Introducción a la Bioelectricidad

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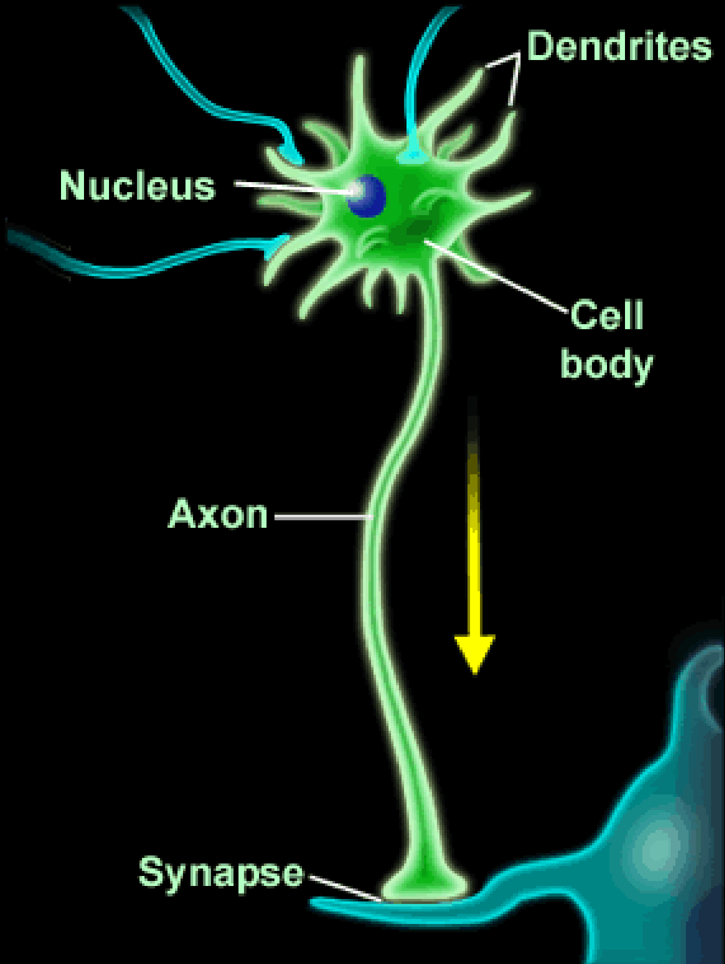
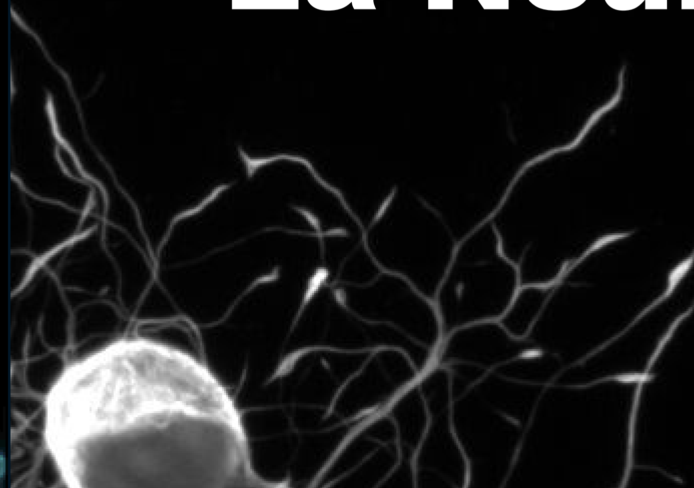
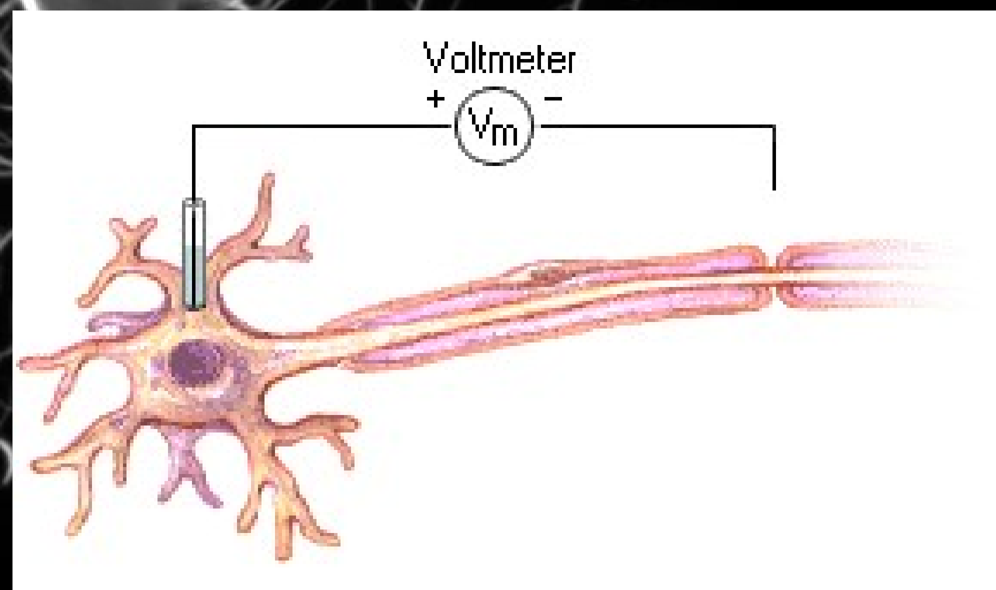
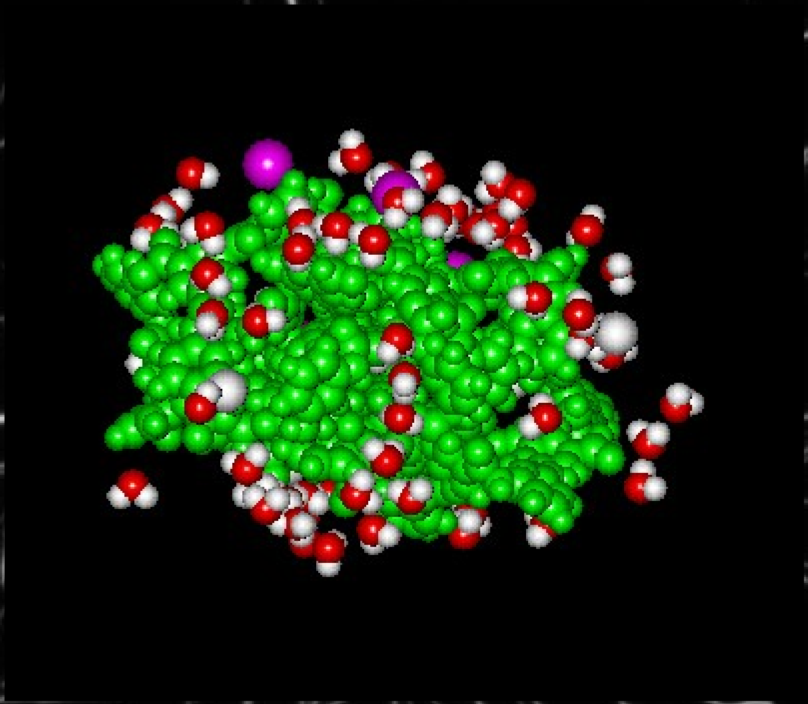
La Neurona



