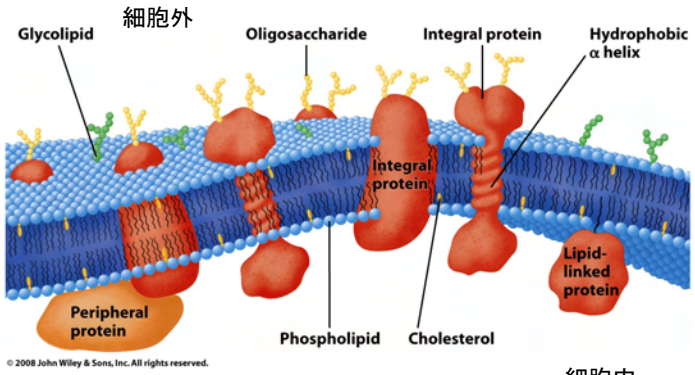
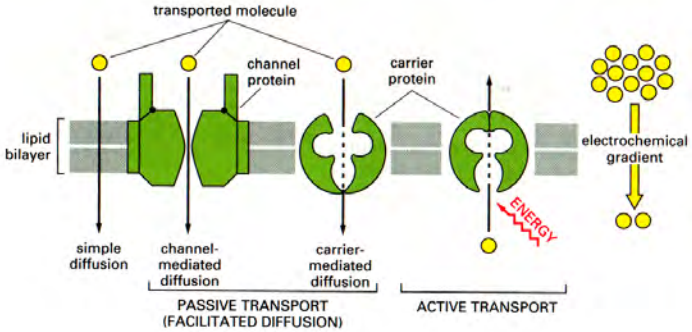
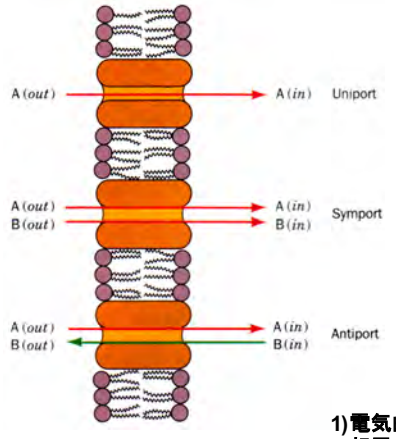
細胞膜の模式図



膜蛋白質による輸送形態



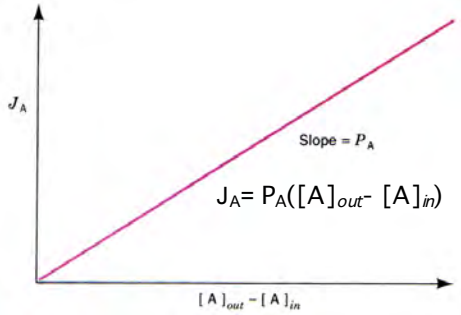
輸送形式の分類



1)ユニポート
2)シンポート
3)アンチポート

1)電気的中性輸送(electroneutral)
2)起電的輸送(electrogenic)

