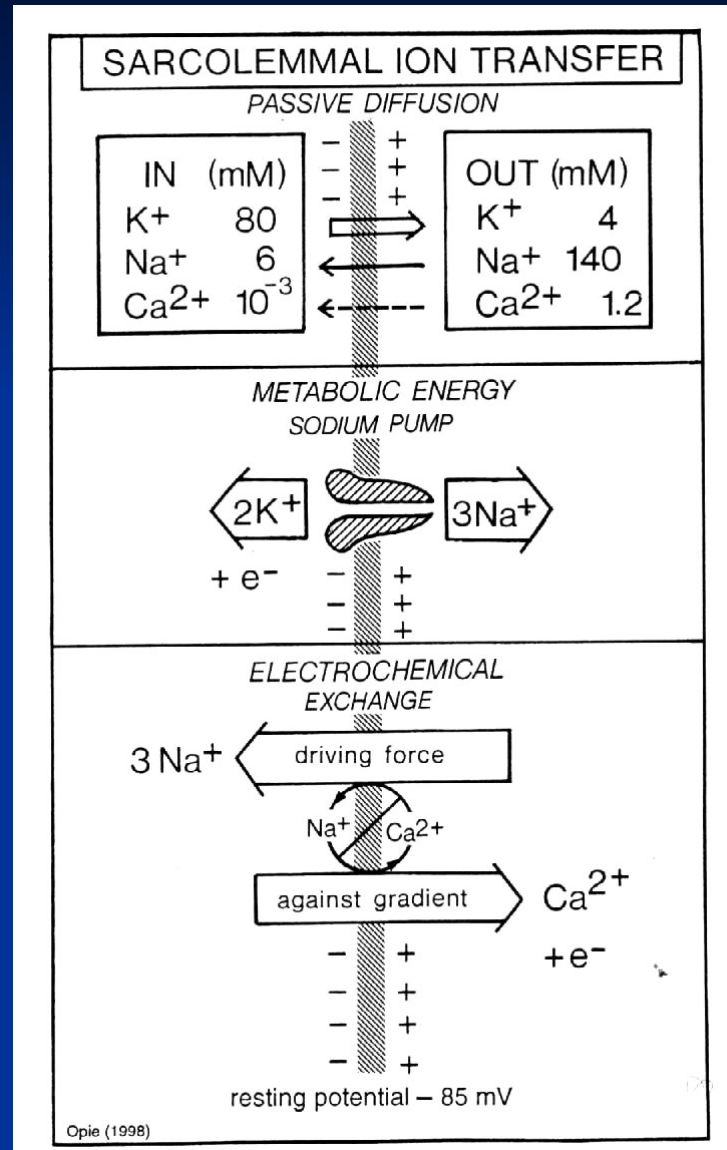
התשובה – ג'