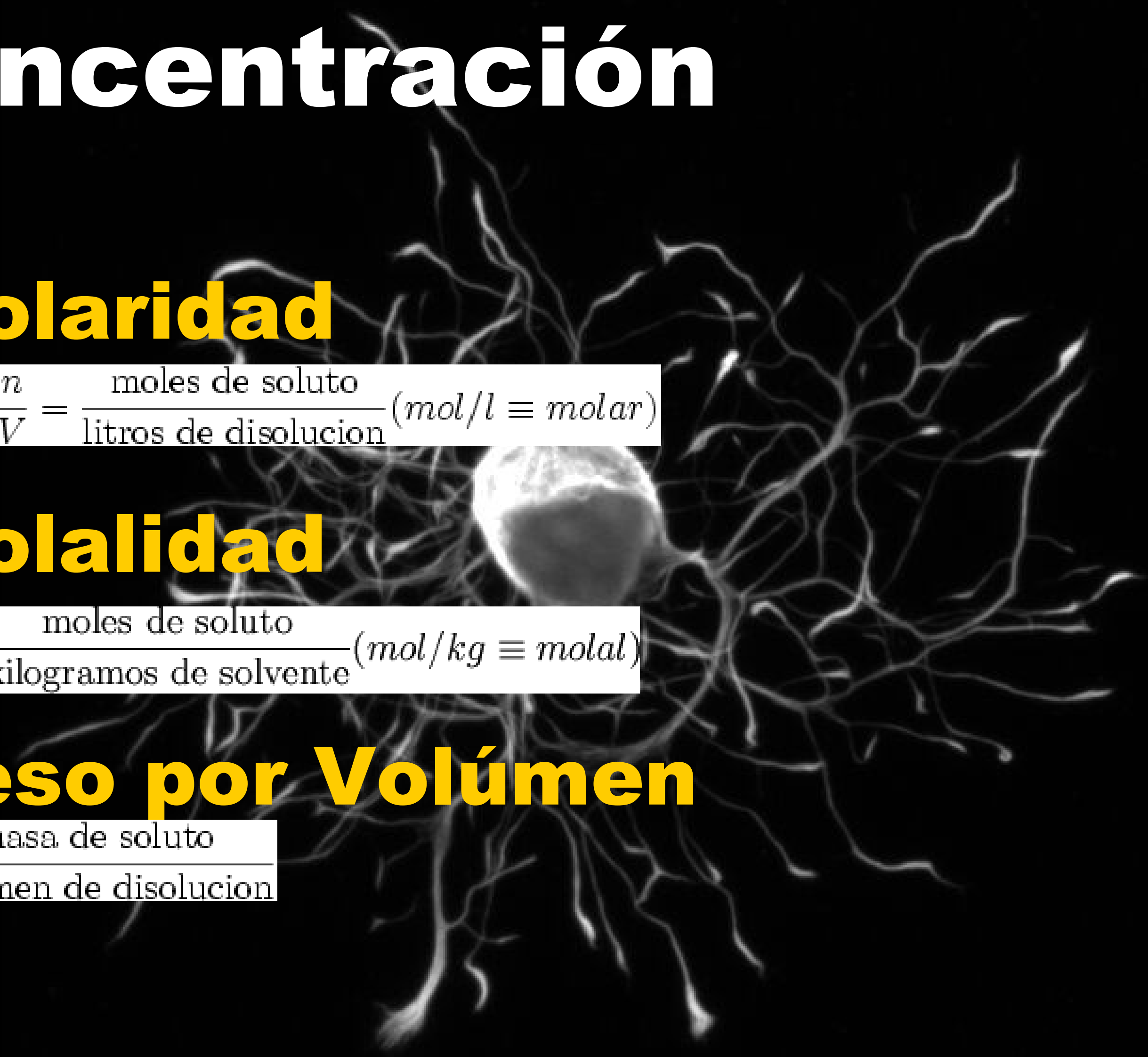




Soluciones



Concentración



- **Molaridad**

$$M = \frac{n}{V} = \frac{\text{moles de soluto}}{\text{litros de disolucion}} (mol/l \equiv molar)$$

