Corso di Laurea Magistrale in "Medicina e Chirurgia"

Biofisica e Fisiologia I

Potenziale di membrana (II)

Conduttance equation

Carica stazionaria: i flussi di carica sono uguali ed opposti. $J_K = - J_{Na}$

$$i_K = -i_{Na}$$

$$i_K = g_K(E_m - E_K) \qquad i_{Na} = g_{Na}(E_m - E_{Na})$$

$$g_K(Em - E_K) = -g_{Na}(E_m - E_{Na})$$

$$E_m = \frac{g_k \cdot E_k + g_{Na} \cdot E_{Na}}{g_k + g_{Na}}$$

$$E_m = \frac{E_k + \frac{g_{Na}}{g_k} \cdot E_{Na}}{1 + \frac{g_{Na}}{g_k}}$$

$$E_m = \frac{E_K + (g_{Na}/g_K)\, E_{Na}}{1 + (g_{Na}/g_K)}$$

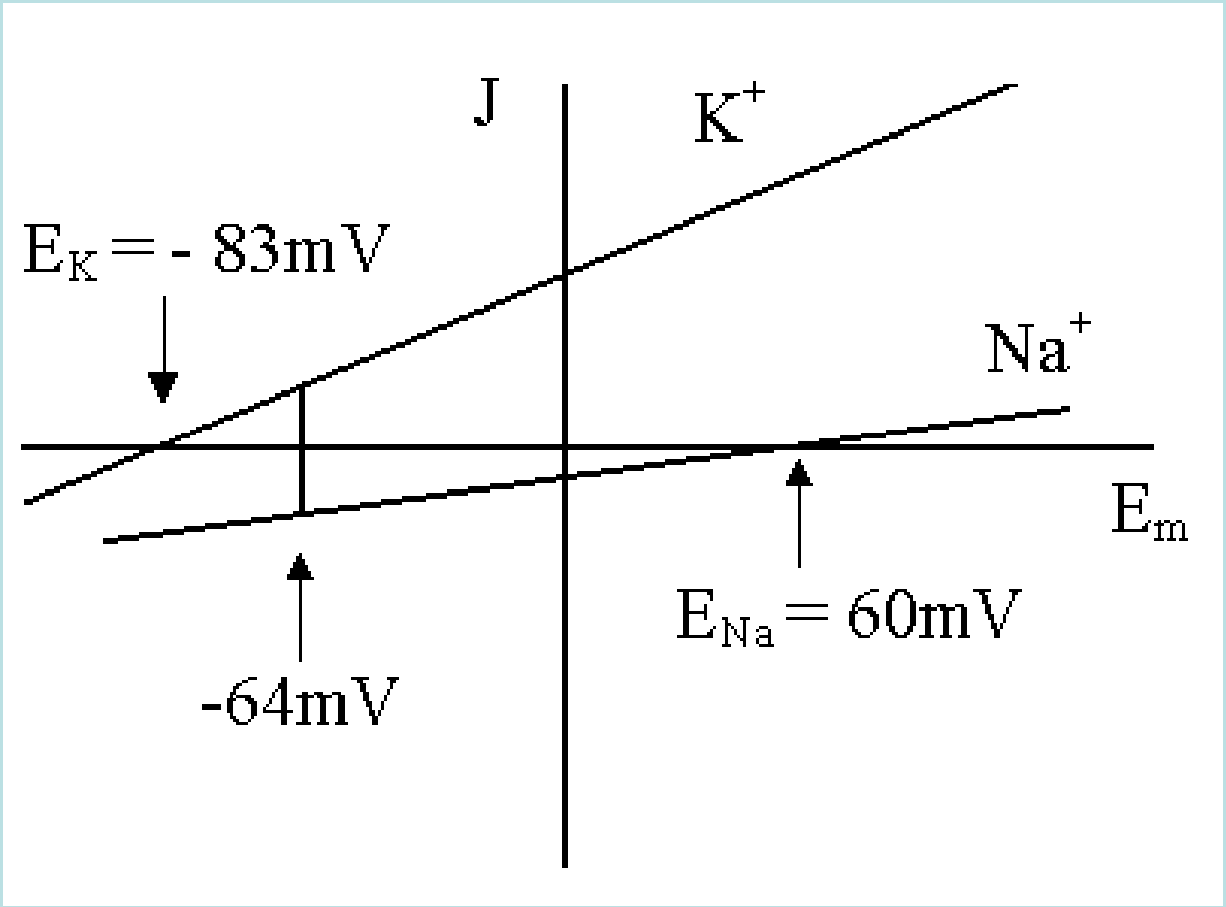
$E_K = -83\text{mV}$
$E_{Na} = +60\text{mV}$
$(g_K/g_{Na}) = 0.15$

