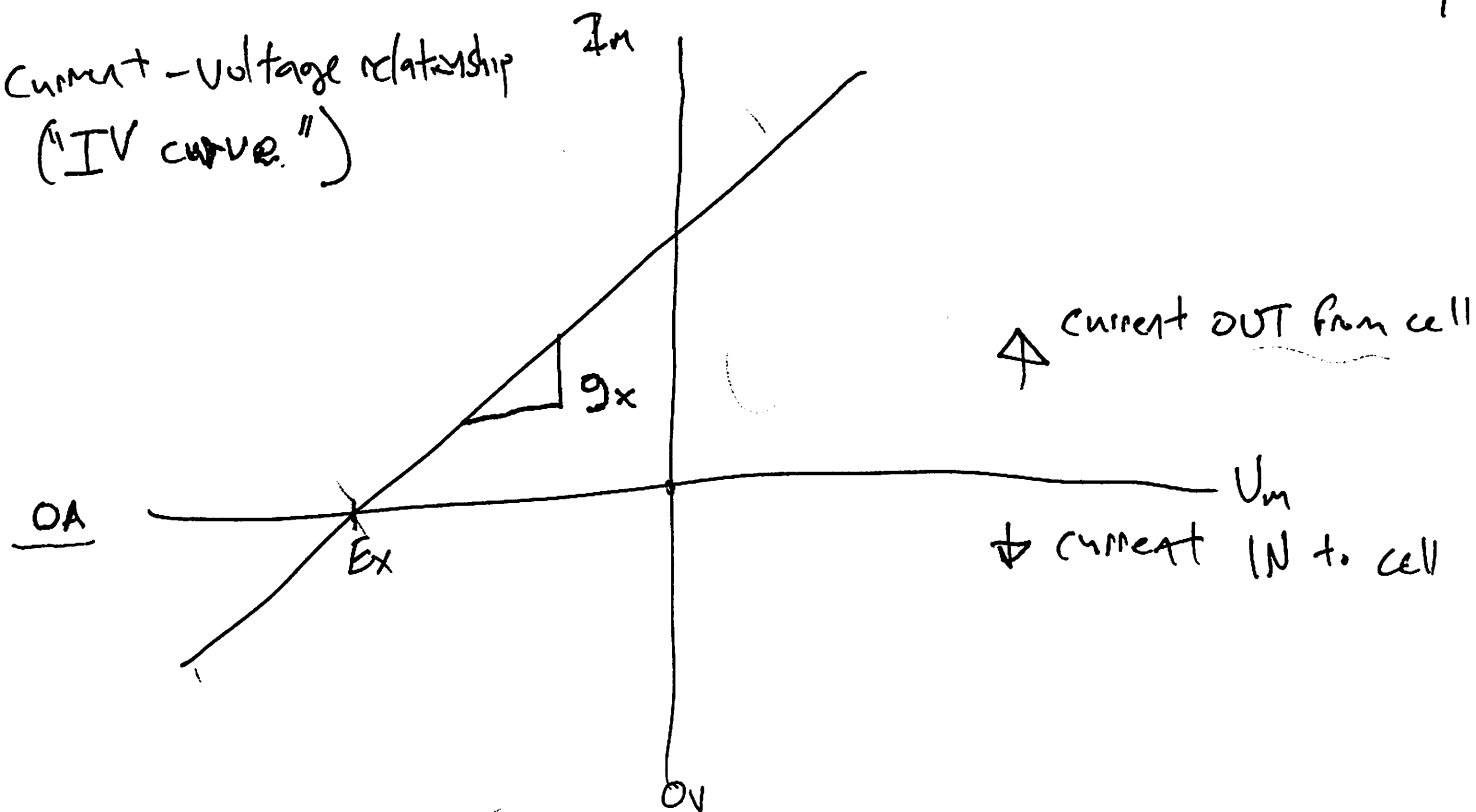


Current - Voltage relationship
("IV curve")

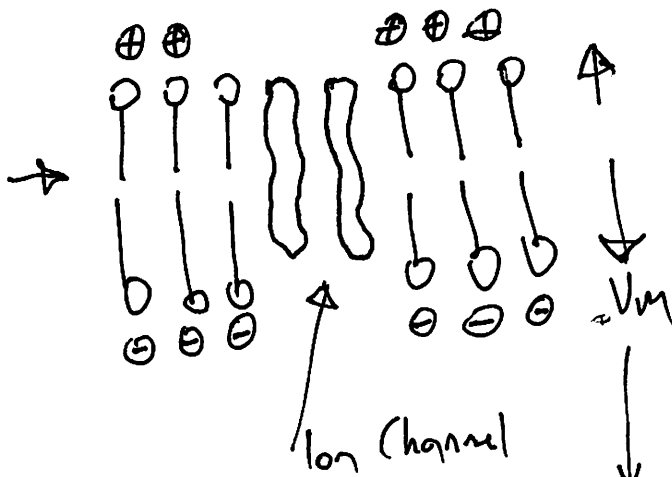


$$I_x = g_x (U_m - E_x)$$

g_x is conductance (Y_{Rx}) - units S
 E_x is the Nernst (electrochemical equilibrium) potential of ion X