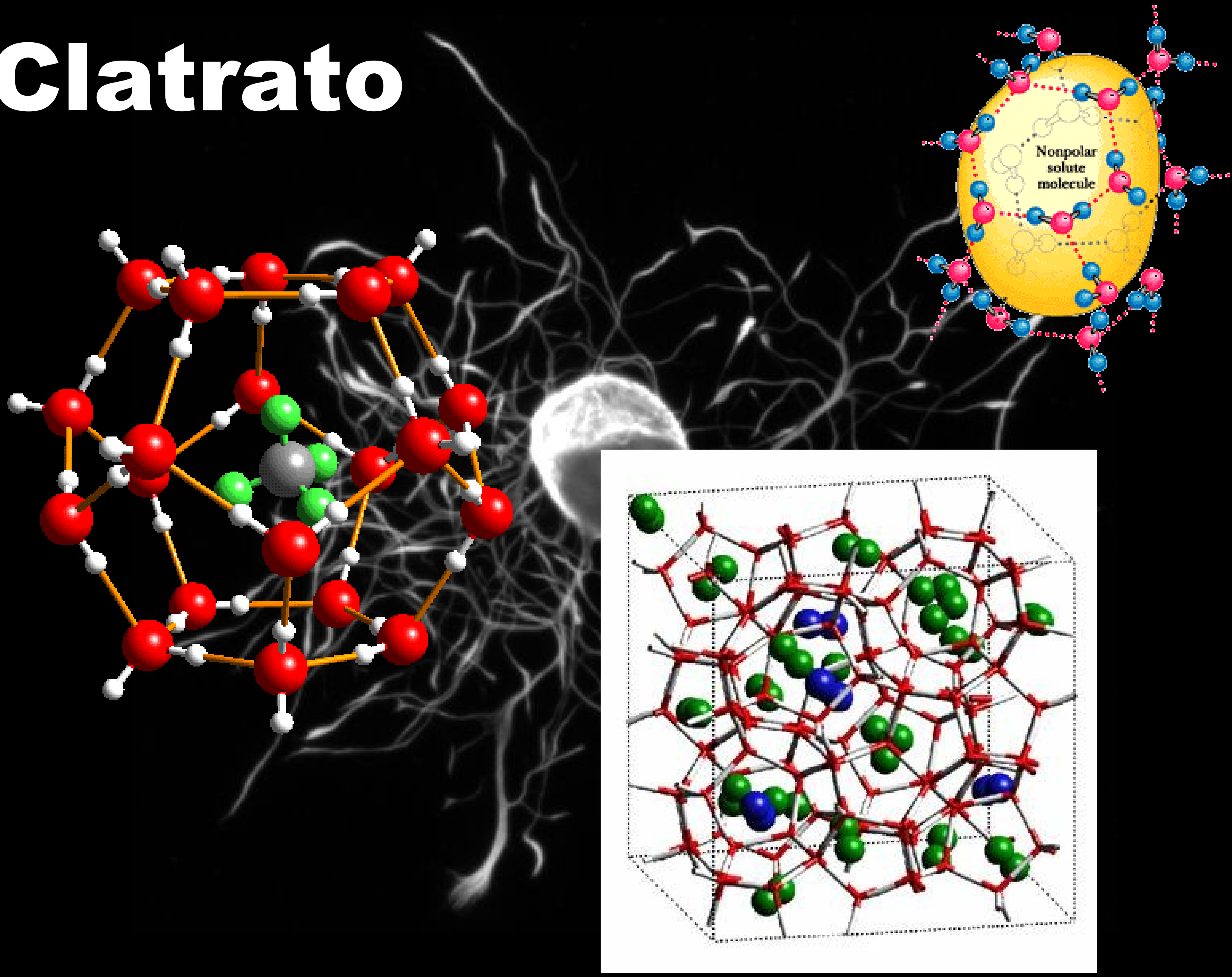
- **Molalidad**

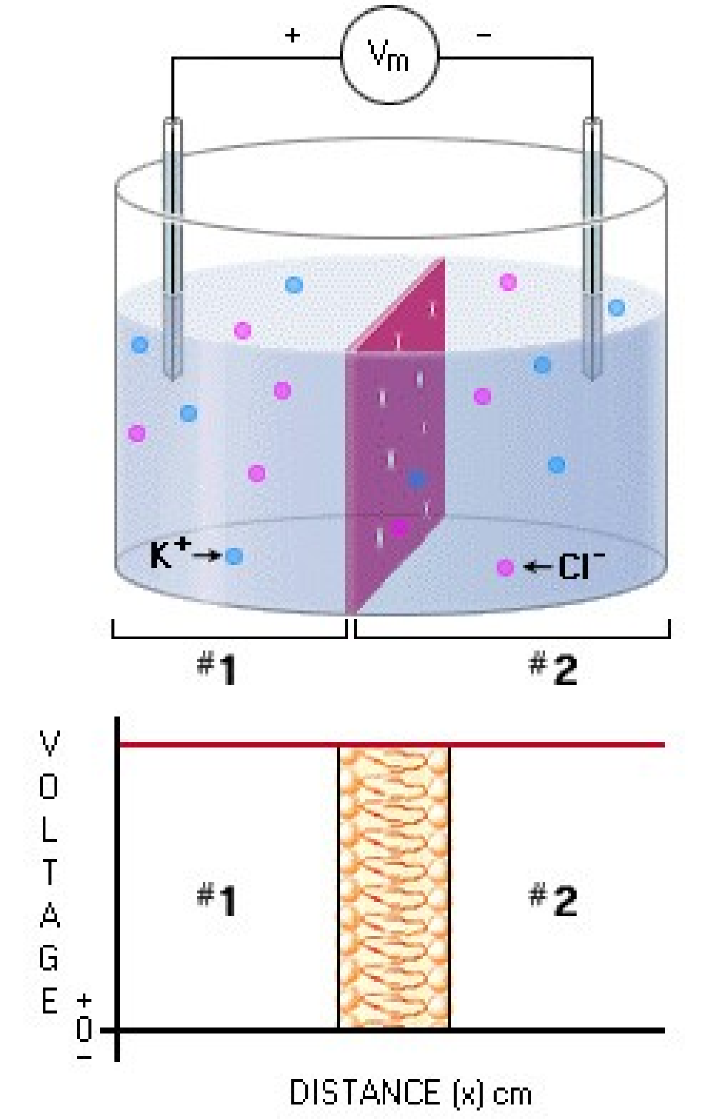
$$m = \frac{\text{moles de soluto}}{\text{kilogramos de solvente}} (mol/kg \equiv molal)$$

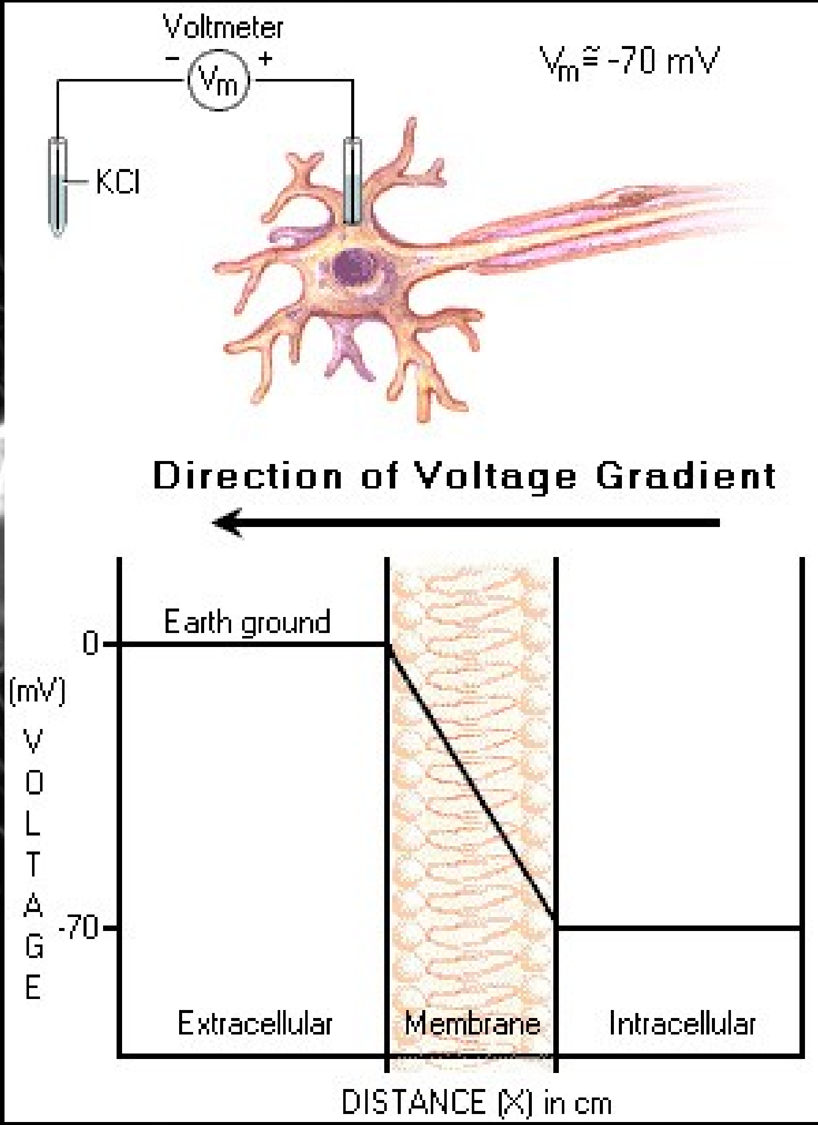
- **Peso por Volúmen**

$$\frac{\text{masa de soluto}}{\text{volumen de disolucion}}$$

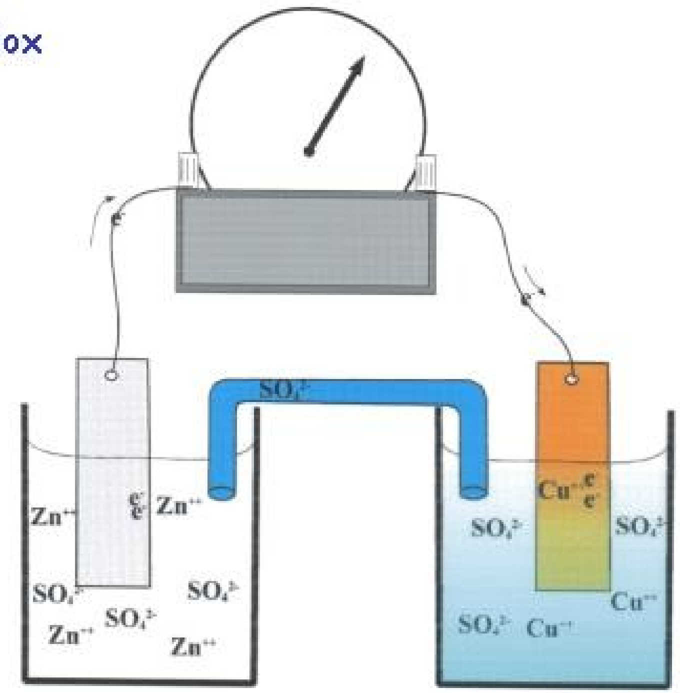
Clatrato




+
Vm
−
K+→
←Cl−
#1
#2
VOLTAGE
+
0
−
#1
#2
DISTANCE (x) cm


Voltmeter
−
Vm
+
Vm ≅ -70 mV
KCl
Direction of Voltage Gradient
Earth ground
0
(mV)
VOLTAGE
-70
Extracellular
Membrane
Intracellular
DISTANCE (X) in cm

Now can express any redox reaction in terms of the 2 half-cell reactions:



Reduction potential half cells:

