

Física do Corpo Humano

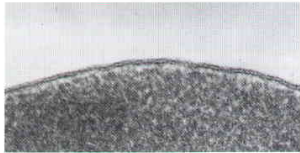
(Física aplicado a Fisiologia)

Adriano M. Alencar

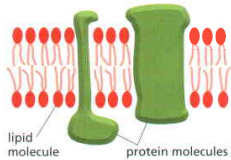
Laboratório de Microrreologia e fisiologia Molecular (LabM²)
Departamento de Física Geral
Instituto de Física
Universidade de São Paulo



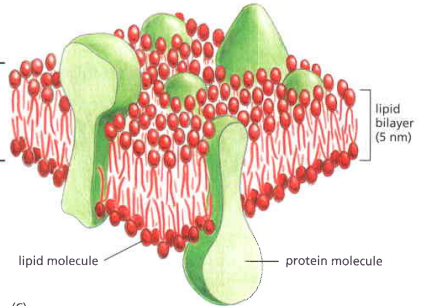
4 de abril de 2013



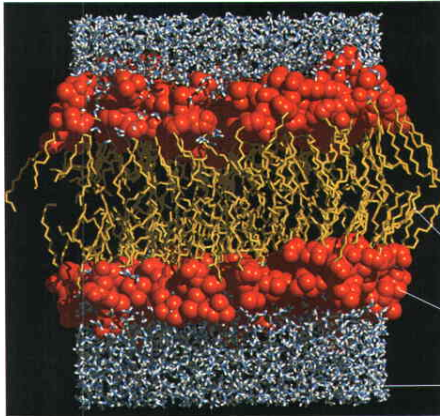
(A)



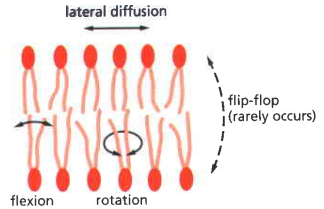
(B)



(C)



(A)

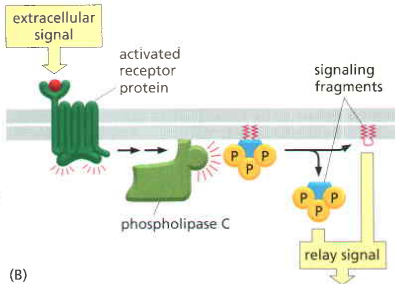
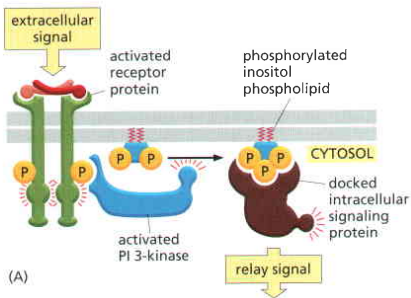


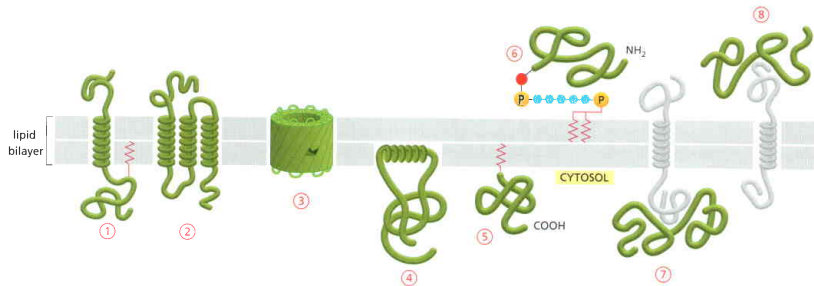
(B)

fatty acid tails

lipid head groups

water molecules





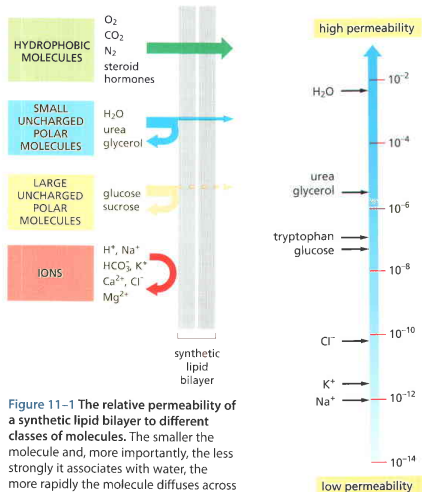
2/3 da energia metabólica total da célula é gasta com transporte

Table 11–1 A Comparison of Ion Concentrations Inside and Outside a Typical Mammalian Cell

COMPONENT	INTRACELLULAR CONCENTRATION (mM)	EXTRACELLULAR CONCENTRATION (mM)
Cations		
Na ⁺	5–15	145
K ⁺	140	5
Mg ²⁺	0.5	1–2
Ca ²⁺	10 ^{−4}	1–2
H ⁺	7 × 10 ^{−5} (10 ^{−7.2} M or pH 7.2)	4 × 10 ^{−5} (10 ^{−7.4} M or pH 7.4)
Anions*		
Cl [−]	5–15	110