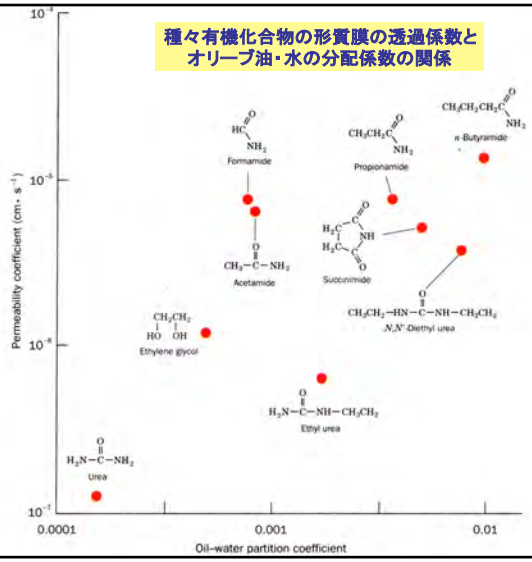
半透膜を横切る拡散速度と膜内外の基質濃度



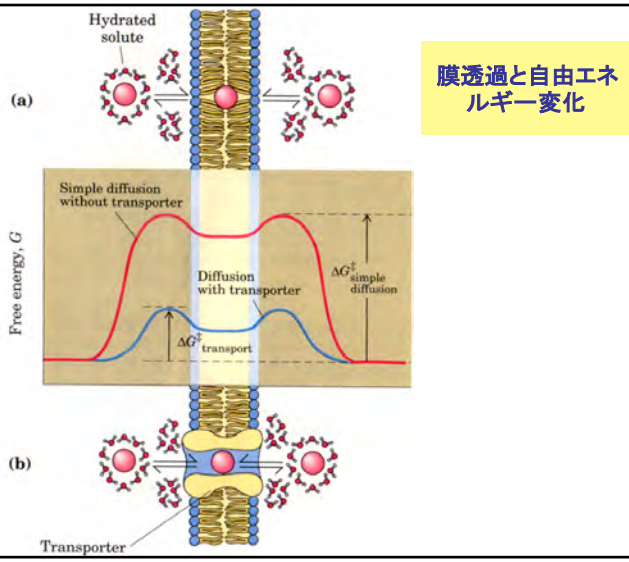
$J_A = P_A([A]_{out} - [A]_{in})$

P_A=D/L
P_A:透過係数(permerbility coefficient)
D:拡散係数(diffusion coefficient)
L:膜厚

種々有機化合物の形質膜の透過係数とオリーブ油･水の分配係数の関係



膜透過と自由エネルギー変化



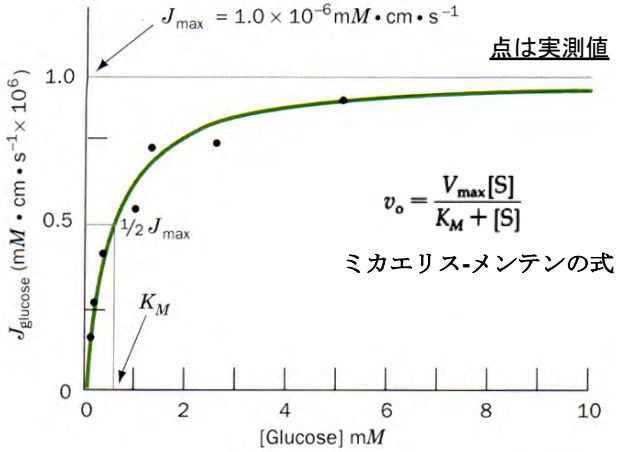
生体膜と合成膜での糖の透過係数

Permeability Coefficients of Natural and Synthetic Membranes to D-Glucose and D-Mannitol at 25° C

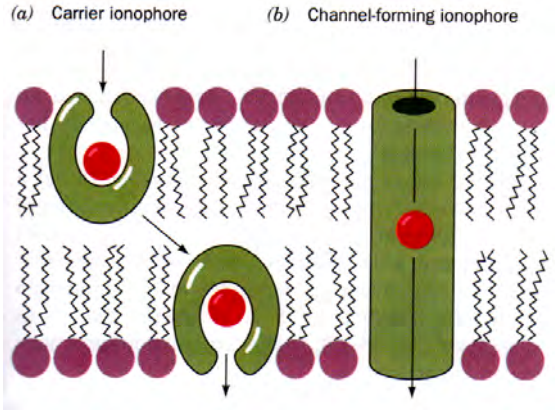
Membrane Preparation	Permeability Coefficients ($cm \cdot s^{-1}$) D-Glucose	D-Mannitol
Synthetic lipid bilayer	2.4×10^{-10}	4.4×10^{-11}
Calculated nonmediated diffusion	4×10^{-9}	3×10^{-9}
Intact human erythrocyte	2.0×10^{-4}	5×10^{-9}

Source: Jung, C. Y., *in* Surgenor, D. (Ed.), *The Red Blood Cell*, Vol. 2, *p.* 709, Academic Press (1975).