$Zn^{++} + 2e^- \rightarrow Zn \qquad E^\circ = -0.763\ V$

$Cu^{++} + 2e^- \rightarrow Cu \qquad E^\circ = 0.337\ V$

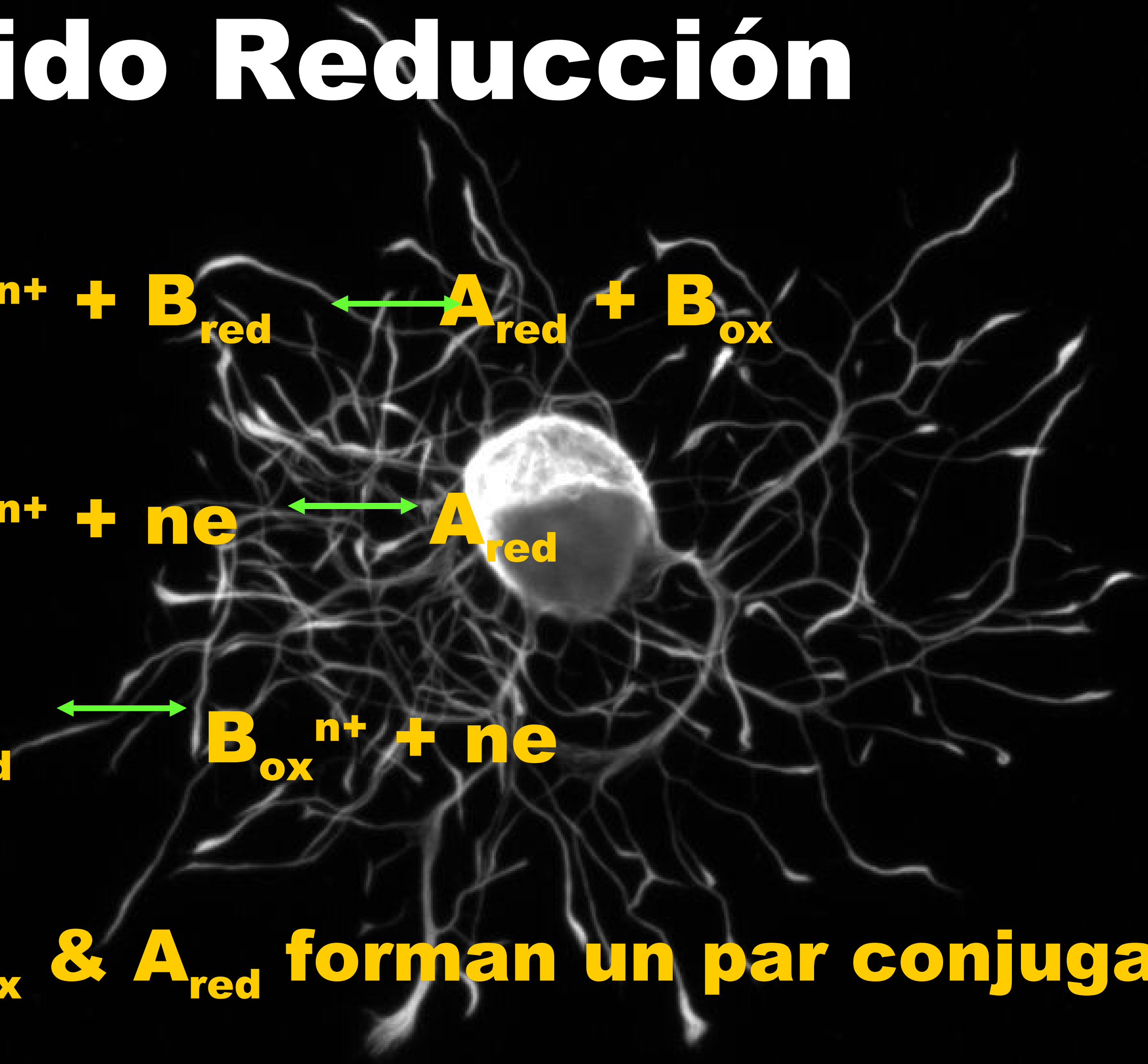
Overall:

$Zn \rightarrow Zn^{++} + 2e^- \qquad 0.763\ V$

$Cu^{++} + 2e^- \rightarrow Cu \qquad 0.337\ V$

$Zn + Cu^{++} \rightarrow Zn^{++} + Cu \qquad 1.100\ V$

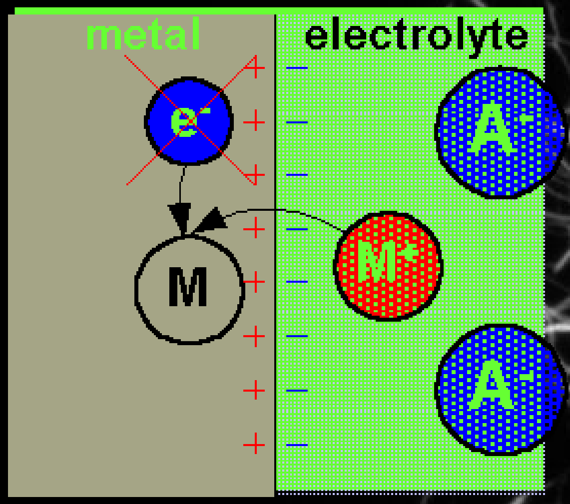
Óxido Reducción



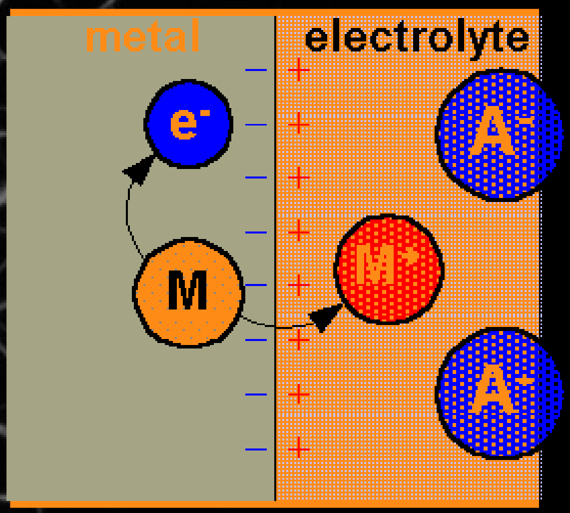
- $A_{ox}^{n+} + B_{red} \leftrightarrow A_{red} + B_{ox}$
- $A_{ox}^{n+} + ne \leftrightarrow A_{red}$
- $B_{red} \leftrightarrow B_{ox}^{n+} + ne$
- (A_{ox} & A_{red} forman un par conjugado)