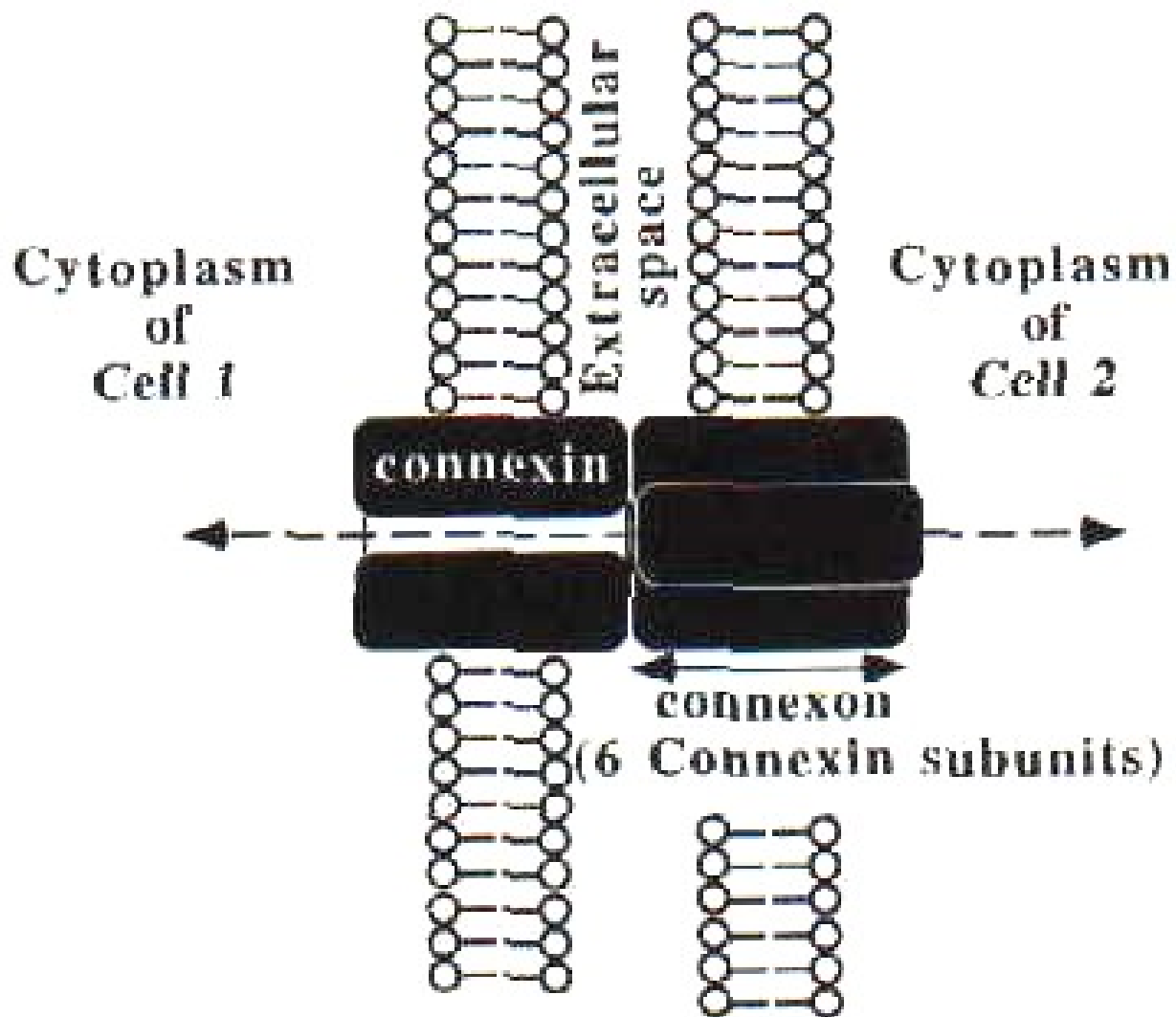


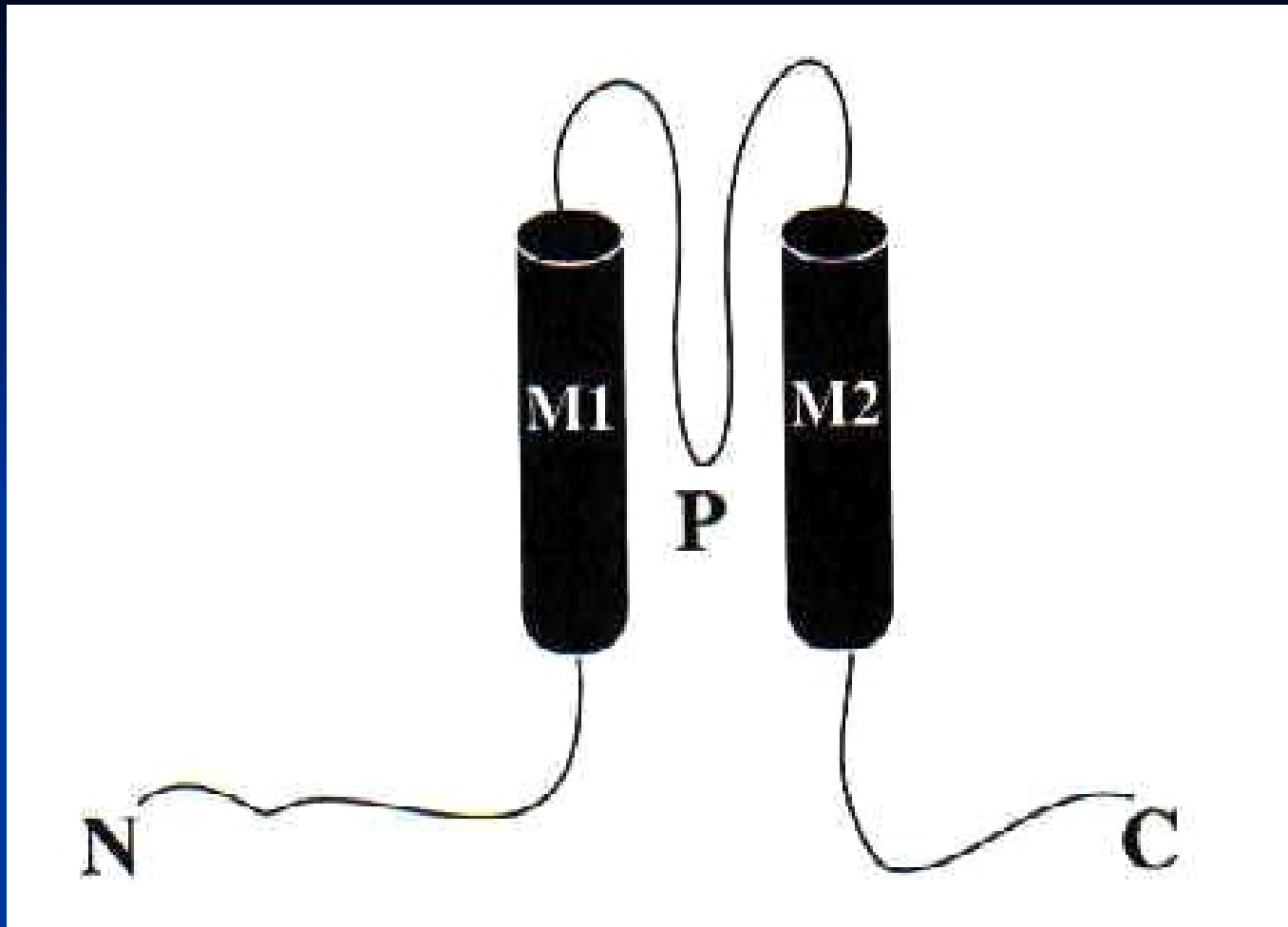


Jalife et al. Basic Cardiac Electrophysiology for the Clinician, 1998:40

Transmembrane Ion-Transfer Modes

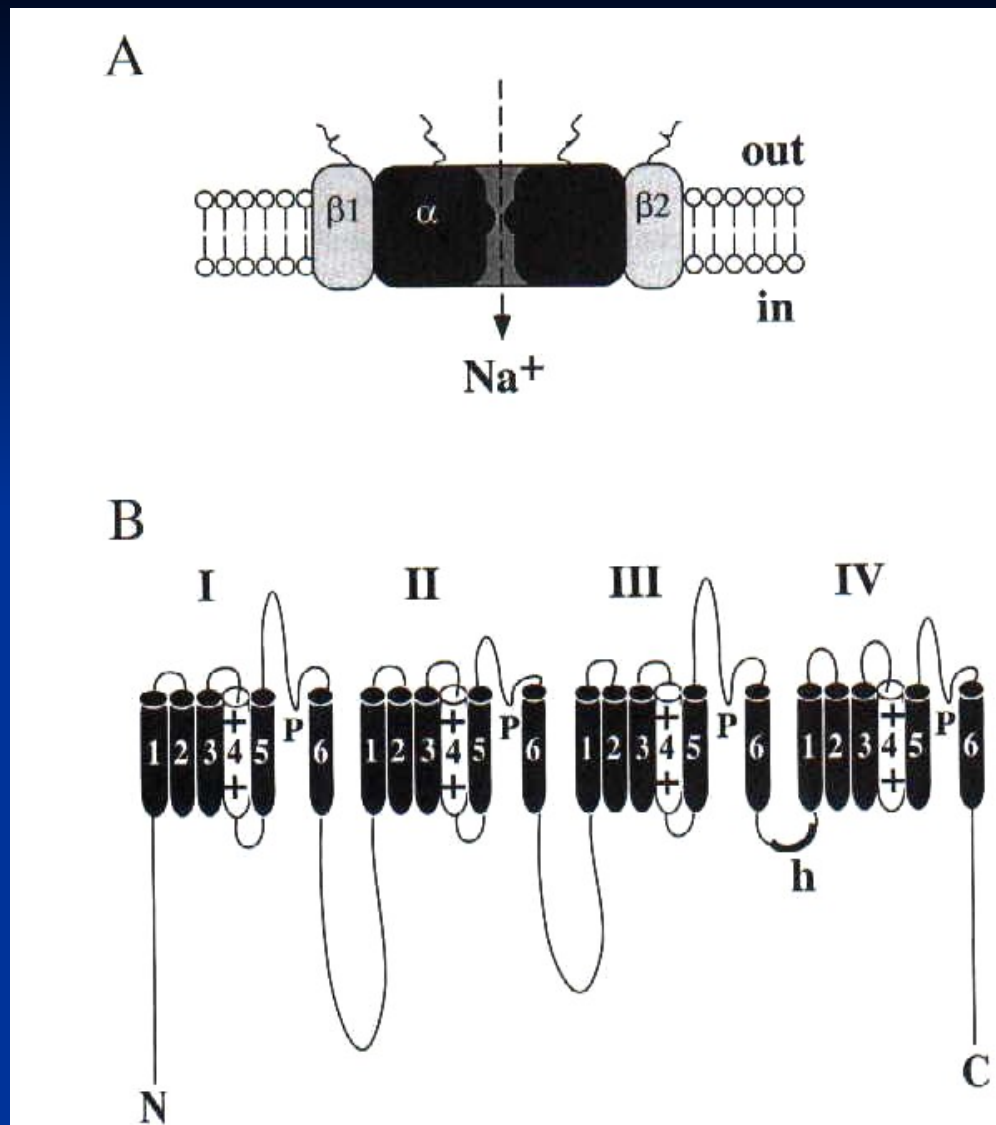






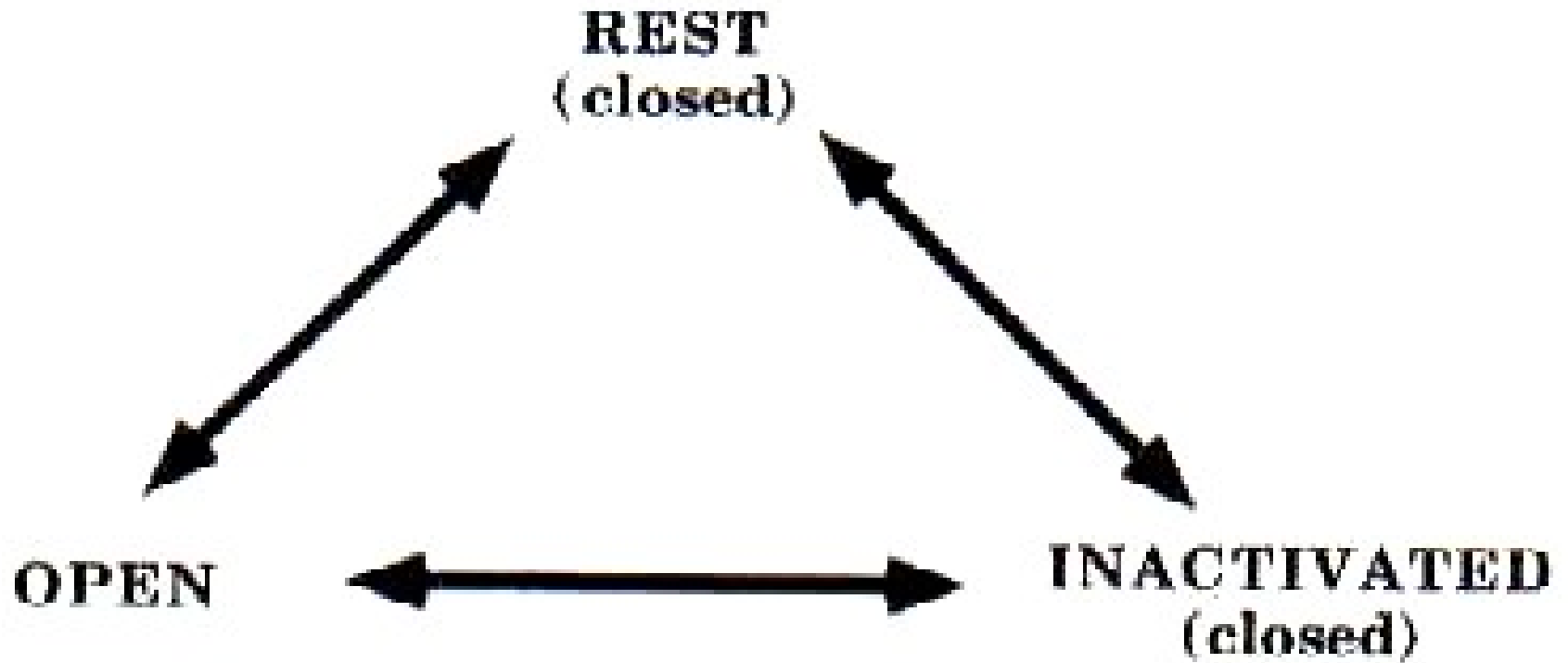
Inward Rectifier— I_{k_1}

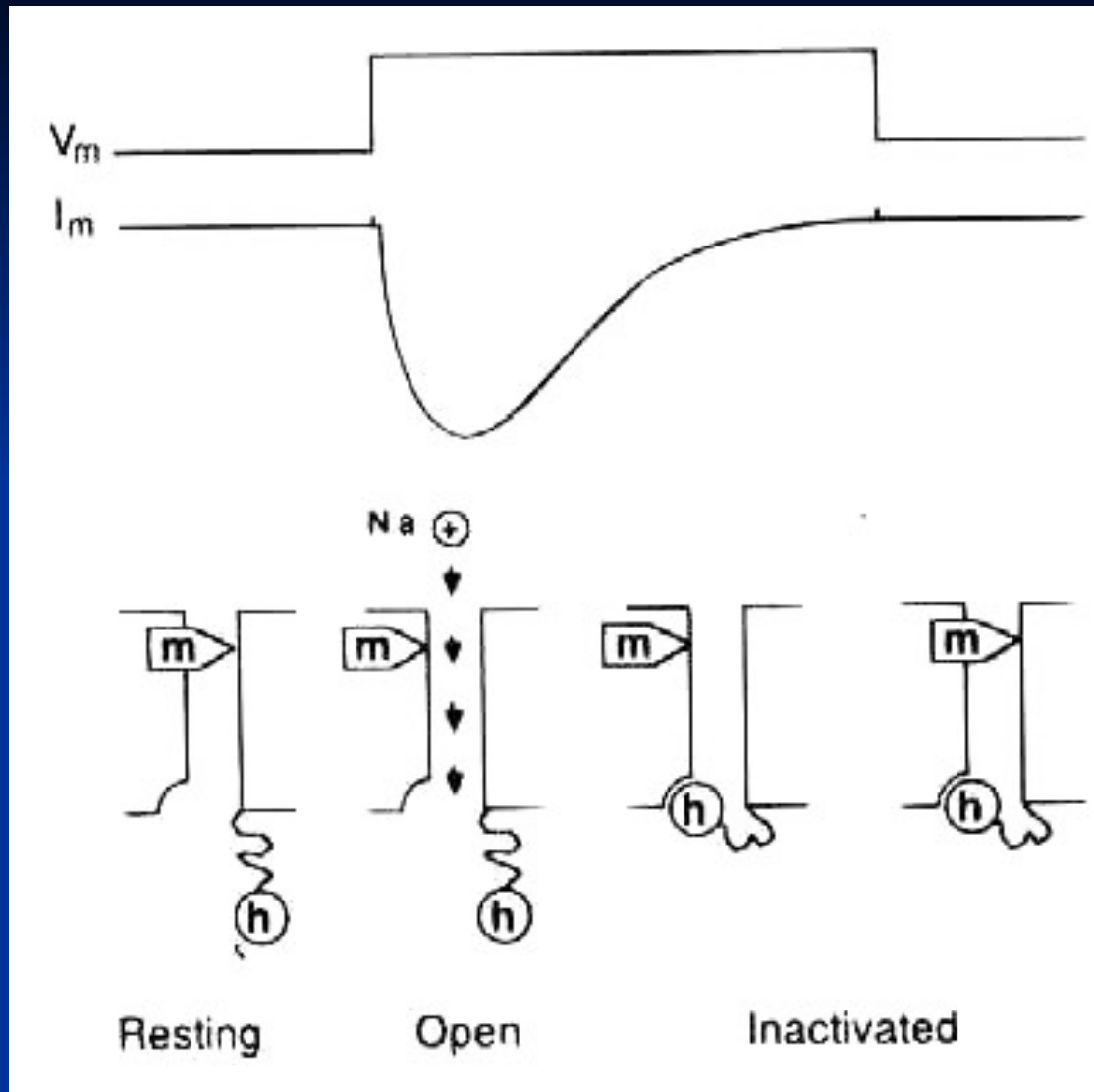
Jalife et al. Basic Cardiac Electrophysiology for the Clinician, 1998:69



Voltage-Gated Sodium channel

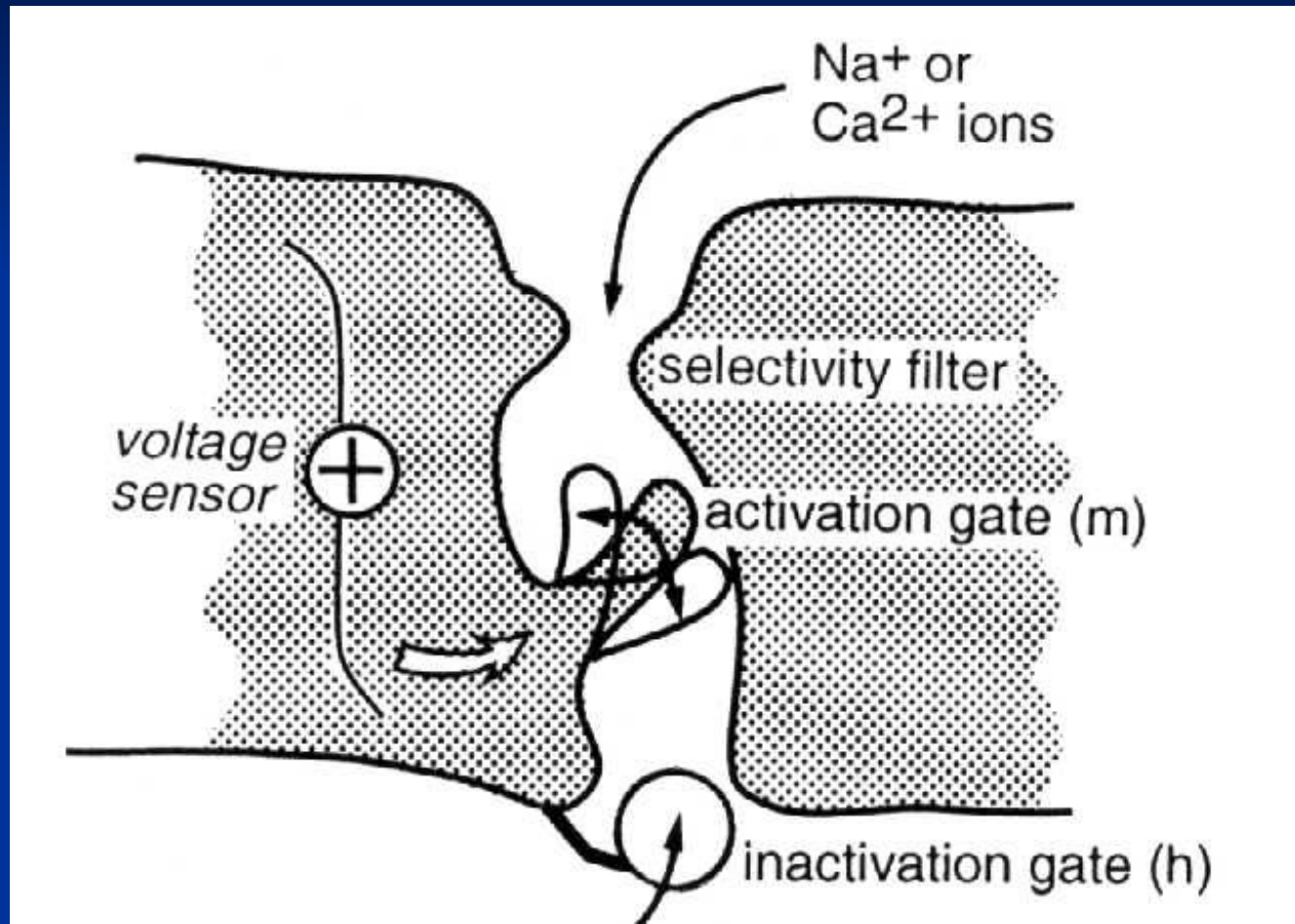
Jalife et al. Basic Cardiac Electrophysiology for the Clinician, 1998:64





Whalley DW et al, PACE 1995;18:1561

Channel Pore Model



2. מי מהתעלות הבאות האחראית העיקרית

לשלב II של פוטנציאל הפעולה החדרי?