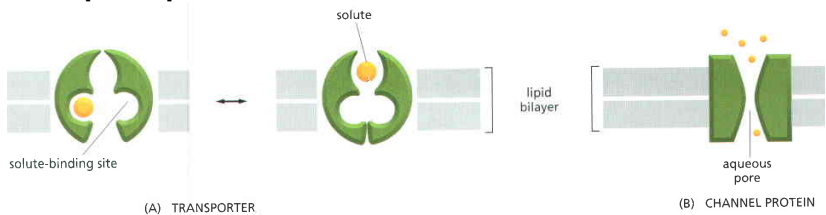
*The cell must contain equal quantities of positive and negative charges (that is, it must be electrically neutral). Thus, in addition to Cl[−], the cell contains many other anions not listed in this table; in fact, most cell constituents are negatively charged (HCO₃[−], PO₄^{3−}, proteins, nucleic acids, metabolites carrying phosphate and carboxyl groups, etc.). The concentrations of Ca²⁺ and Mg²⁺ given are for the free ions. There is a total of about 20 mM Mg²⁺ and 1–2 mM Ca²⁺ in cells, but both are mostly bound to proteins and other substances and, for Ca²⁺, stored within various organelles.

Na ausência de proteínas, membranas são impermeáveis a íons devido a carga e a forte hidratação dos mesmos



Todos os canais e a maioria dos transportadores permitem o soluto passar apenas passivamente, de acordo com a concentração do gradiente.

Transporte passivo ou difusão facilitada



Transporte Passivo

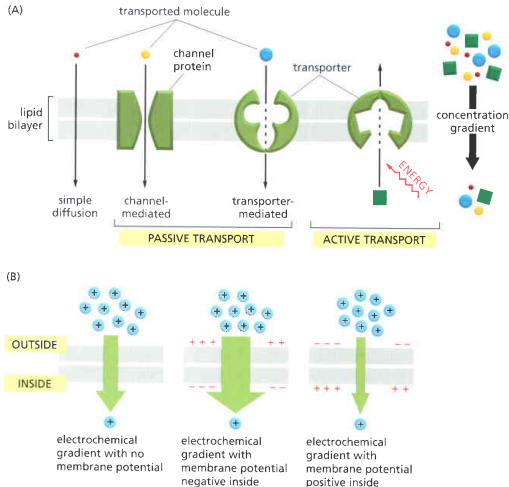
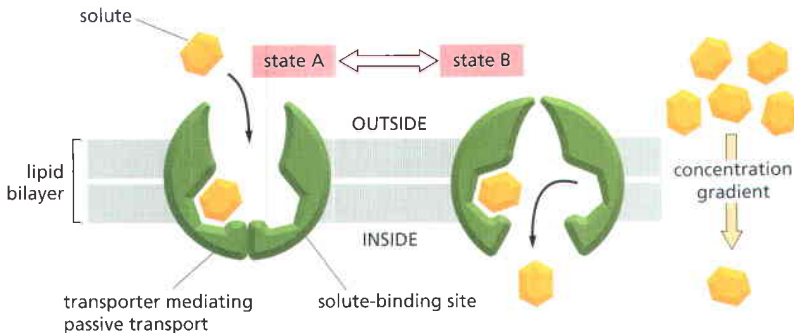
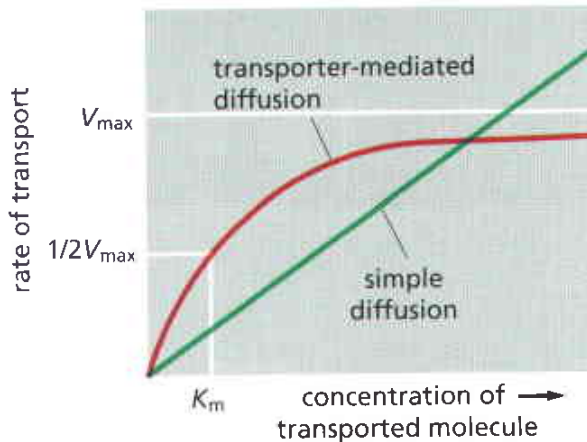


Figure 11–4 Passive and active transport compared. (A) Passive transport down an electrochemical gradient occurs spontaneously, either by simple diffusion through the lipid bilayer or by facilitated diffusion through channels and passive transporters. By contrast, active transport requires an input of metabolic energy and is always mediated by transporters that harvest metabolic energy to pump the solute against its electrochemical gradient. (B) An electrochemical gradient combines the membrane potential and the concentration gradient; they can work additively to increase the driving force on an ion across the membrane (middle) or can work against each other (right).

Transportadores

Um transportador possui sítios com afinidade a solutos e aleatoriamente alterna de posição expondo esse sítio para a parte interna e externa da célula com **Mudanças Conformacionais Reversíveis**





Onde $V_{\max}$ é a taxa máxima possível de transporte e K_m é a constante de acoplamento entre o soluto e o transportador.

Transportadores

Três formas de transporte ativo. A molécula transportada está em amarelo e a forma de energia em vermelho