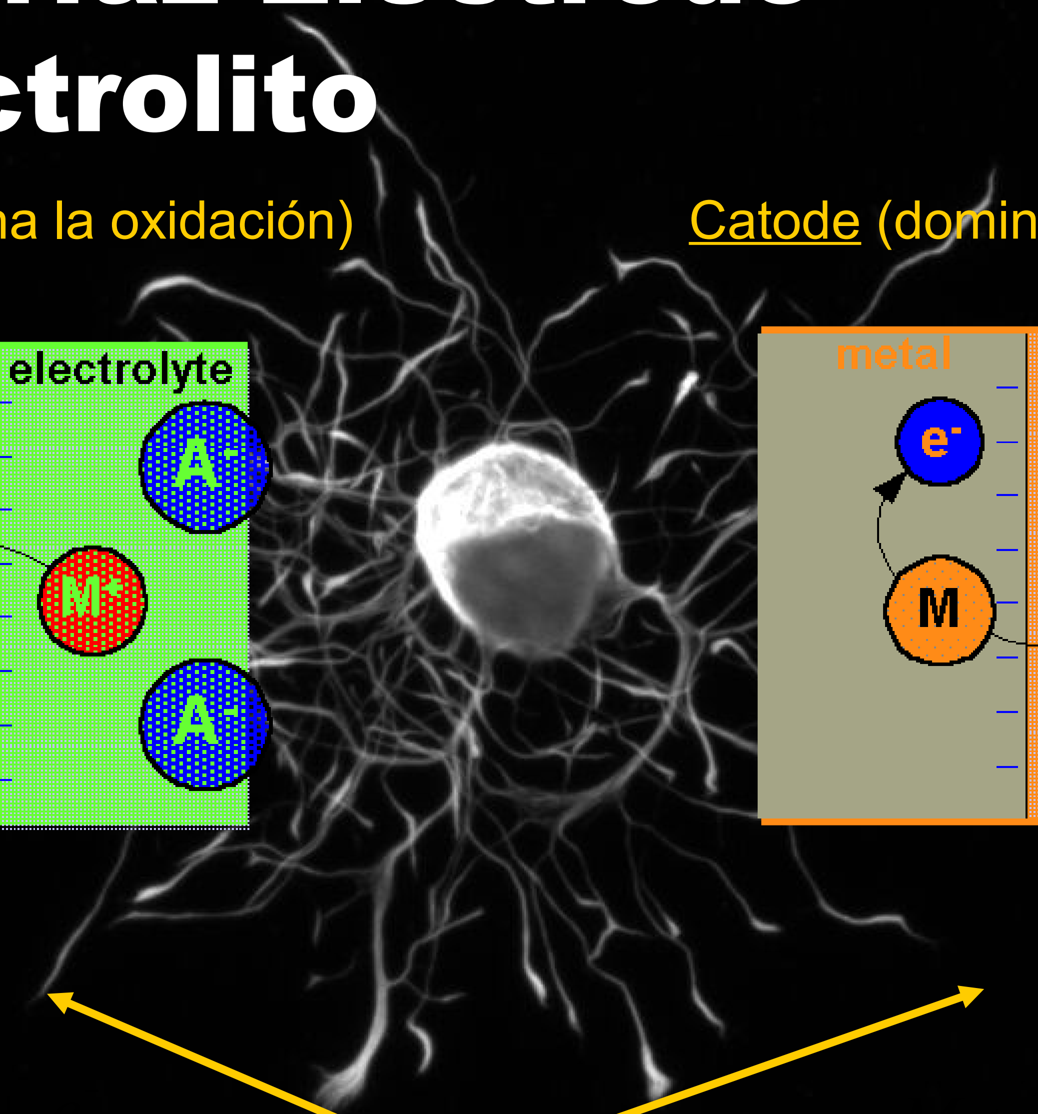
Interfaz Electrodo-Electrolito

<u>Anodo</u> (domina la oxidación)



<u>Catode</u> (domina la reducción)

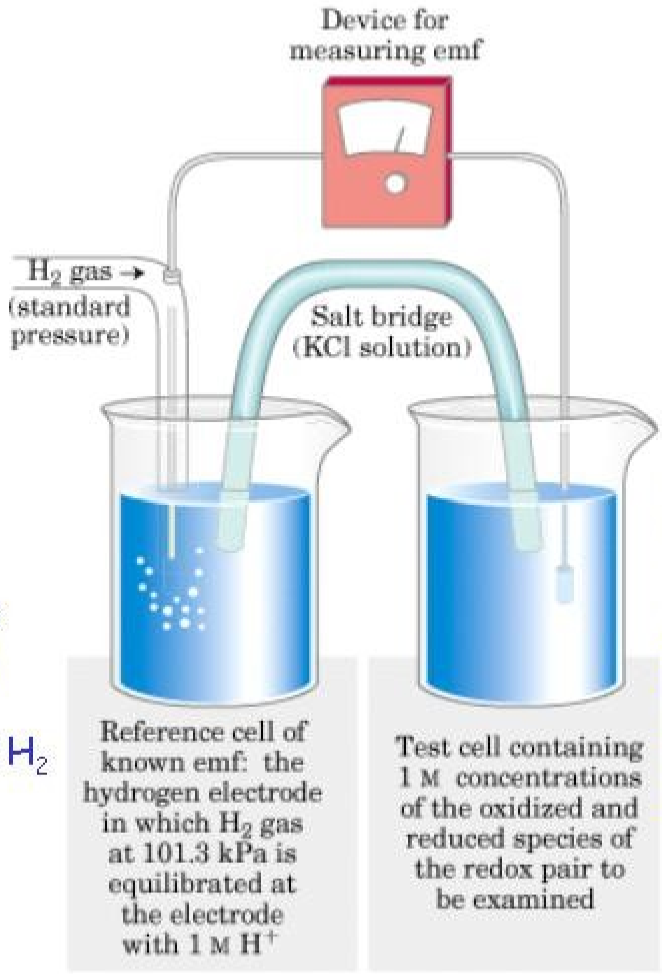




E_{hc} creada por separación de cargas hydrogen electrode (reference electrode)