$I_{Ca,l}$ •

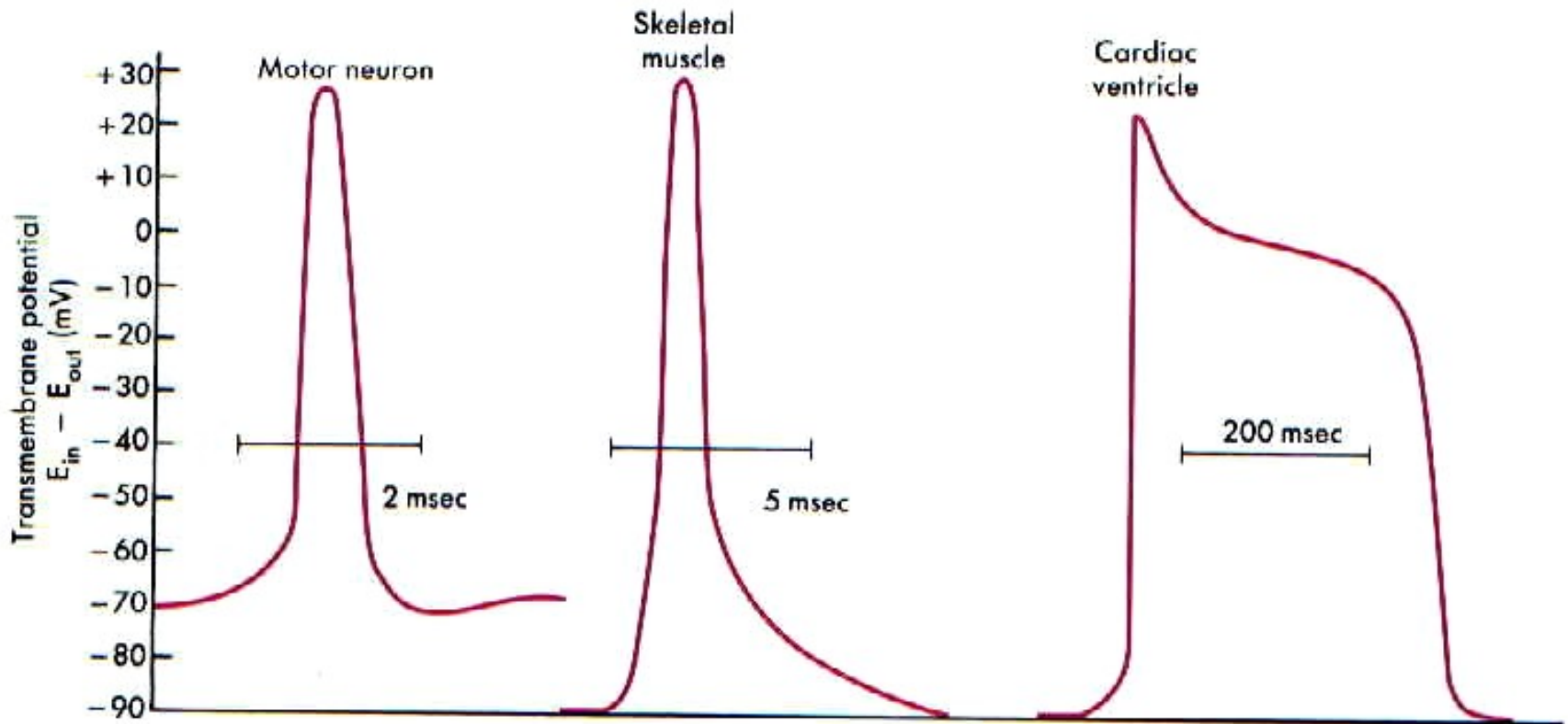
I_{Na} •

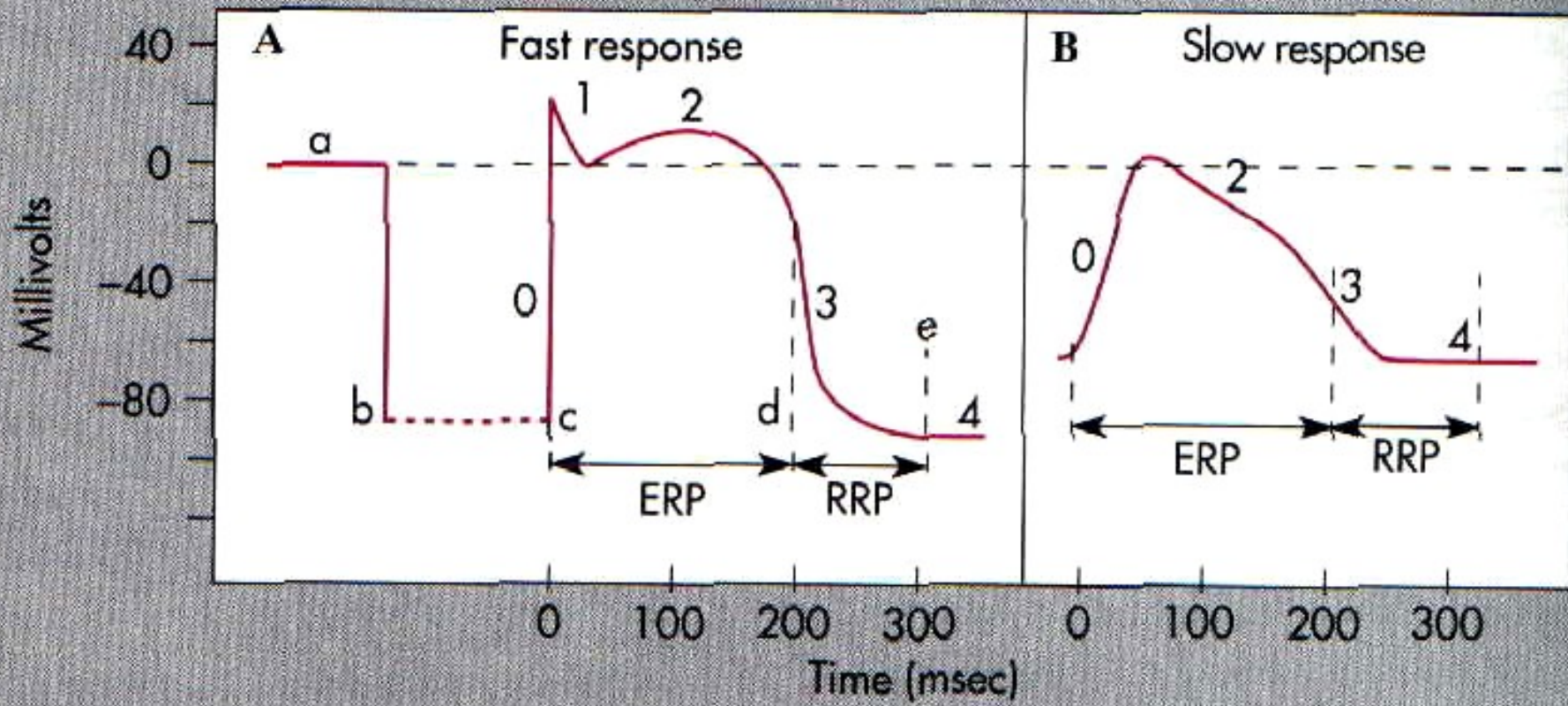
I_K •

I_{K1} •

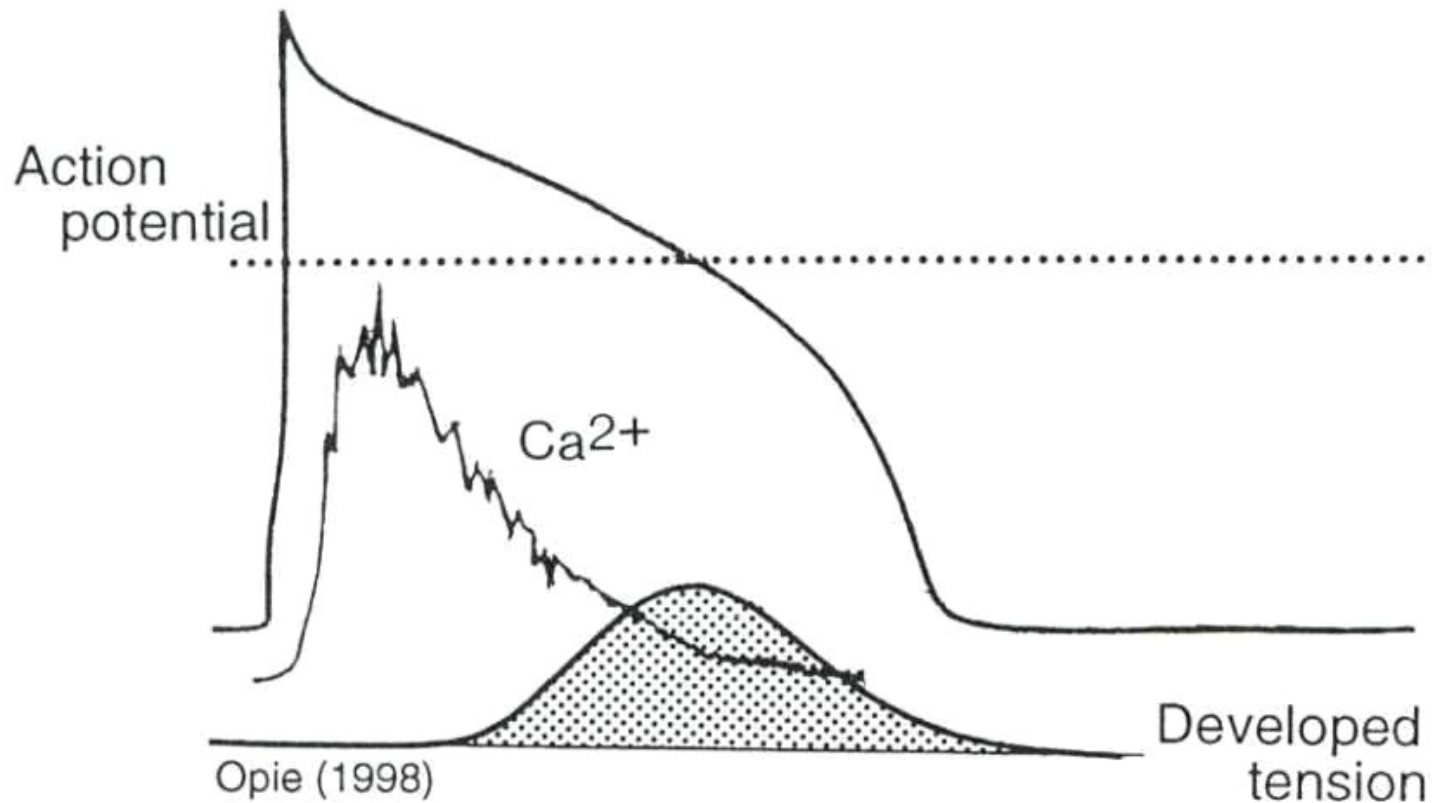
$I_{K,ach}$ •

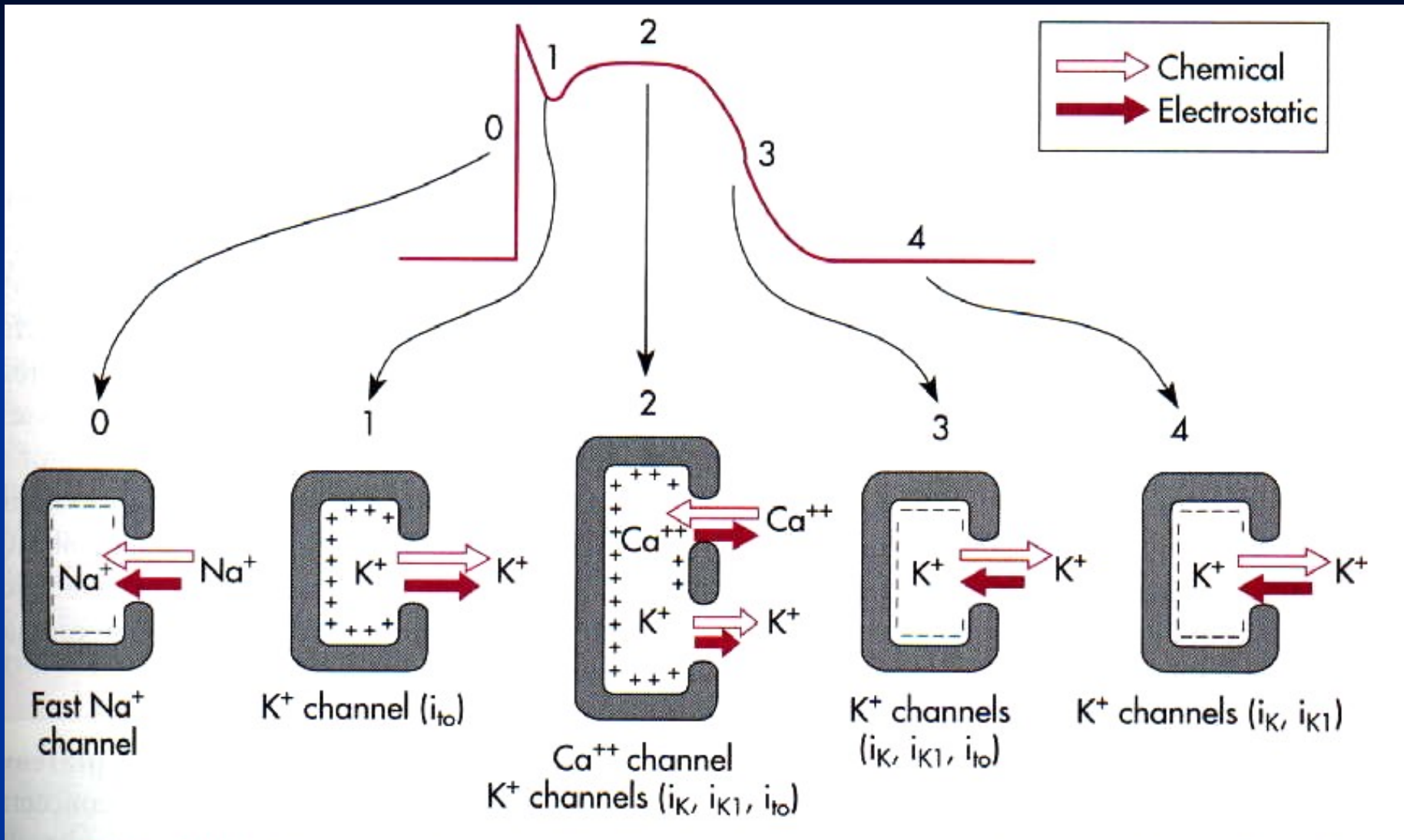
התשובה – א'