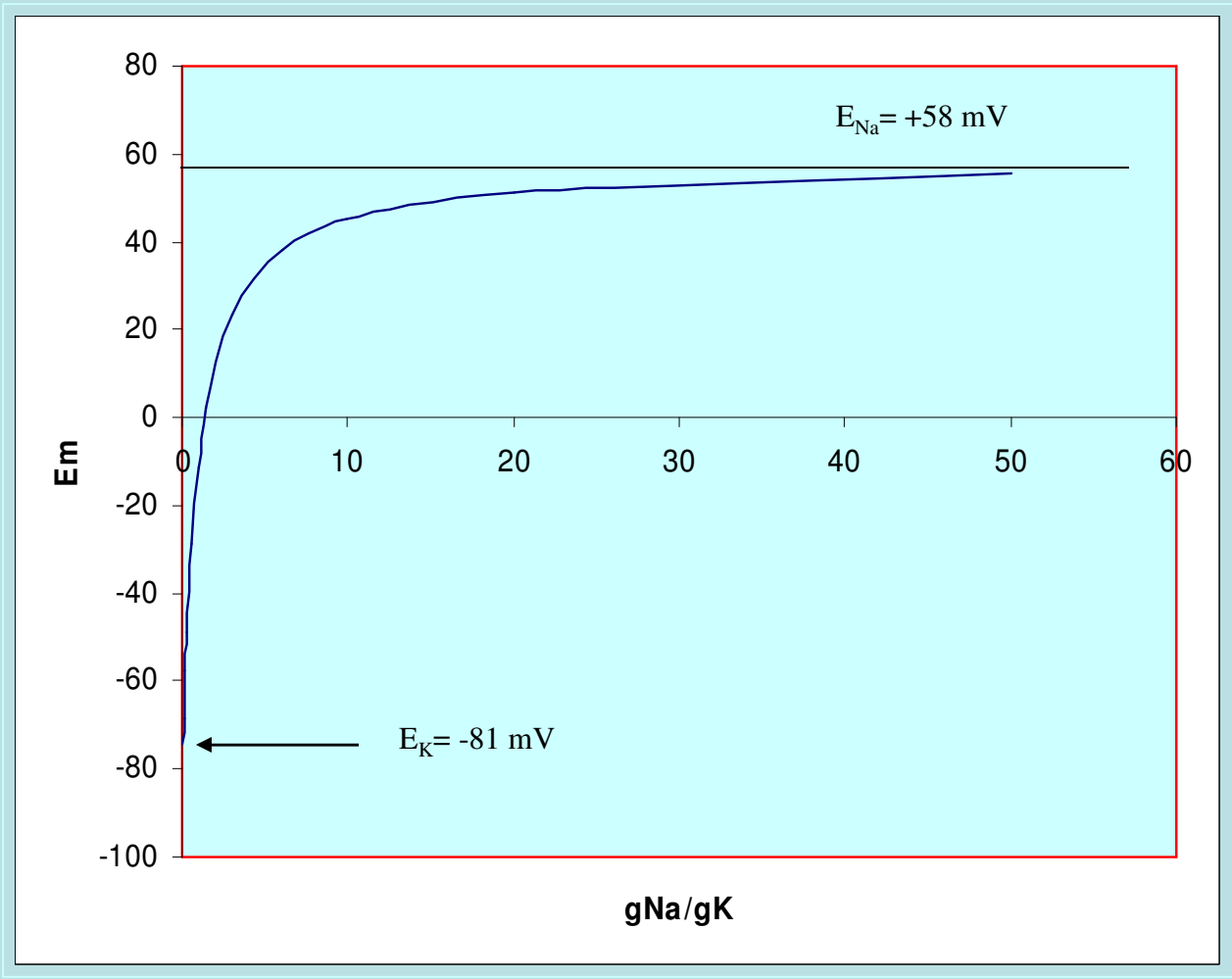
$\longrightarrow$ $E_m = -64\text{mV}$

$\mathbf{E_K < E_m}$
$\mathbf{E_{Na} > E_m}$

$\longrightarrow$

$\mathbf{J_{K,1\rightarrow 2} \neq J_{K,2\rightarrow 1}}$
$\mathbf{J_{Na,1\rightarrow 2} \neq J_{Na,2\rightarrow 1}}$