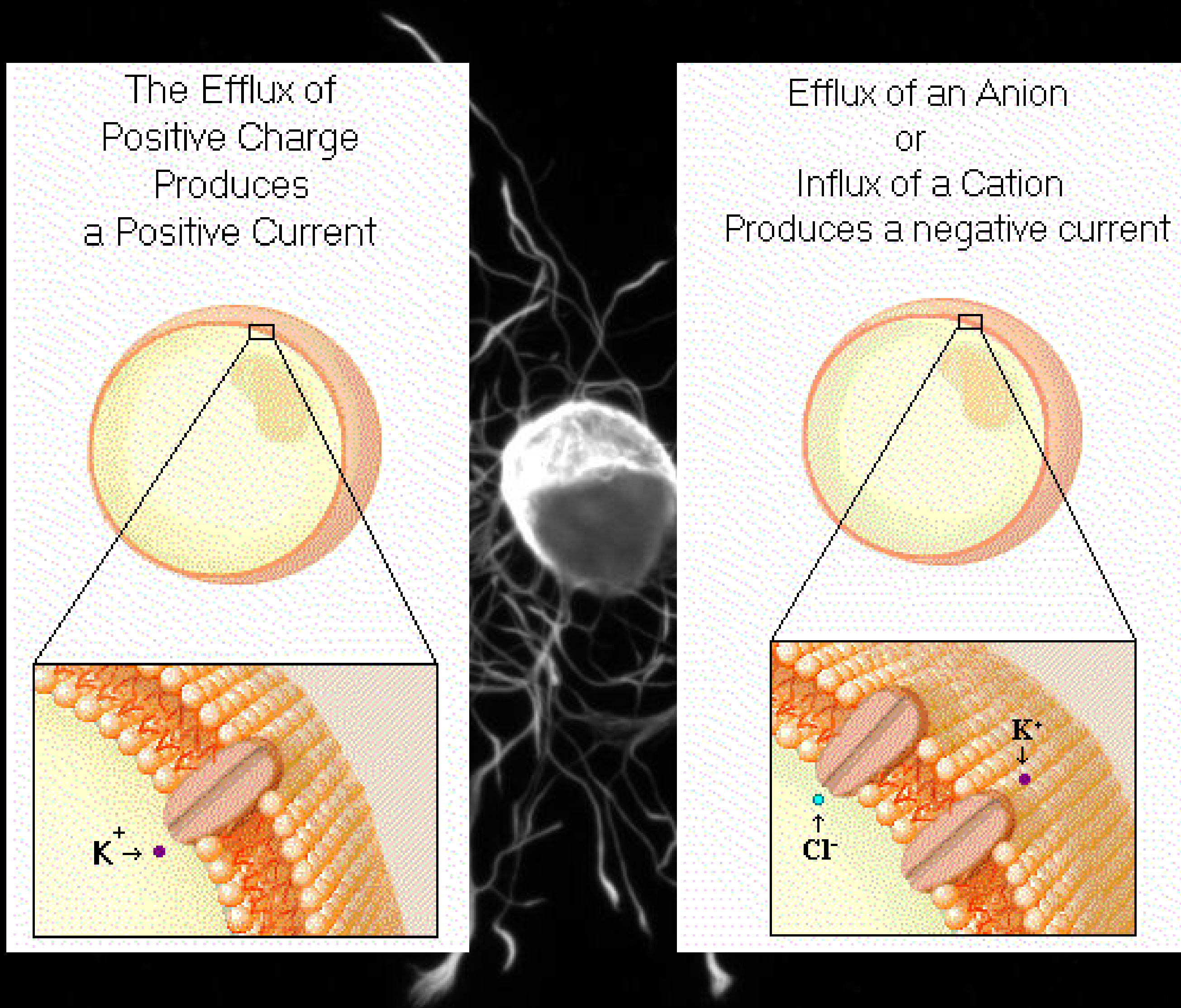
$H^+ + e^- \rightarrow 1/2\ H_2$

$E° = 0$ V

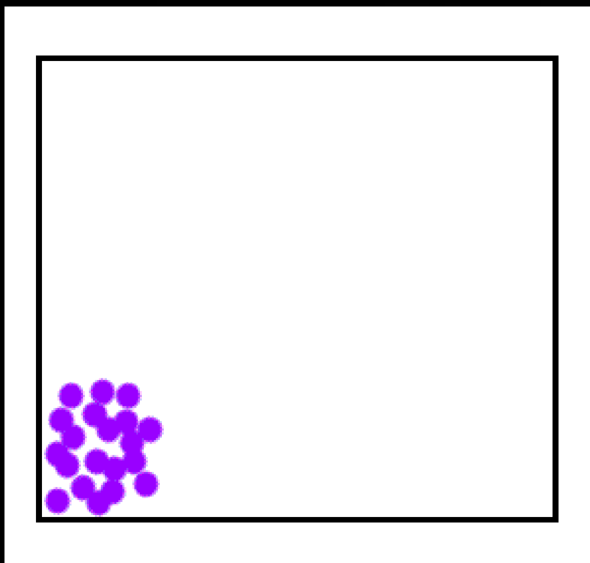


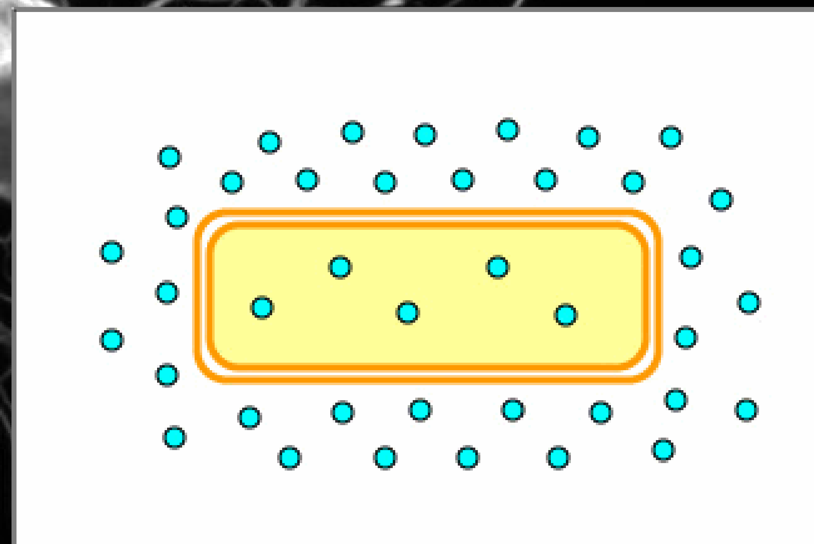
test electrode

electrons flow from 1/2 cell of lower standard reduction potential ($E°$) to 1/2 cell of higher $E°$.


The Efflux of
Positive Charge
Produces
a Positive Current
K+
Efflux of an Anion
or
Influx of a Cation
Produces a negative current
K+
Cl-