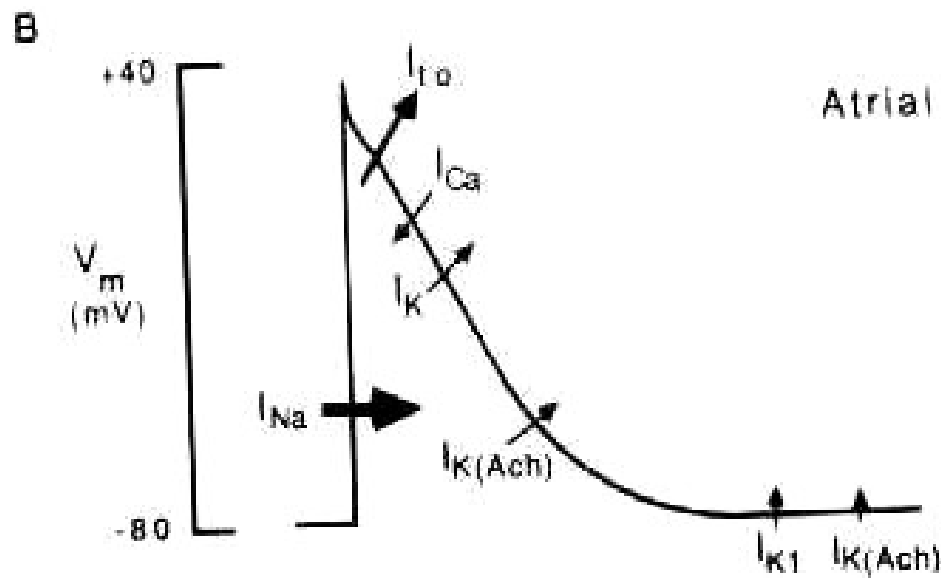
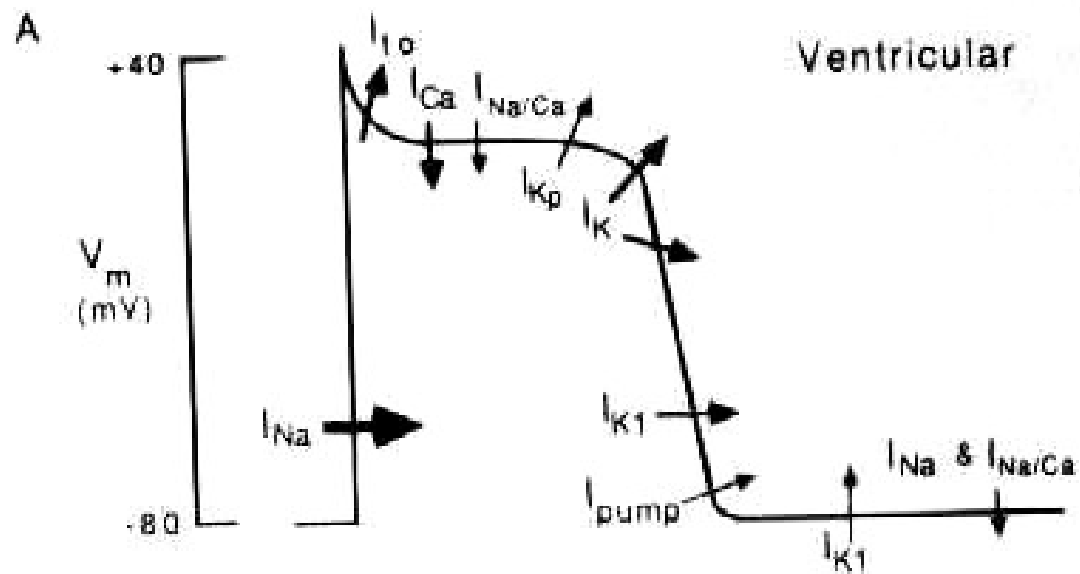




Electro-Mechanical Relation







3. אחת מהפרעות הקצב להלן נגרמת עקב . Abnormal automaticity. איזו היא?

א- PAT עקב הרעלת דיגוקסין

ב- TdP מקינידין

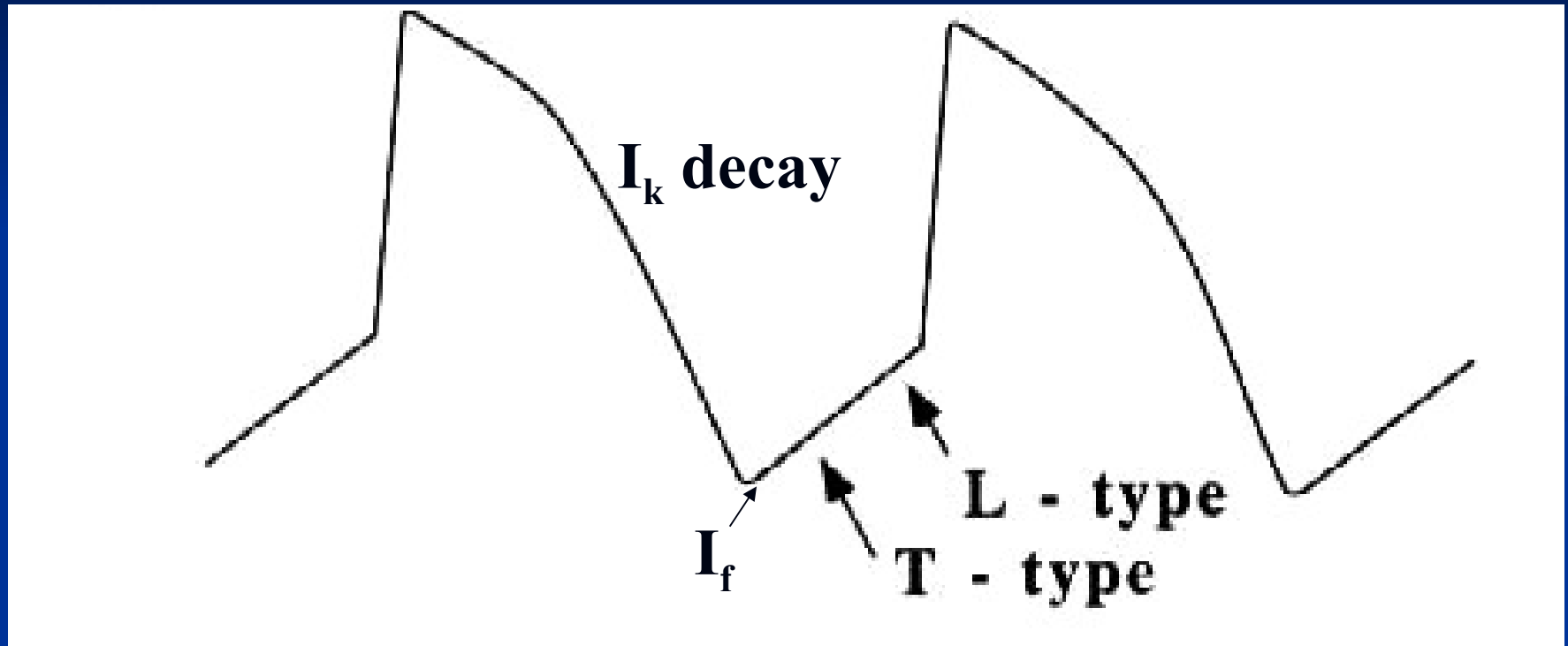
ג- RVOT VT במאמץ

ד- AVNRT

ה- AIVR

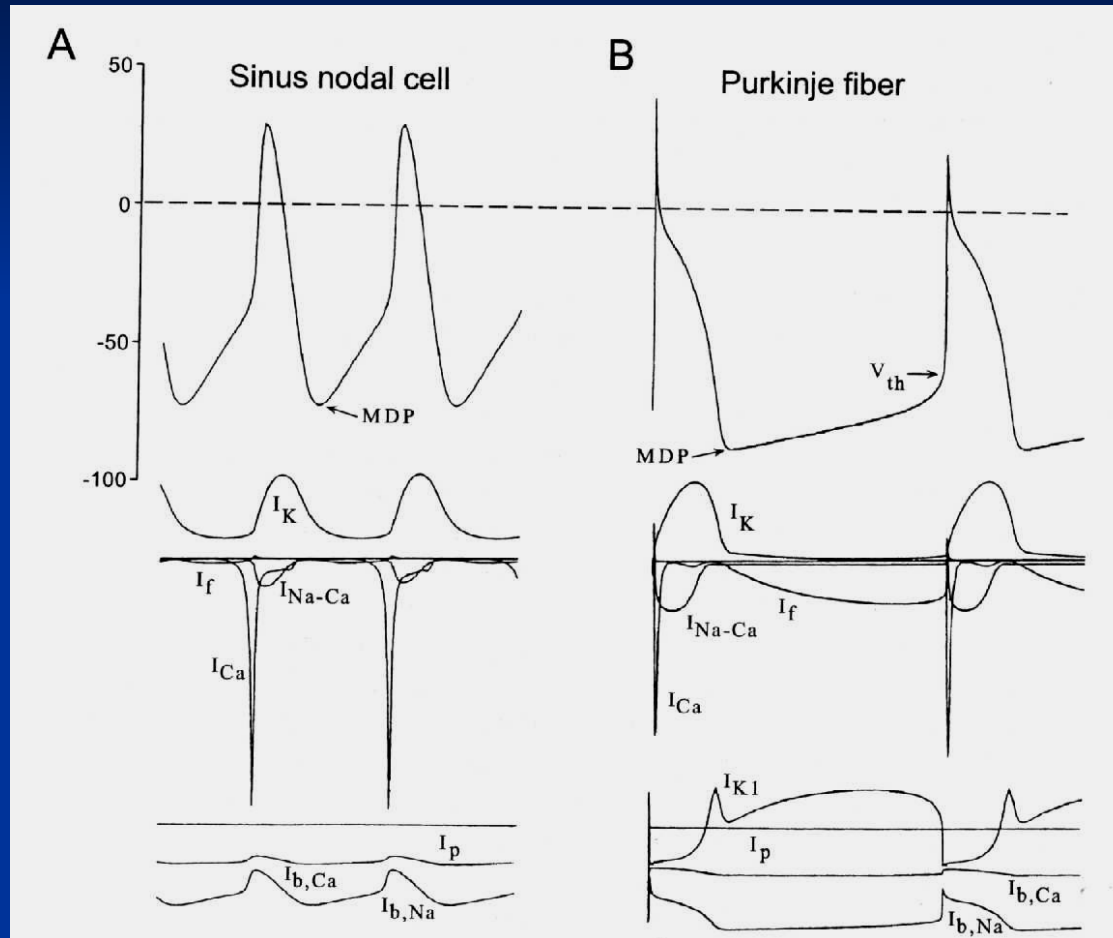
התשובה הנכונה – ה'

Normal Automaticity



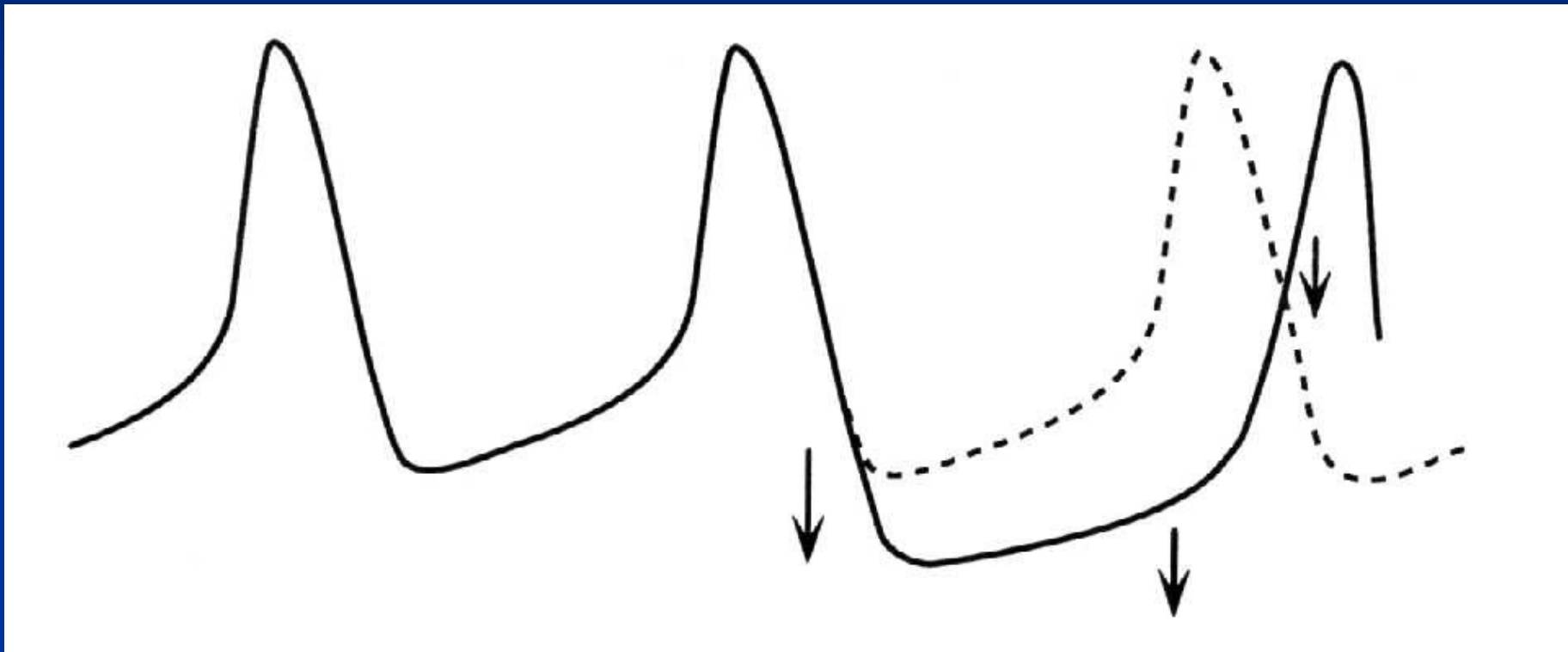
Jalife et al. Basic Cardiac Electrophysiology for the Clinician, 1998:55