I_x - current - units A
 - flow of positive charge

lipid bilayer

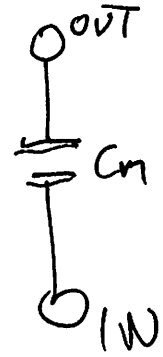
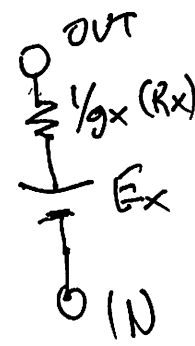


ion channel

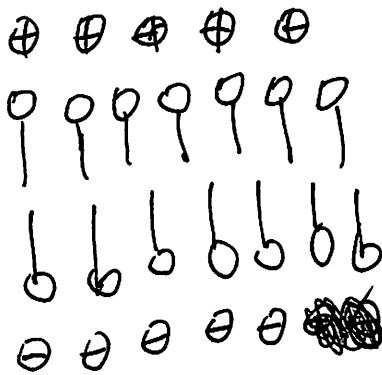
$V_m =$ transmembrane potential

Resistive

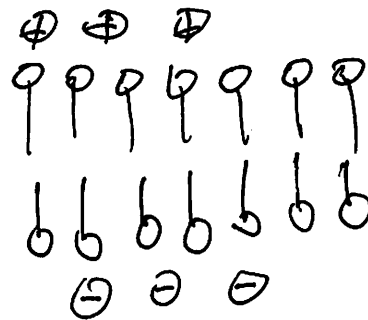
Capacitive



OUT



IN



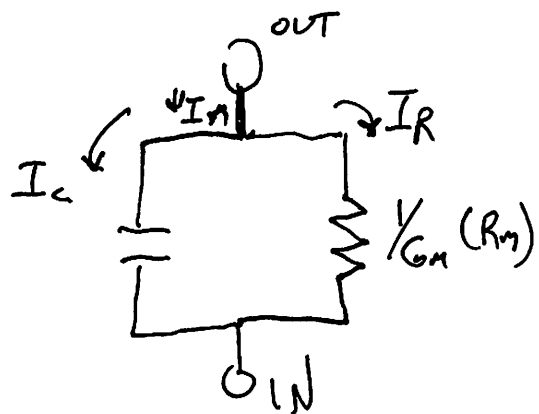
Has current flowed?
In what direction?

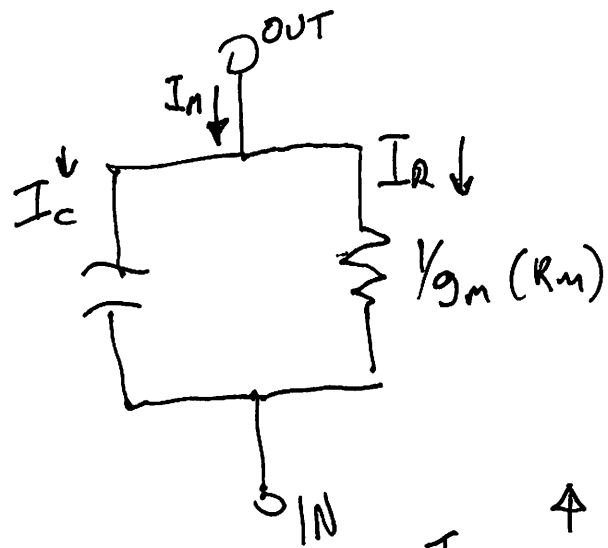
$$Q_m = C_m V_m$$

Q_m is charge

$$I_m = \frac{dQ_m}{dt} = C_m \frac{dV_m}{dt}$$

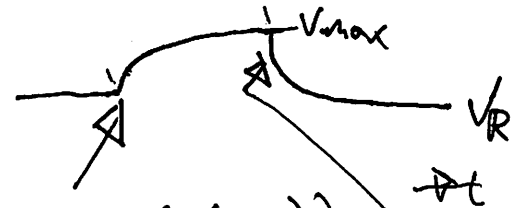
Note: Removing E_x battery
• assuming w.r.t. Nernst potential





$$I_m = I_c + I_R$$

time constant, $\tau_m = R_m C_m$



$$V = V_{max} (1 - \exp(-t/\tau_m))$$

$$V = V_{max} \exp(-t/\tau_m)$$