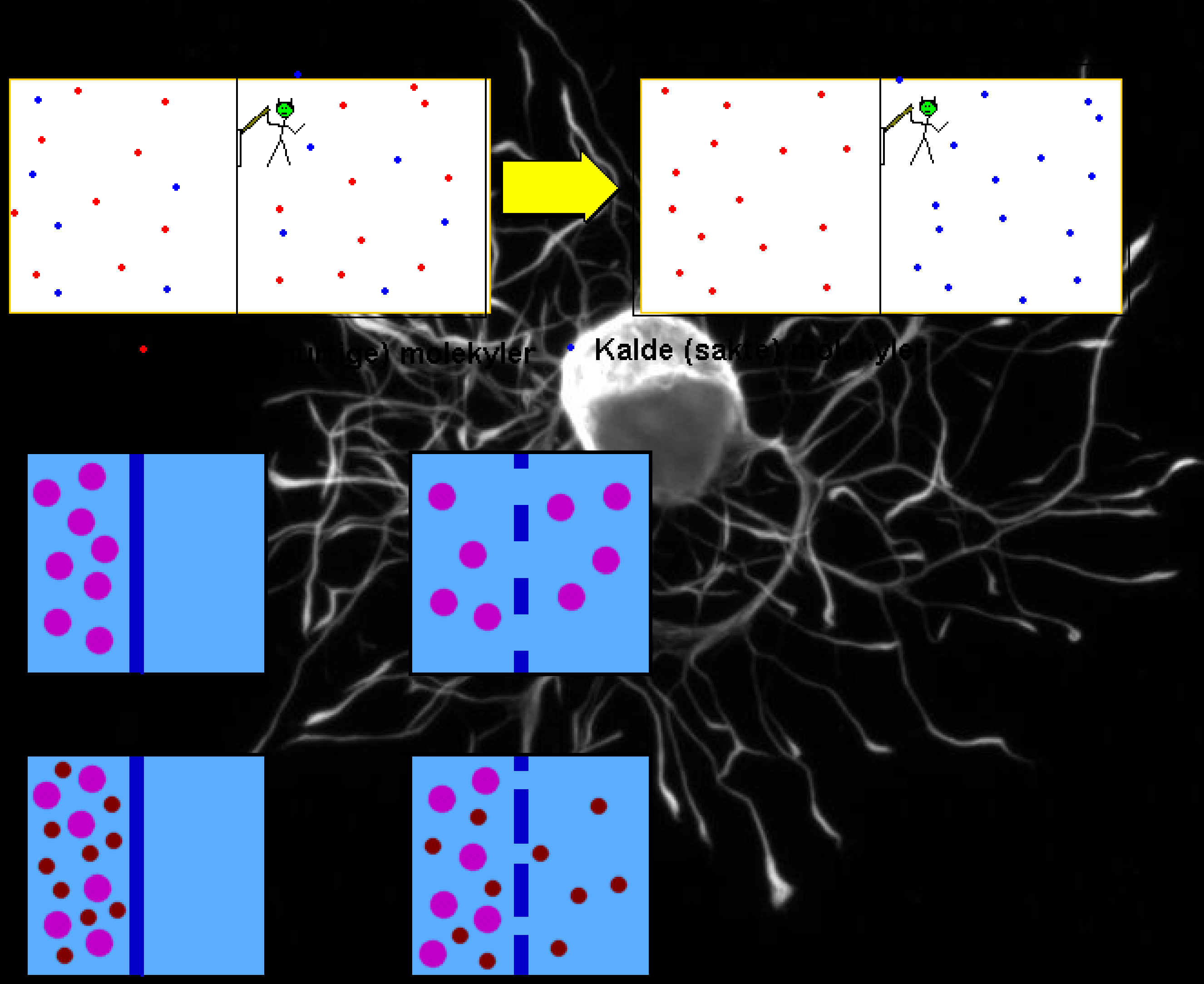
Difusión



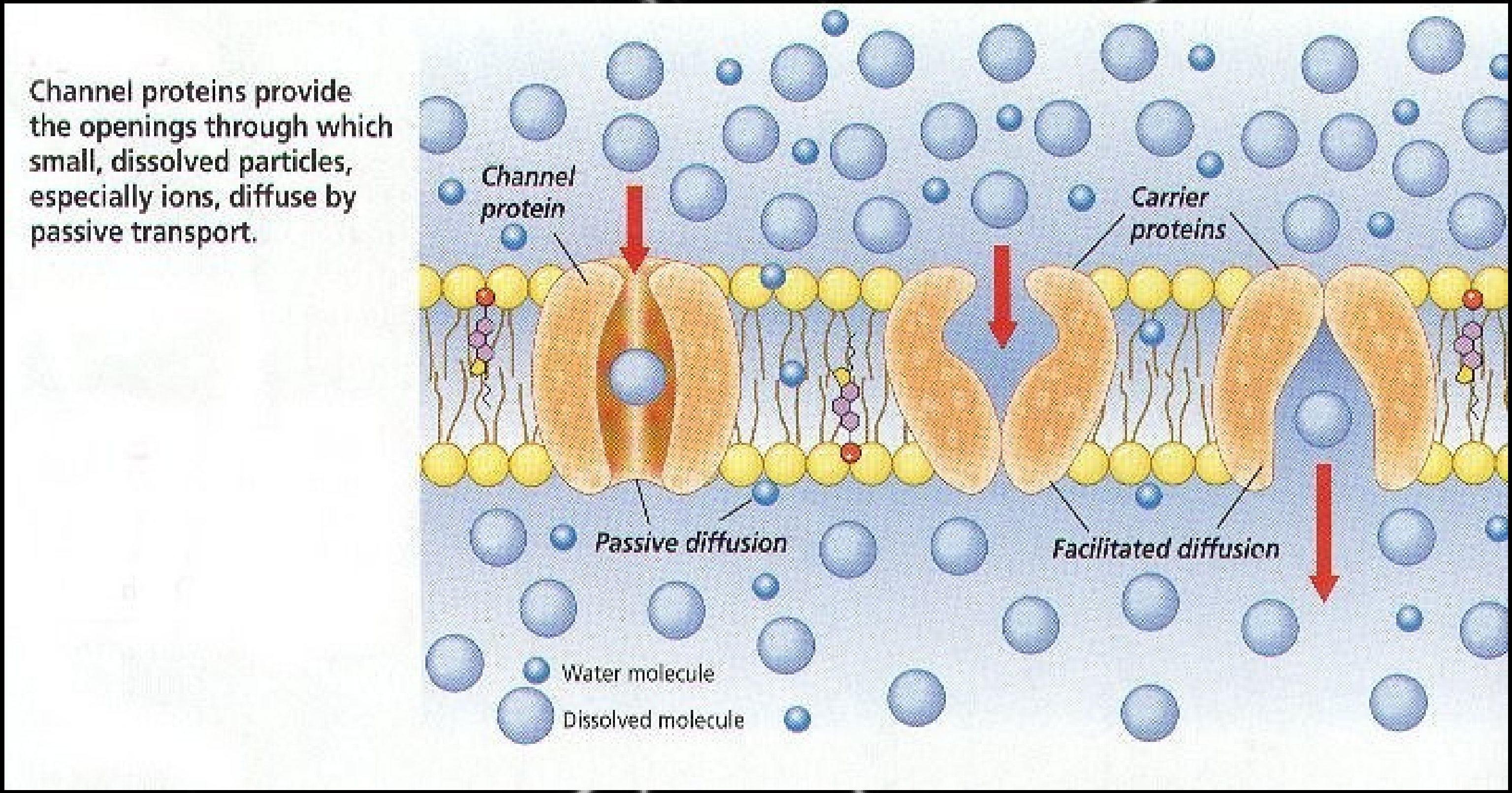


http://www.biosci.ohiou.edu/introbioslab/Bios170/diffusion/Diffusion.html

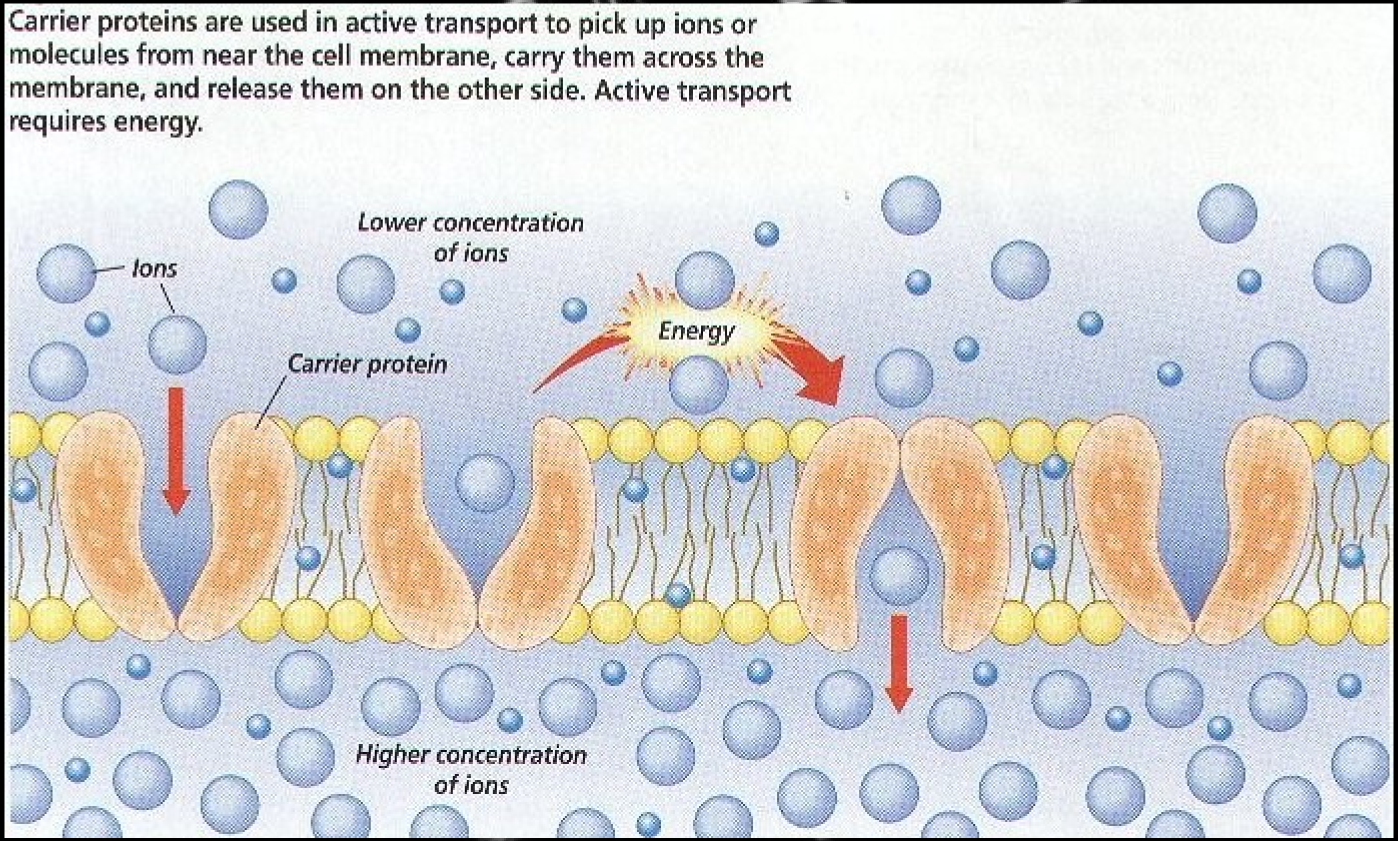
Demonio de Maxwell



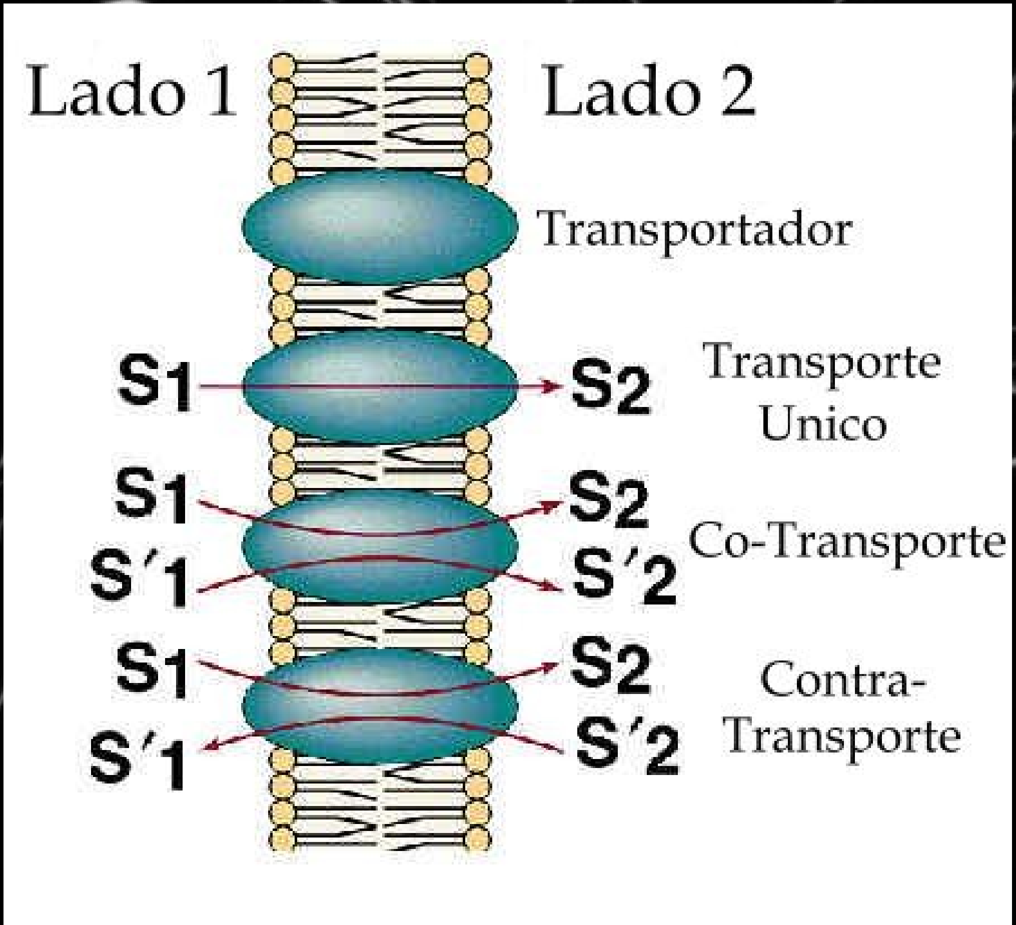
Transporte Pasivo



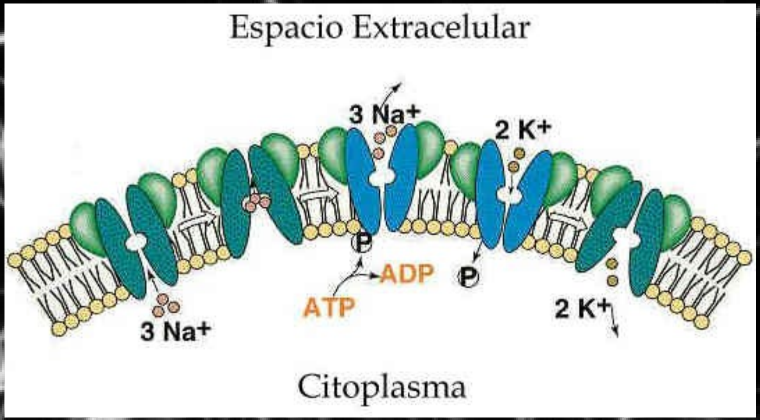
Transporte Activo

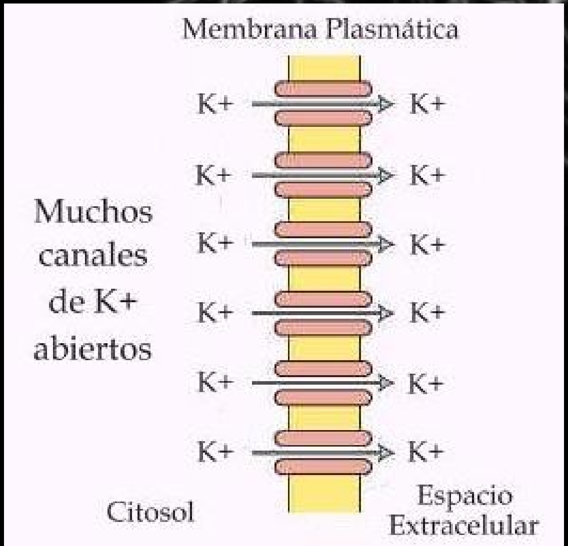


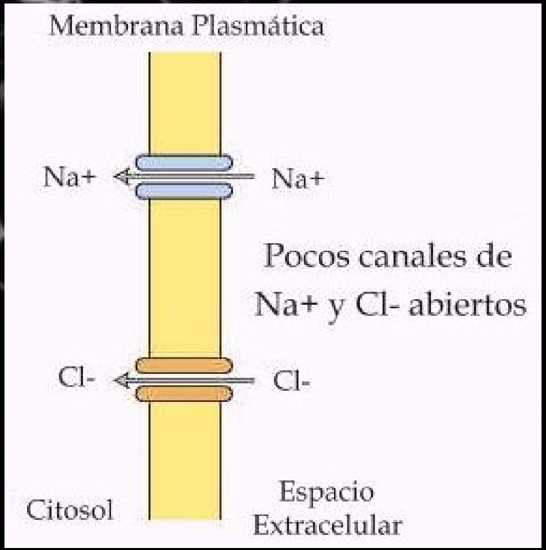
Movimiento de Solutos a través de las Membranas