Normal Automaticity



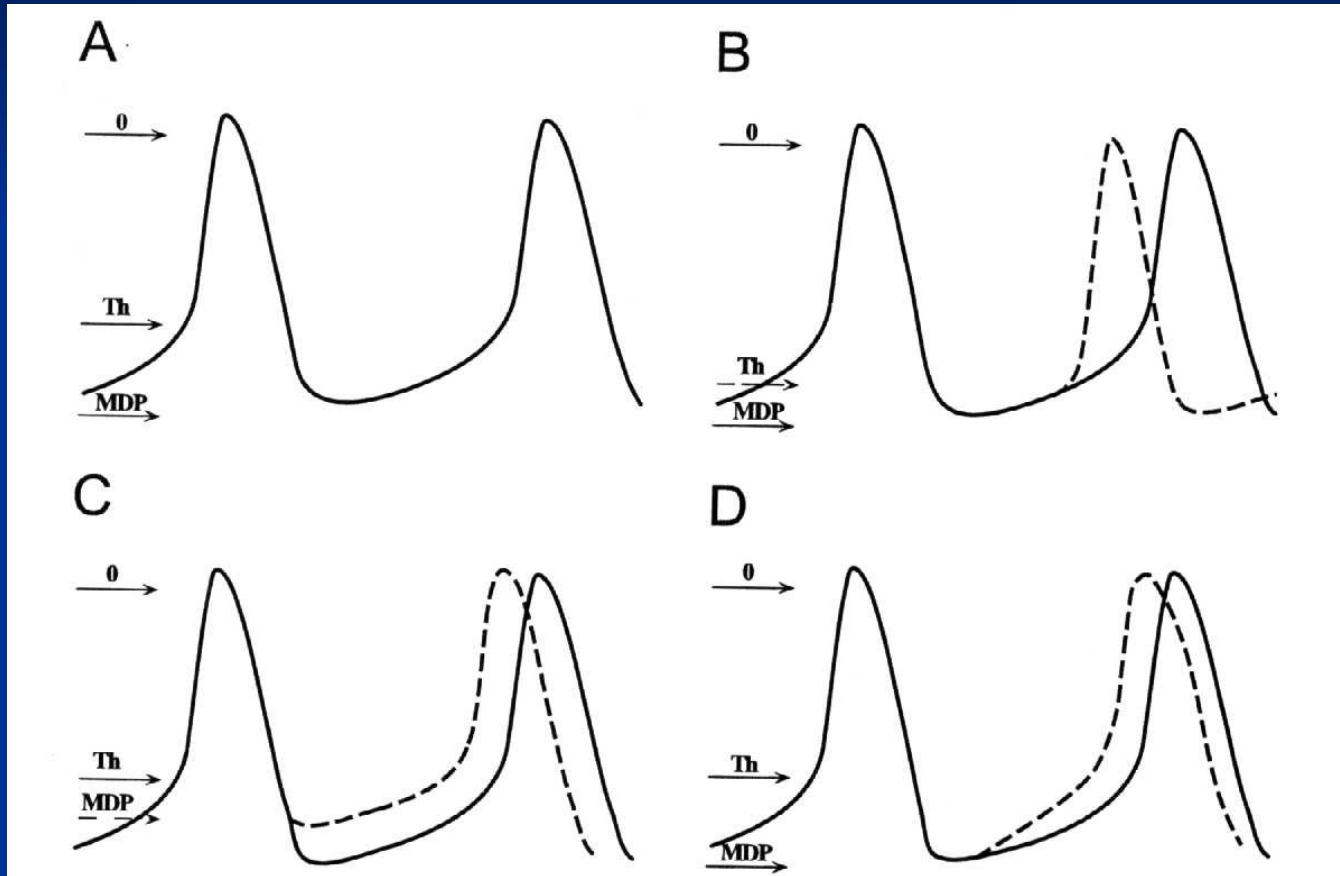
Jalife et al. Basic Cardiac Electrophysiology for the Clinician, 1998:199

ACh and Automaticity



Jalife et al. Basic Cardiac Electrophysiology for the Clinician, 1998:202

Acceleration of Normal Automaticity

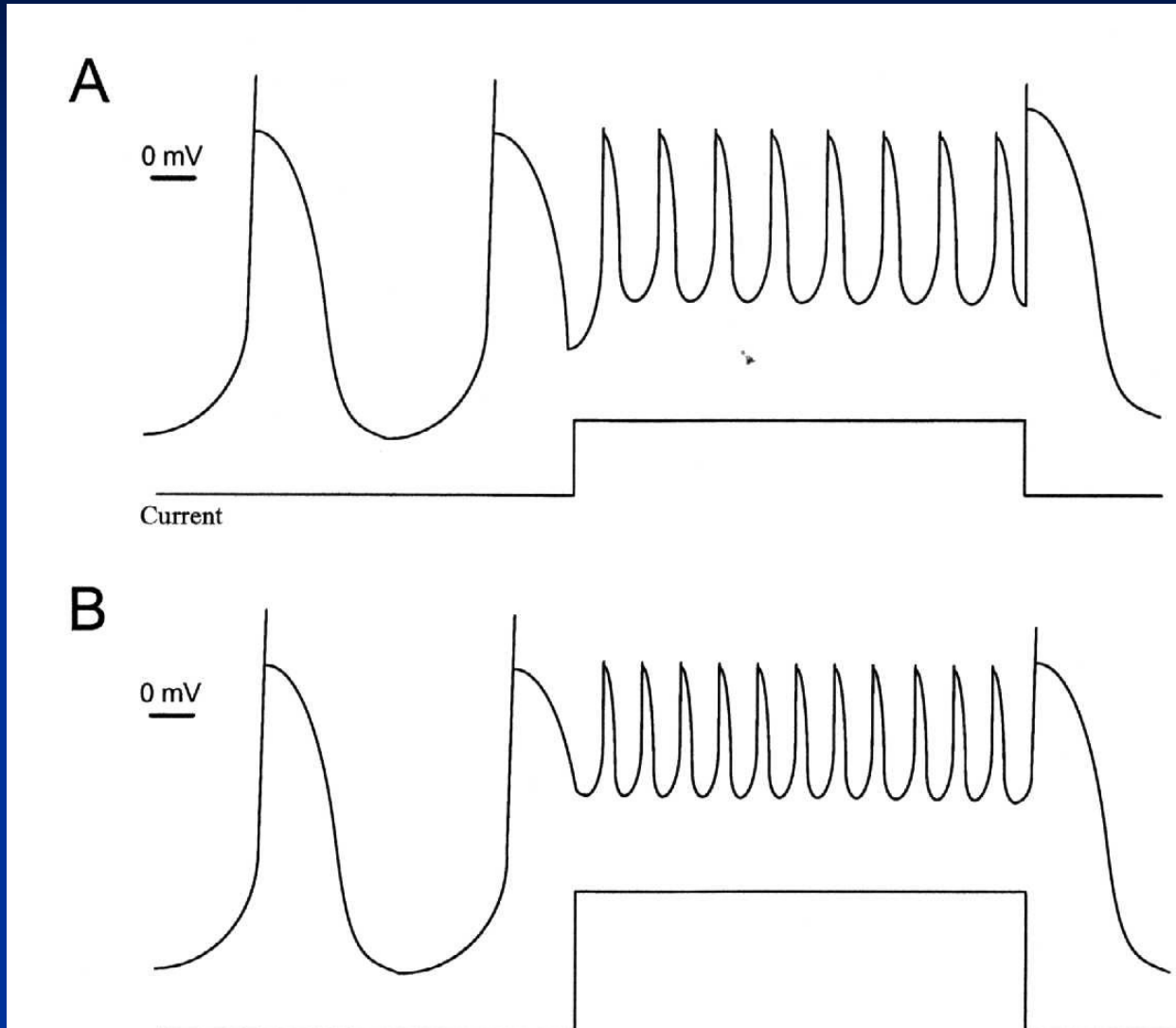


Jalife et al. Basic Cardiac Electrophysiology for the Clinician, 1998:201

Abnormal automaticity

- Depolarized myocytes
(-60 \rightarrow -10 mV)
- \downarrow pH
- \downarrow $[O_2]$
- \uparrow $[K^+]_o$

Depolarization-induced Automaticity



Abnormal automaticity

Clinical Arrhythmias

- Myocardial infarction
 - 15-30 minutes
 - 24-72 hours
- AIVR
- $\uparrow[K^+]_o$
 - Ischemia
 - Injury currents

4. המשפטים הבאים מתייחסים

ל - Triggered Activity.

אחד אינו נכון, מהו?

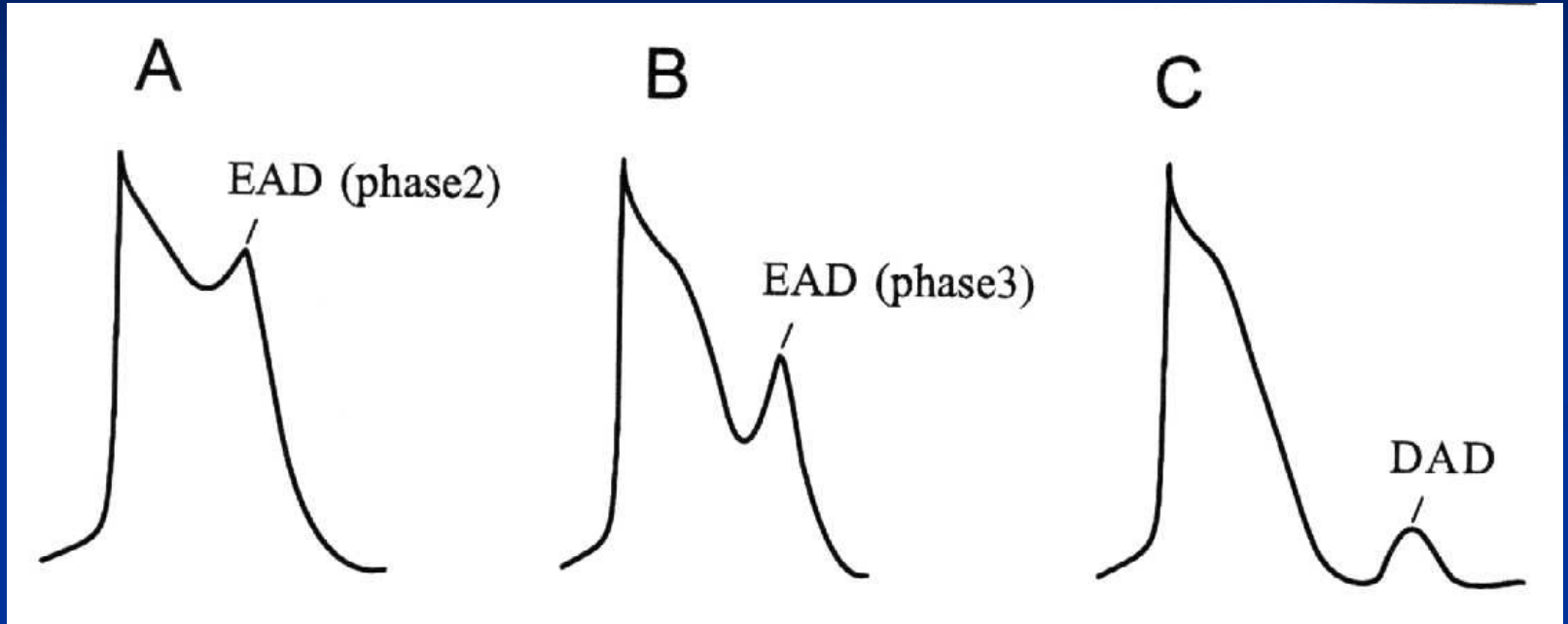
- א- DAD גדלים עקב טכיקרדיה
- ב- LQT3 נגרם בשל מוטציה בתעלת אשלגן
- ג- TdP מתרופות נגרם מחסימת תעלת אשלגן
- ד- מחויב להיגרם ע"י פוטנציאל פעולה קודם
- ה- עודף יונים חיוביים בתא גורם להארכת QT

התשובה הנכונה – ב'

Triggered Activity

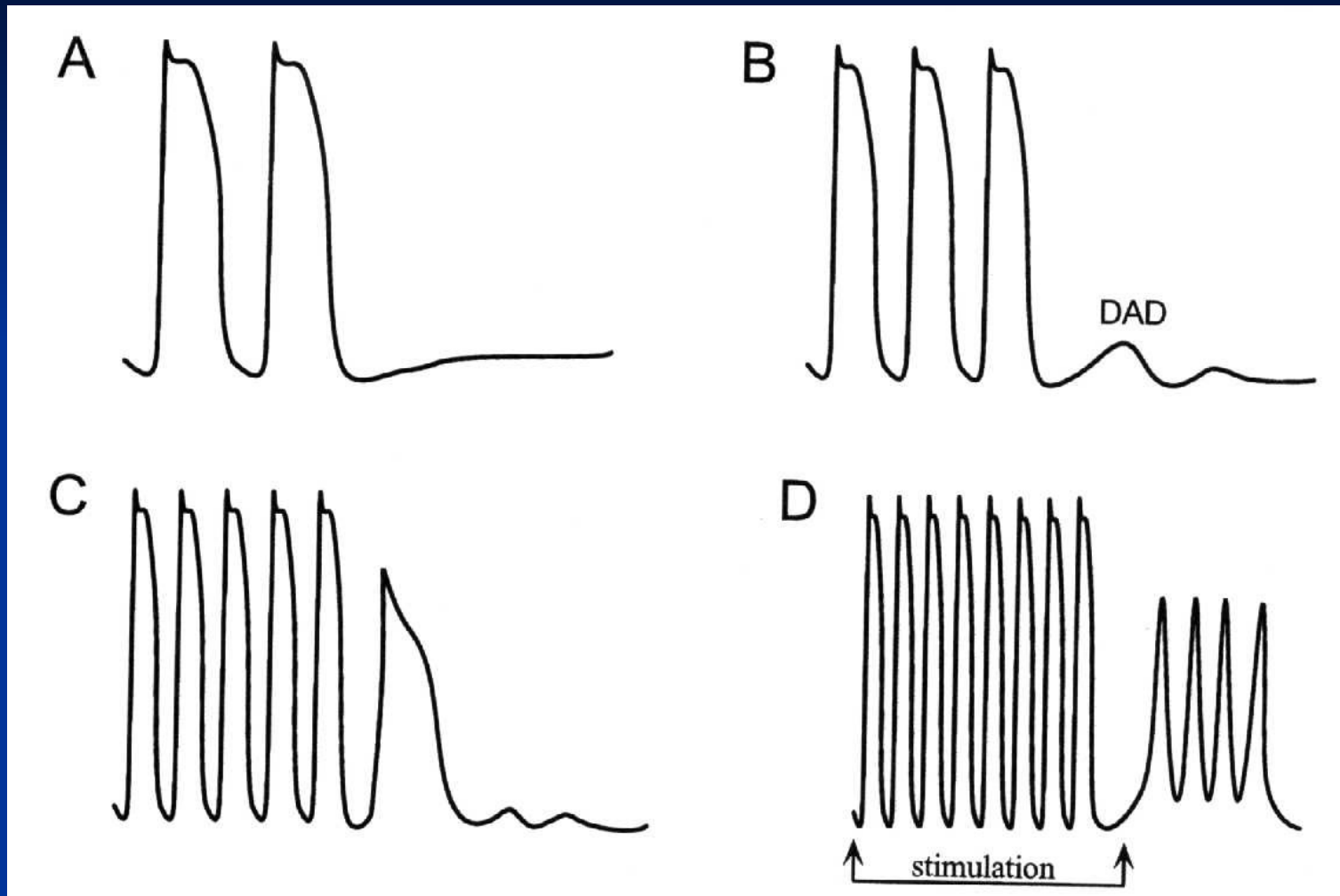
- activity arising from membrane potential oscillations during or immediately following an AP
- Should occur following a previous AP (spontaneous or driven)