J
K+
EK = - 83mV
Na+
Em
ENa = 60mV
-64mV


80
60
40
20
0
-20
-40
-60
-80
-100
0
10
20
30
40
50
60
Em
gNa/gK
E_{Na}= +58 mV
E_K= -81 mV

Conduttance equation

$$E_m = \frac{g_k \cdot E_k + g_{Na} \cdot E_{Na} + g_{Cl} \cdot E_{Cl}}{g_k + g_{Na} + g_{Cl}}$$

$$E_m = \frac{E_k + \frac{g_{Na}}{g_k} \cdot E_{Na} + \frac{g_{Cl}}{g_k} \cdot E_{Cl}}{1 + \frac{g_{Na}}{g_k} + \frac{g_{Cl}}{g_k}}$$

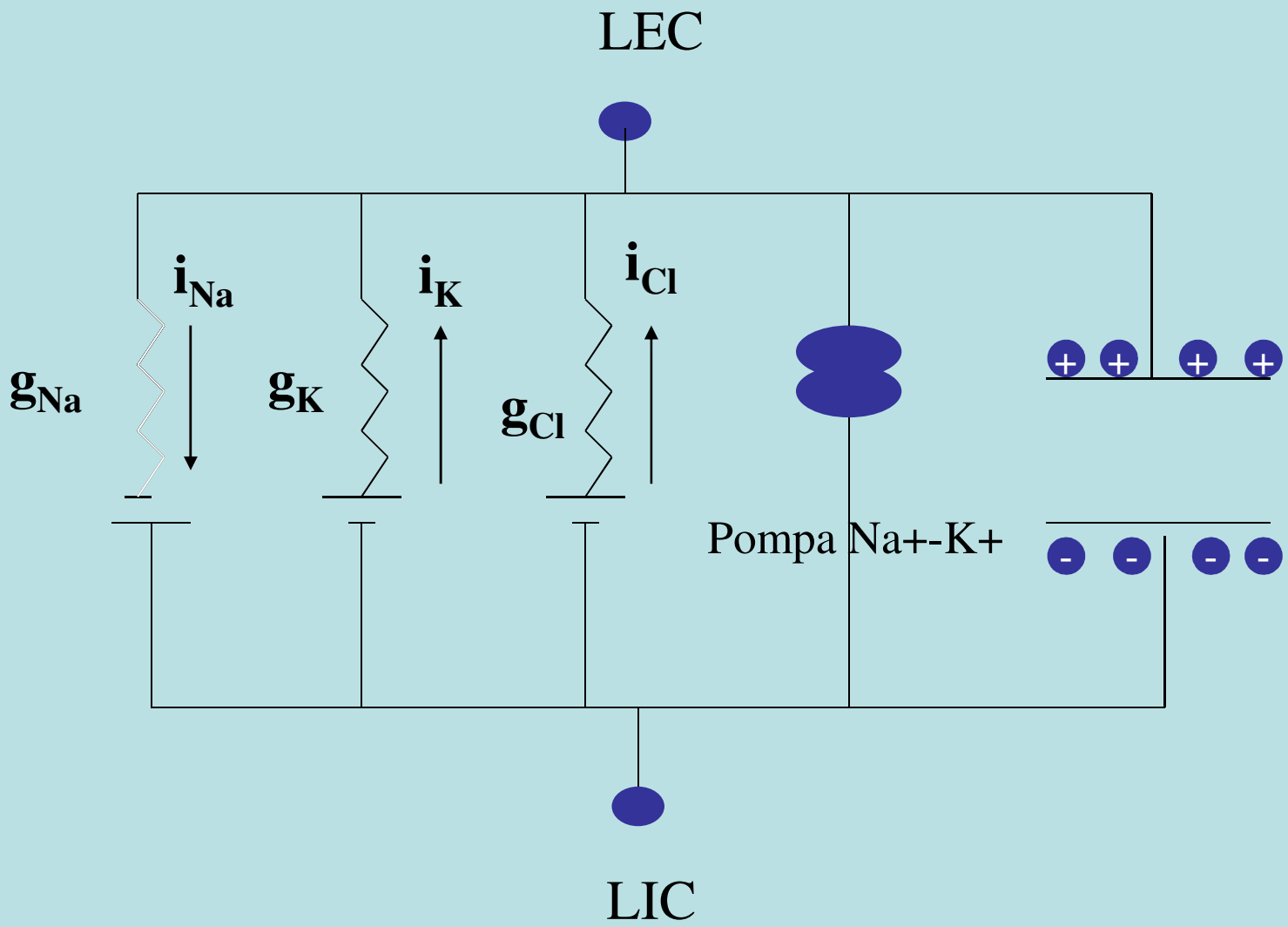
Conduttance equation

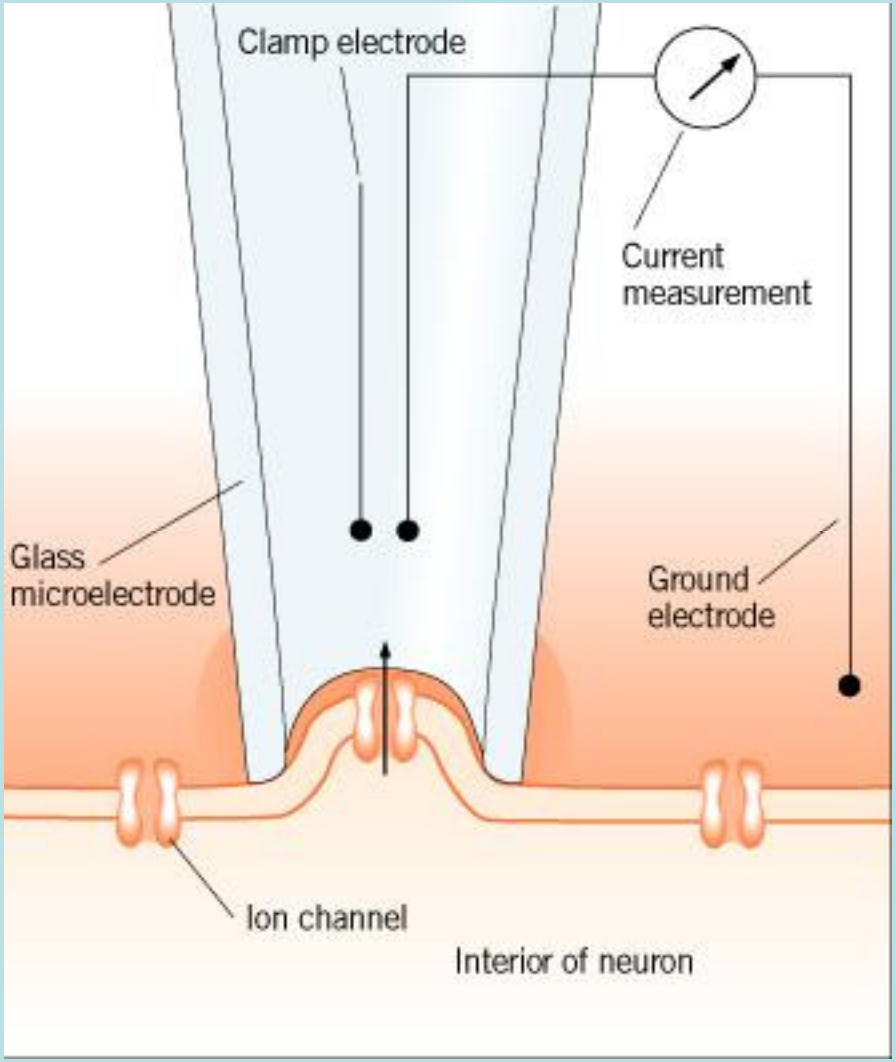
$$i_K + i_{Na} + i_{Cl} = 0$$

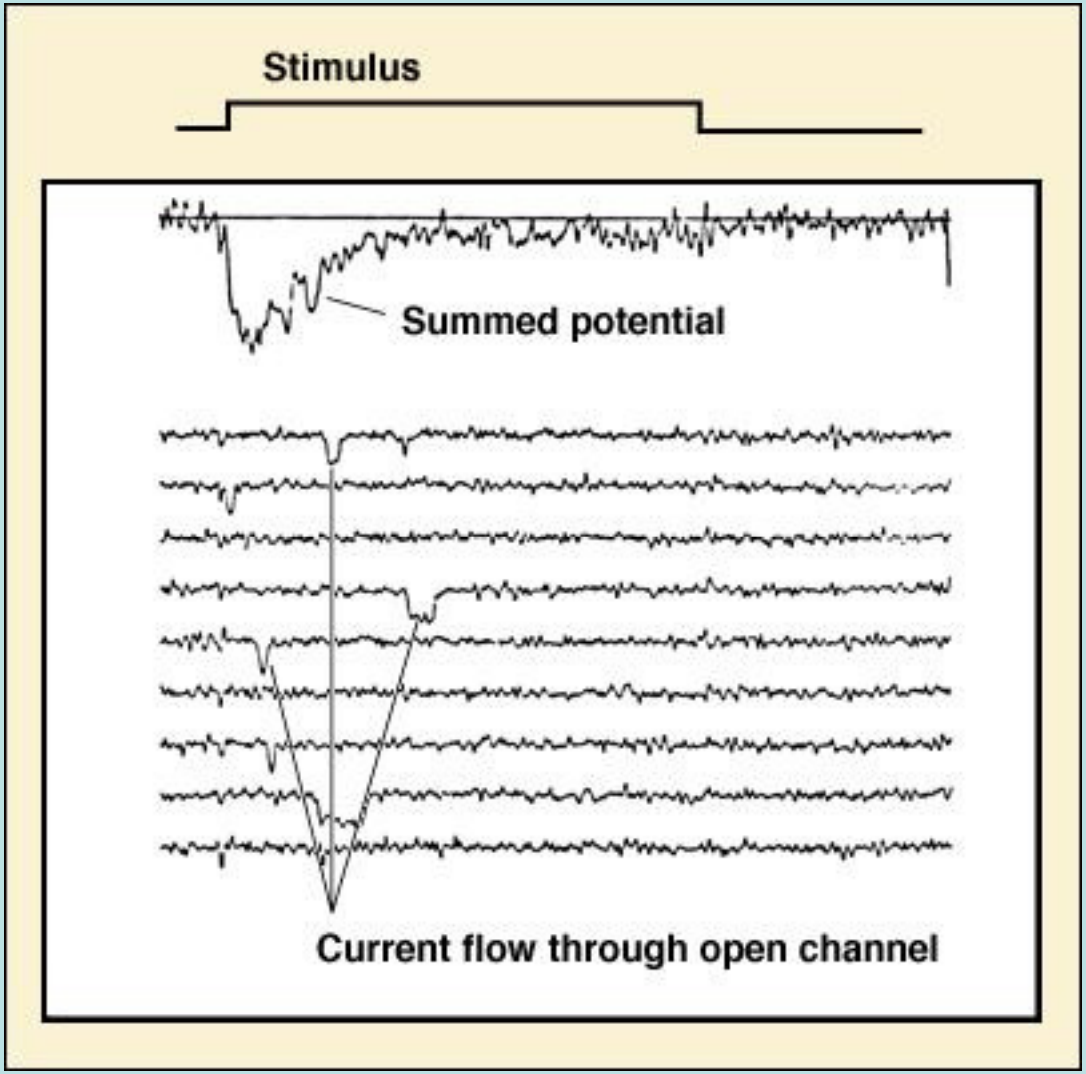
con $i_{Cl} = g_{Cl}(E_m - E_{Cl})$

se E_{Cl} è molto prossimo a E_m,
i_{Cl} è molto prossimo a 0

$$i_{Cl} = 0$$


LEC
i_{Na}
i_K
i_{Cl}
g_{Na}
g_K
g_{Cl}
Pompa Na+-K+
LIC


Clamp electrode
Current measurement
Glass microelectrode
Ground electrode
Ion channel
Interior of neuron


Stimulus
Summed potential
Current flow through open channel