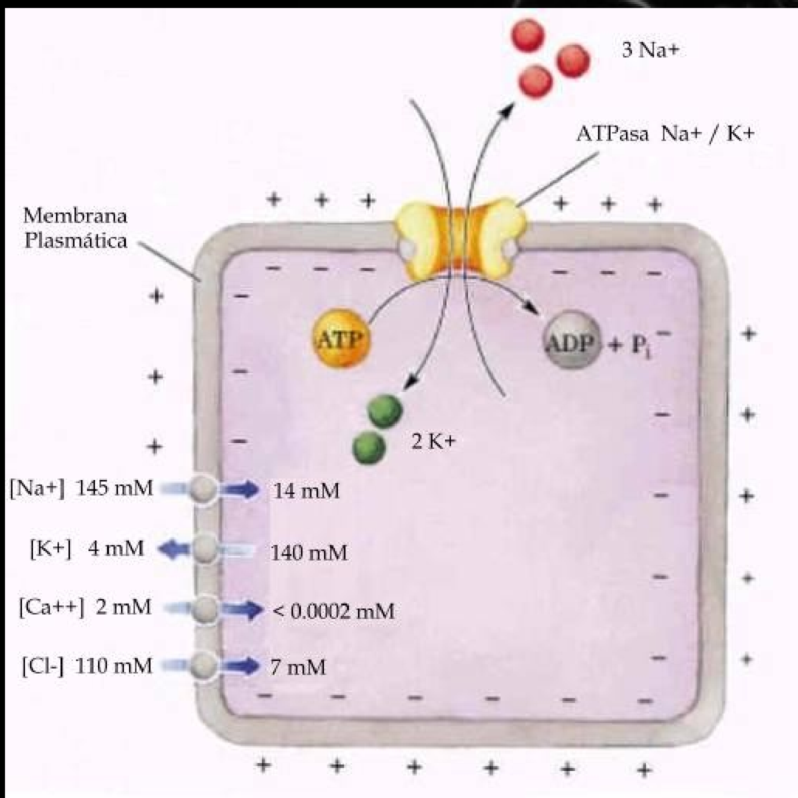
Movimientos Iónicos a través de las Membranas Neuronales







Potencial de Membrana en Reposo



Ecuación de Nernst - Planck

$$E_{Ion} = \frac{RT}{ZF} \ln \frac{[Ion_{\ extracelular}]}{[Ion_{\ intracelular}]}$$

$E_K \cong - 90\ mV$

$E_{Na} \cong + 60\ mV$

$E_{Cl} \cong - 70\ mV$

Ecuación de Goldmann

$$E_M = \frac{RT}{ZF} \ln \frac{P_K[K_{\ ext.}]+P_{Na}[Na_{\ ext.}]+P_{Cl}[Cl_{\ int.}]}{P_K[K_{\ int.}]+P_{Na}[Na_{\ int.}]+P_{Cl}[Cl_{\ ext.}]}$$

$E_M \cong - 60\ mV$