Triggered Activity



Zipes & Jaliffe, Cardiac Electrophysiology 1995:208

Digoxin induced DAD



Rate-Dependence of DAD's

DAD

Clinical Arrhythmias

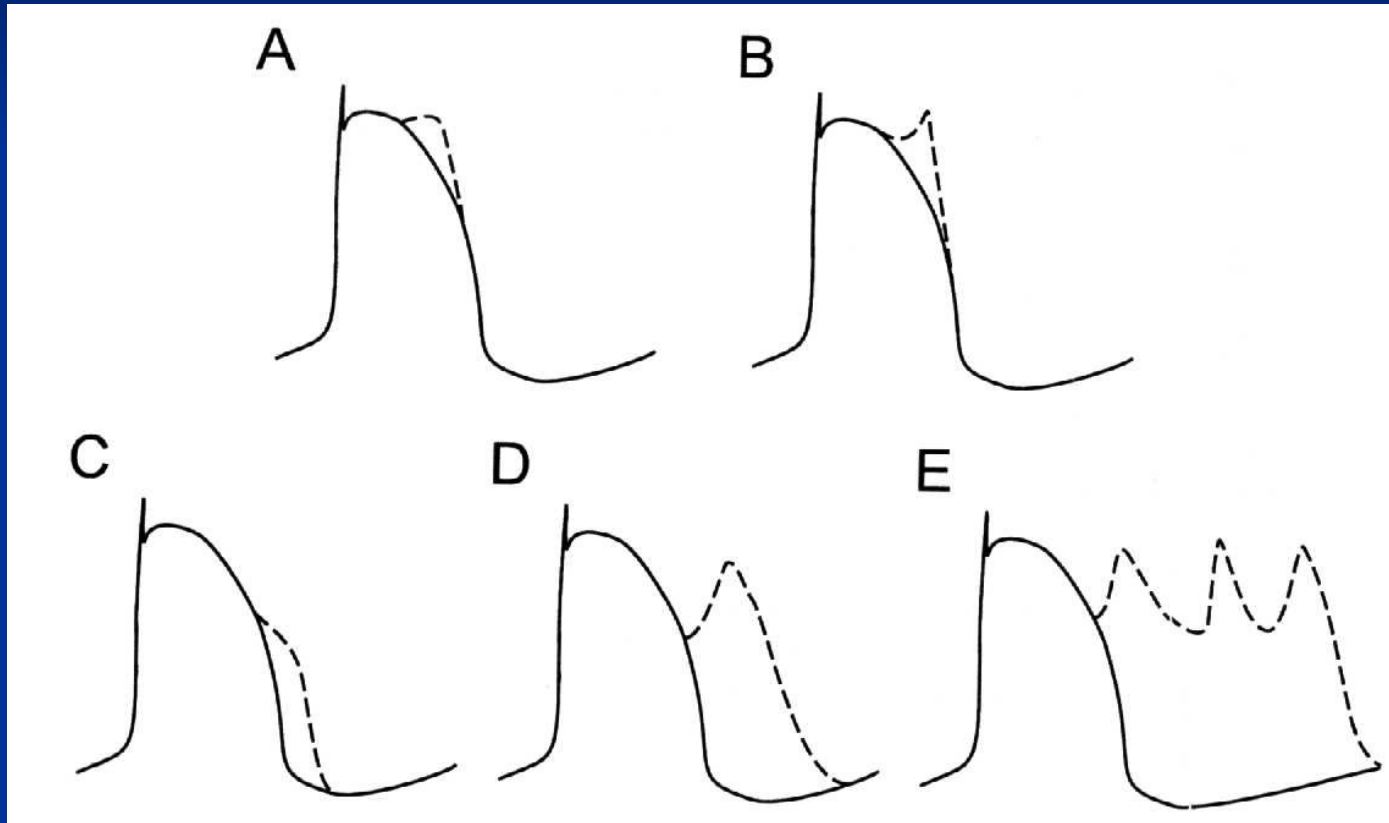
- Dig. Intoxication
 - atrial tach:
 - VT
- Accelerated VT during AMI
- Reperfusion induced arrhythmias
- CPVT
- Exercise (catecholamine, cAMP dependent) induced RVOT VT

Early Afterdepolarization (EAD

Pathophysiology

Outward current ↓
and/or
↑ Inward current

Quinidine-induced EAD's

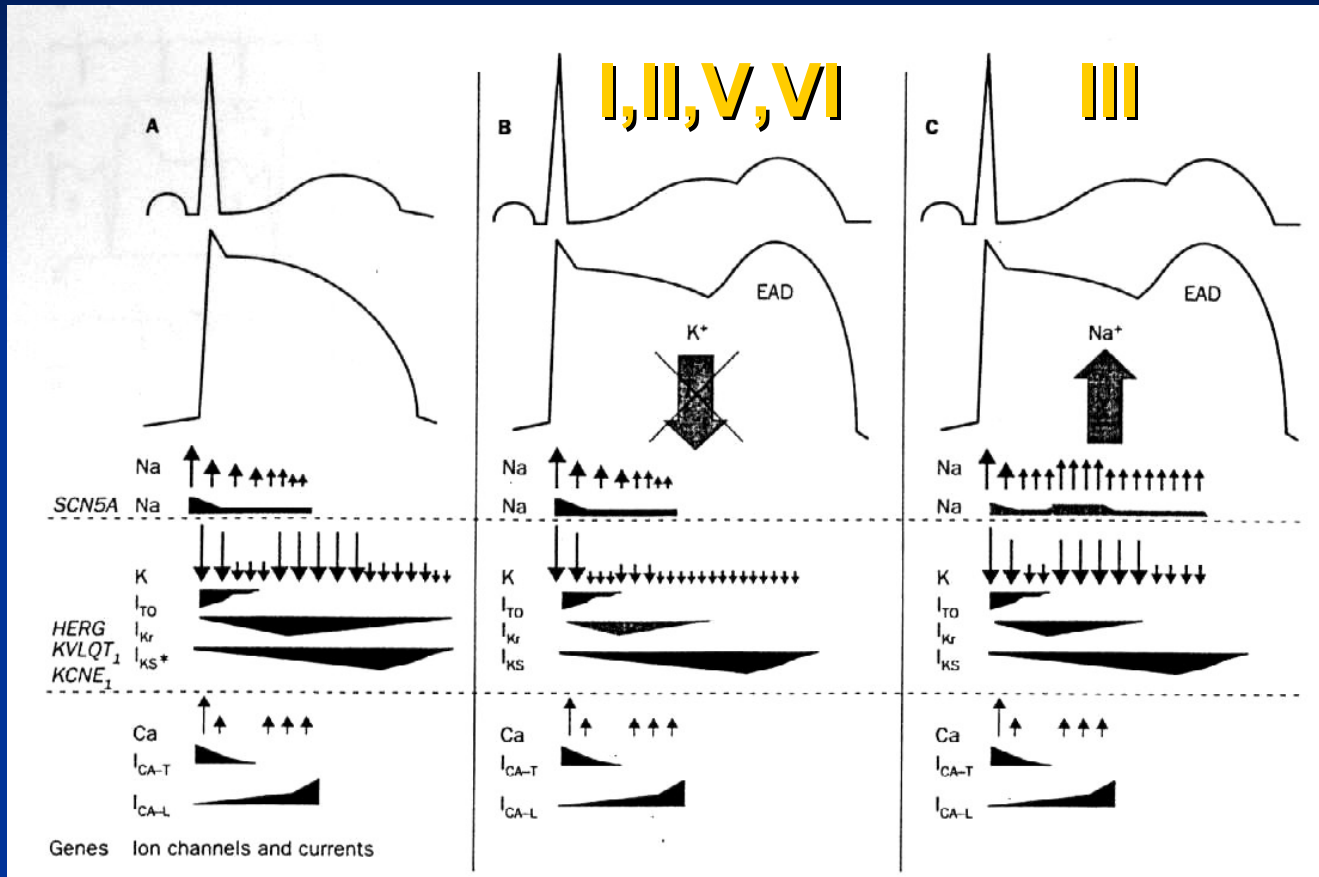


EAD

Clinical arrhythmias

- TDP
 - acquired LQTS
 - congenital LQTS

LQTS- | net outward current



Acquired EAD

- hypokalemia (\downarrow K conductance)
- Acidosis
- Bradycardia
- Ikr blockers
 - AAD
 - Phenothiazine
 - Antihistamines
 - Antibiotics
 - antidepressants

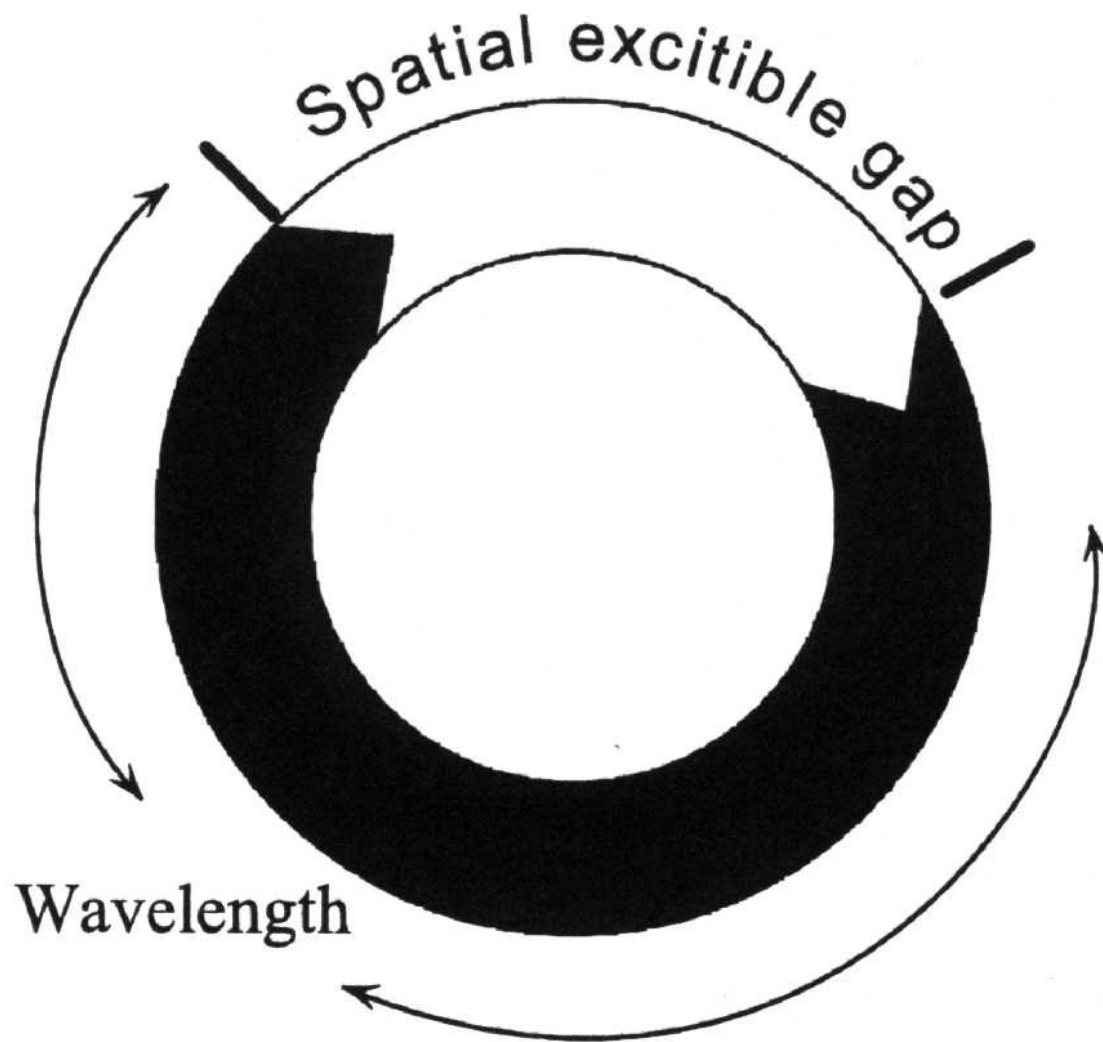
5. המשפטים הבאים מתייחסים ל REENTRY. אחד אינו נכון, מהו?

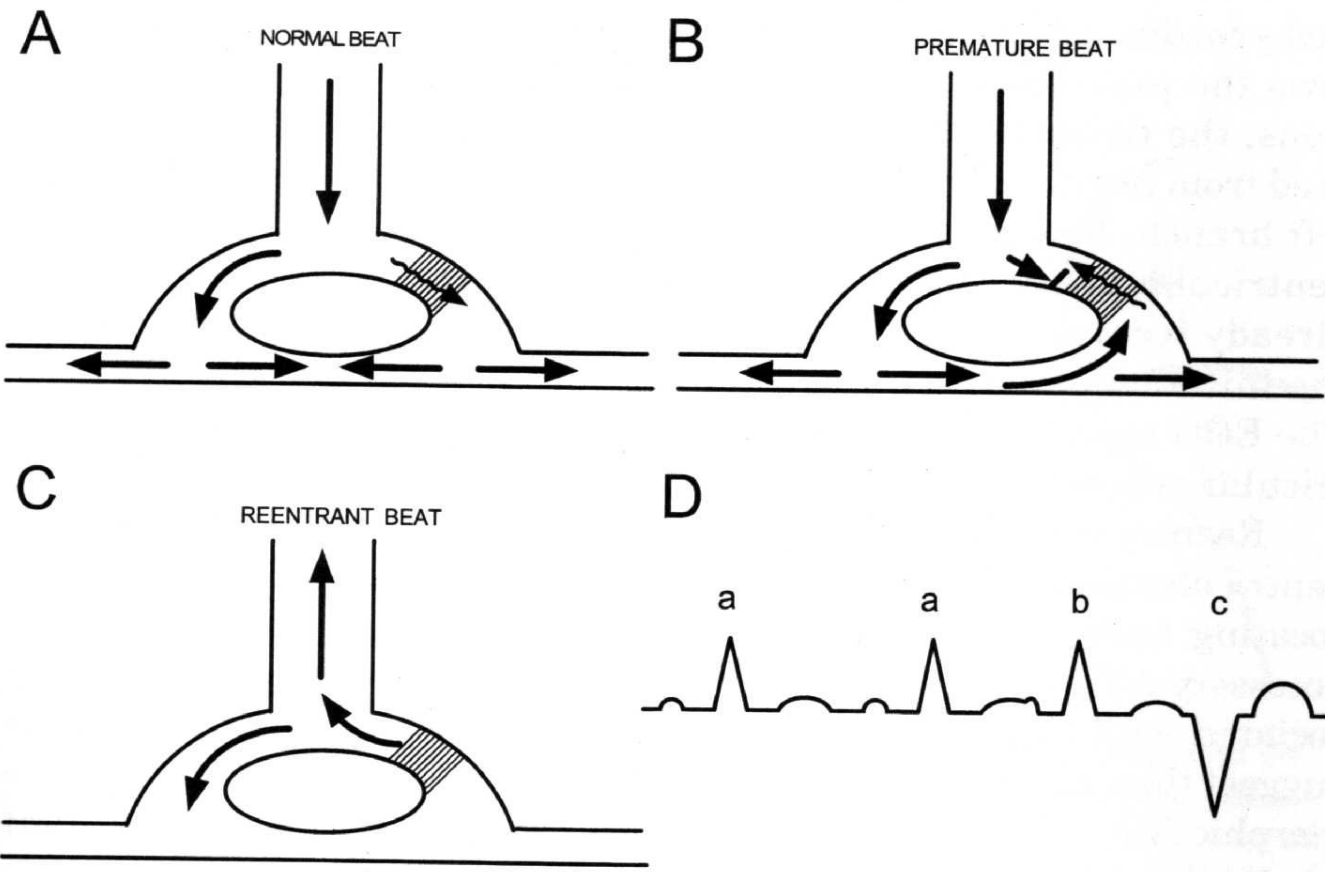
- א- המנגנון השכיח ביותר לאריתמיות באדם
- ב- אחראי לאריתמיה בתסמונת ברוגדה
- ג- אחראי עיקרי ל VT לאחר אוטם ישן
- ד- חסם חד כיווני אינו תנאי הכרחי להתחלתו
- ה- בטכיקרדיה, אורך הגל קצר מאורך המסלול

התשובה הנכונה – ד'

Circus Movement Reentry

1. Intact anatomic circuit
2. Unidirectional block (onset)
3. Area of slow conduction
4. Wavelength of tach. $<$ length of circuit



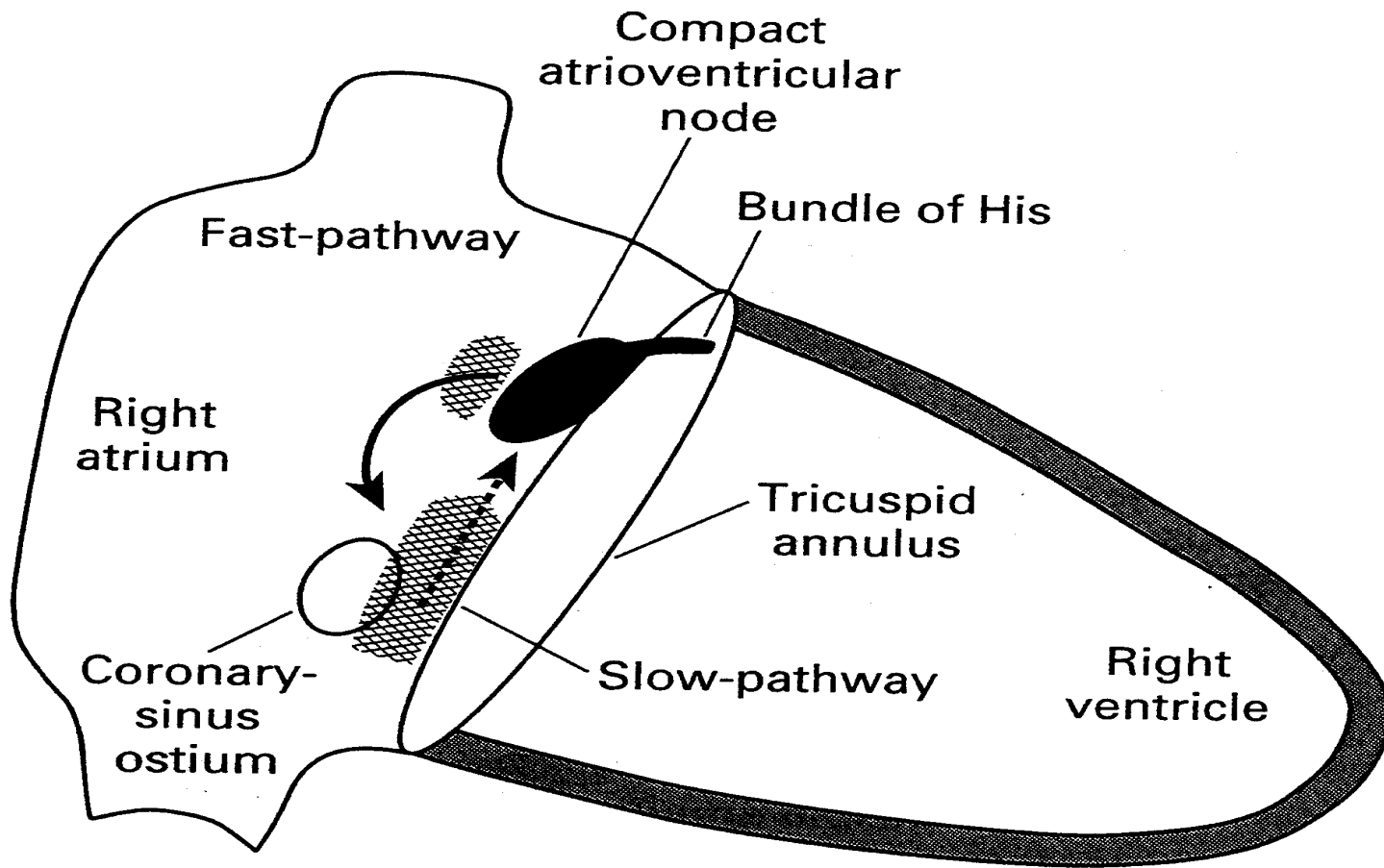


Reentry

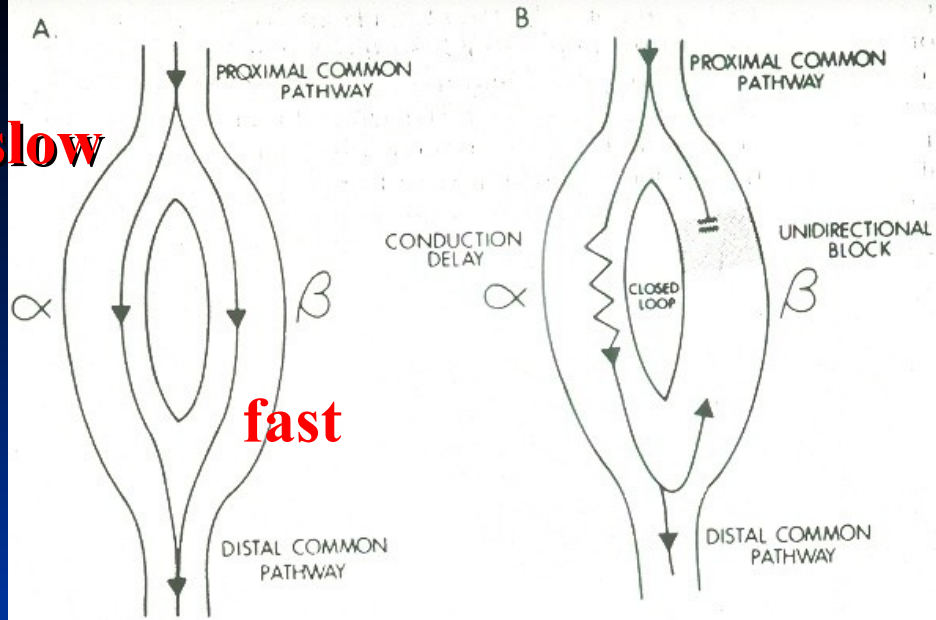
EPS-Diagnosis

1. Continuous electric activity
2. Inducibility/termination by electrical stimulation
3. Inverse relationship of C.I. of initiating extra-stimulus/1st tachycardia beat
4. Entrainment (resetting) by external stimuli

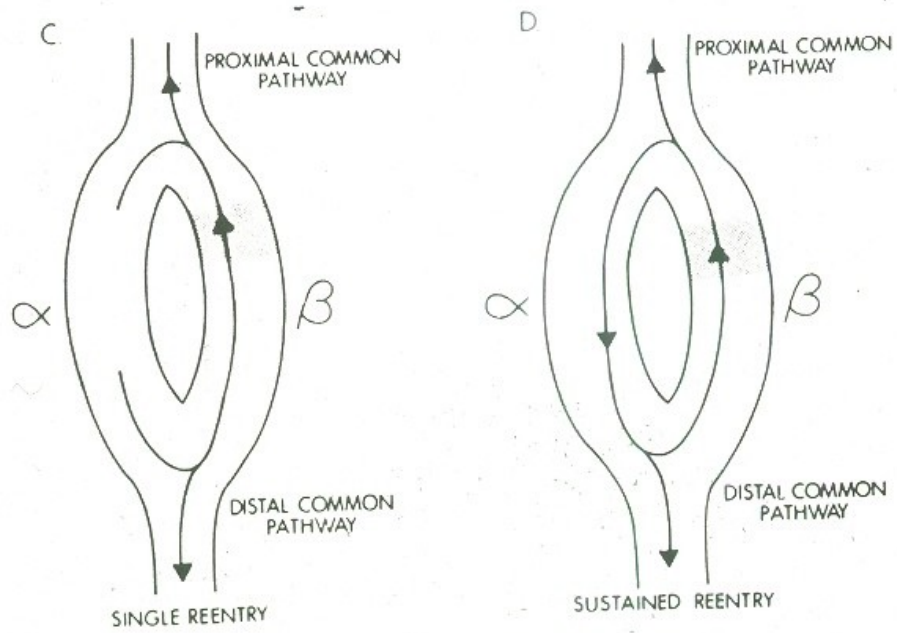
AVNRT

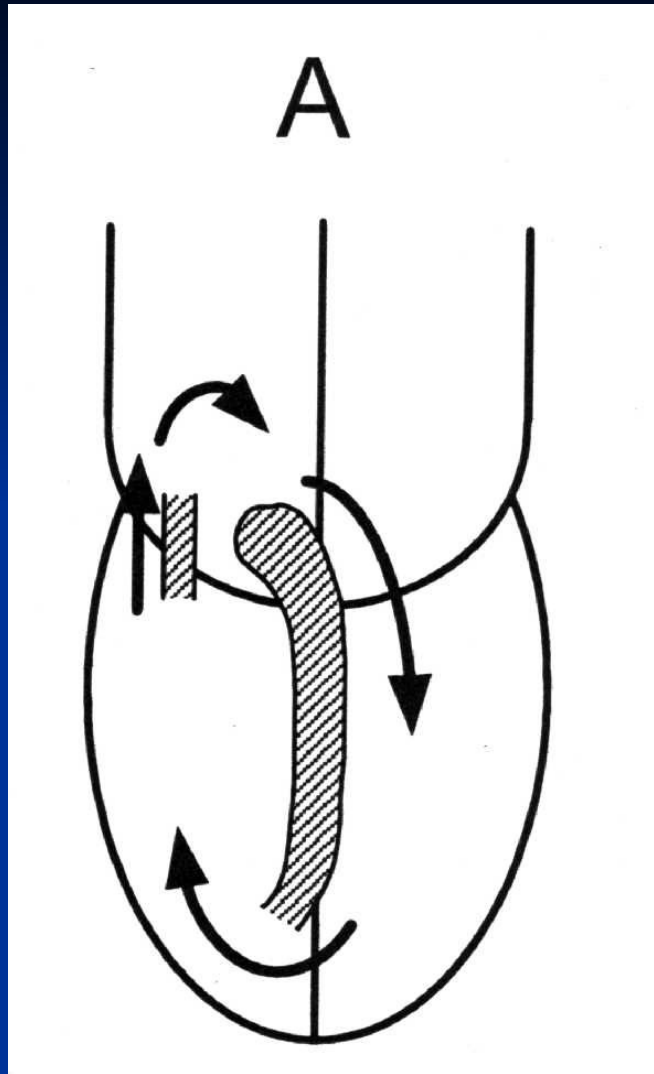


slow

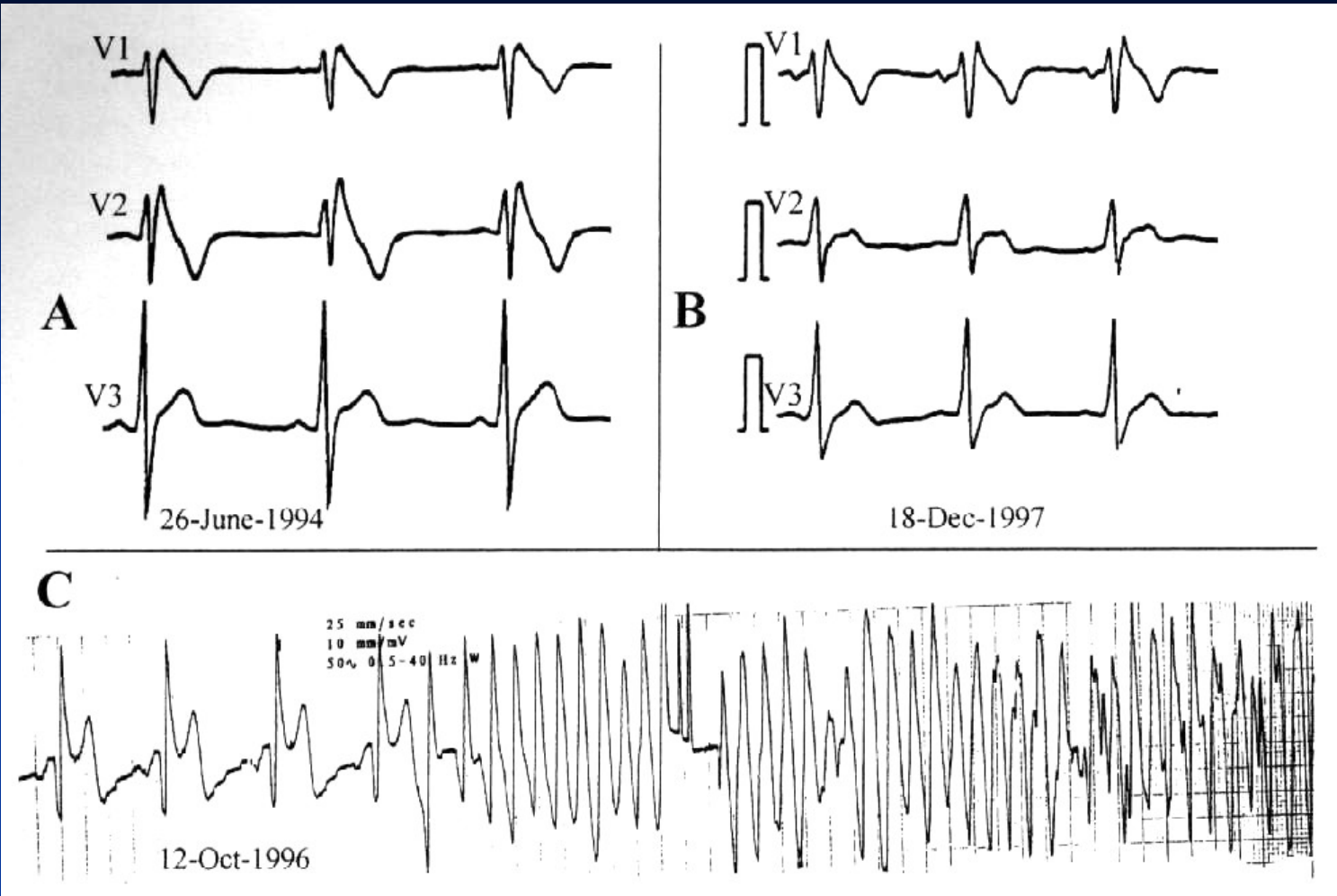


fast

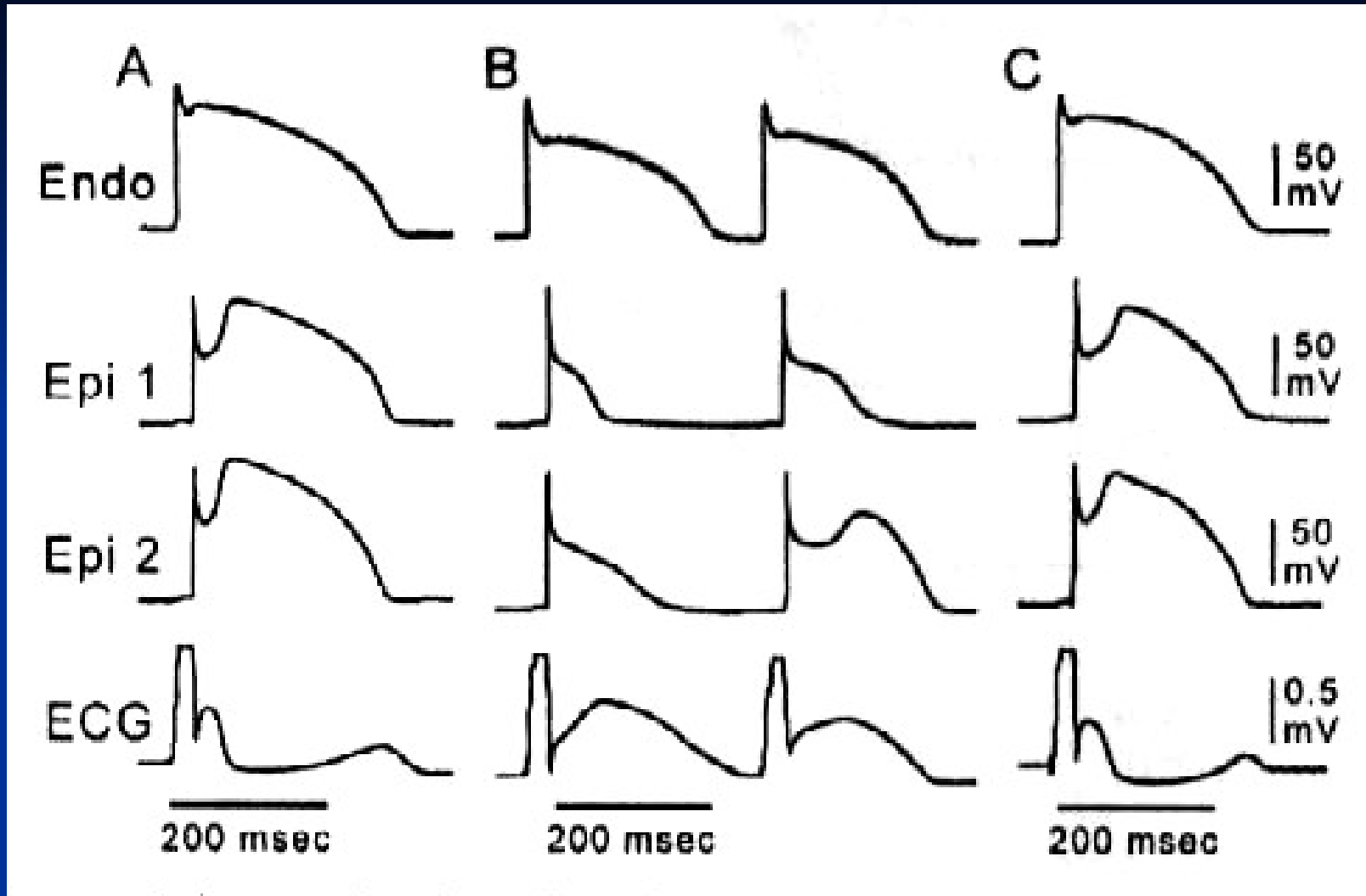




WPW Syndrome

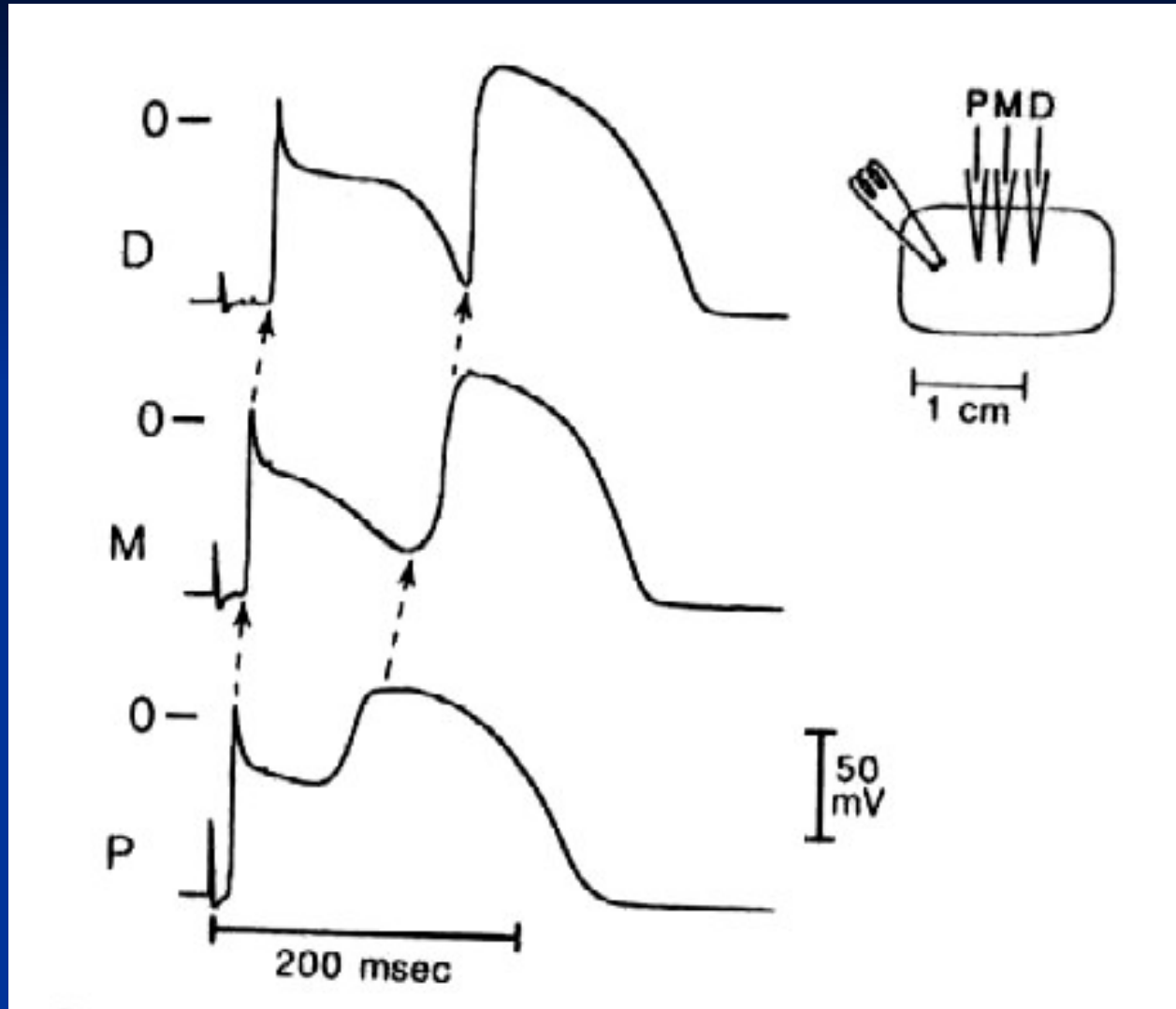


Viskin, Prog Cardiovasc Dis 1998;41:17



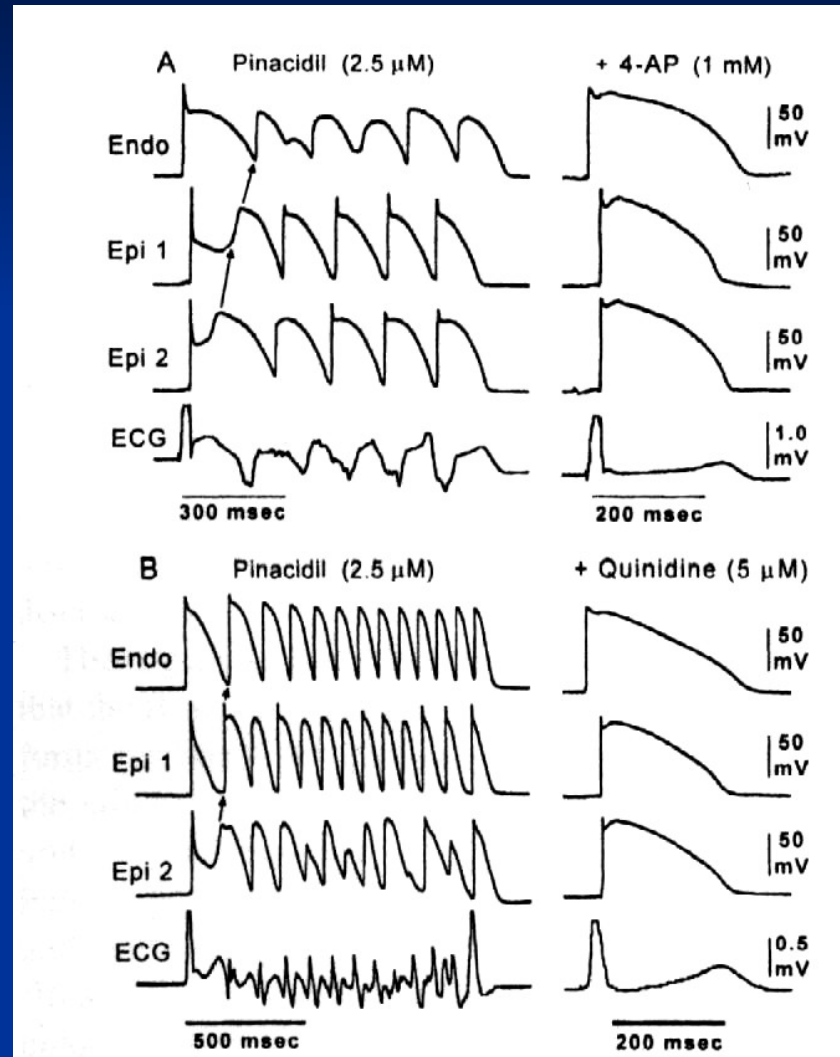
Yan Gan-Xin, Circulation 1999;100:1660

Phase II Reentry



Di Diego, Circulation 1993;88:1177

Phase II Reentry



Clinical Reentry Tachyarrhythmias

Definite

SANRT

AVNRT

AVRT

A Flutter

Post MI VT

BBR VT

Probable

A Fibrillation

PVT

VF