ヒト赤血球へのグルコース流入量と外部グルコース濃度の関係



イオノフォア



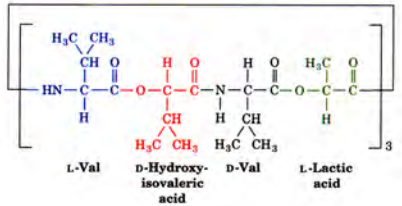
バリノマイシン

$K^+=Rb^+>>Na^+>Li^+$

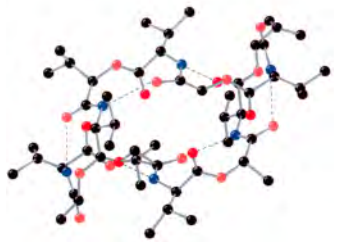
10^4 K^+ イオン/secで輸送

高い選択性

K^+に酸素が配位している

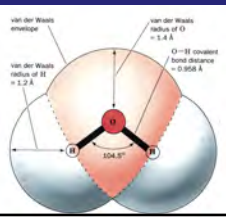


Valinomycin is a cyclic depsipeptide (has both ester and amide bonds) that contains both D- and L-amino acids.



水素とアルカリ金属

	H	Li	Na	K
第一イオン化エネルギ (kcal/mol)	313	124	118	100
原子半径 (Å)	1.0	1.55	1.90	2.35
イオン半径 (Å)		0.64	0.95	1.33
標準水和エンタルピー (kJ/mol)	1090	520	405	321
水中イオンの移動速度 ($x10^{-5}cm^2/V \cdot s$)	362	40	51	76



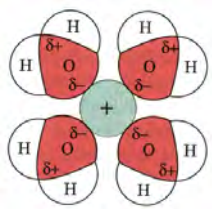
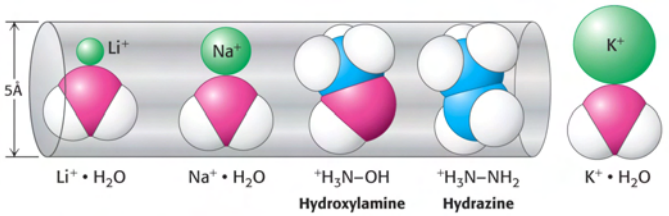


TABLE 13.2 Properties of alkali cations

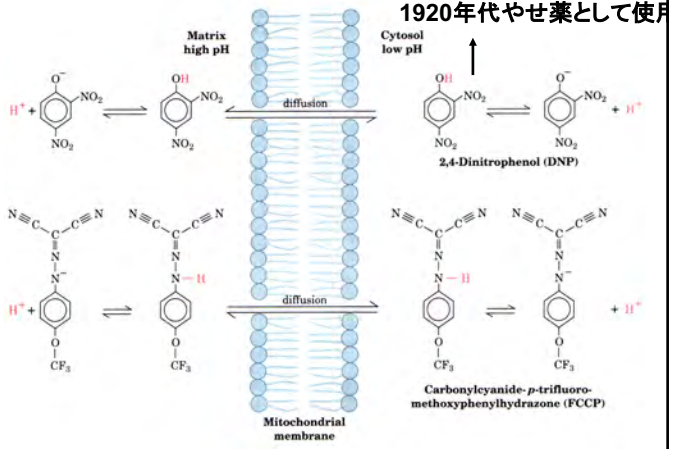
Ion	Ionic radius (Å)	Hydration free energy in kcal mol^{-1} (kJ mol^{-1})
Li^+	0.60	−98 (−410)
Na^+	0.95	−72 (−301)
K^+	1.33	−55 (−230)
Rb^+	1.48	−51 (−213)
Cs^+	1.69	−47 (−197)



プロトノフォア（脱共役剤）

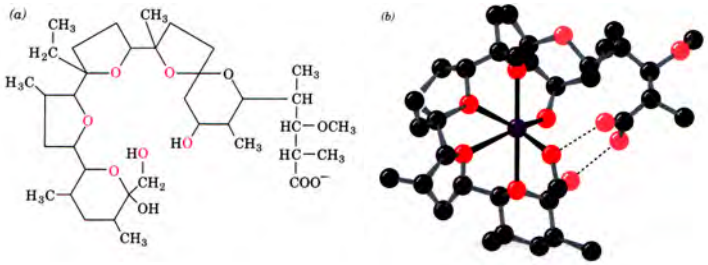
死亡

1920年代やせ薬として使用



モネンシン

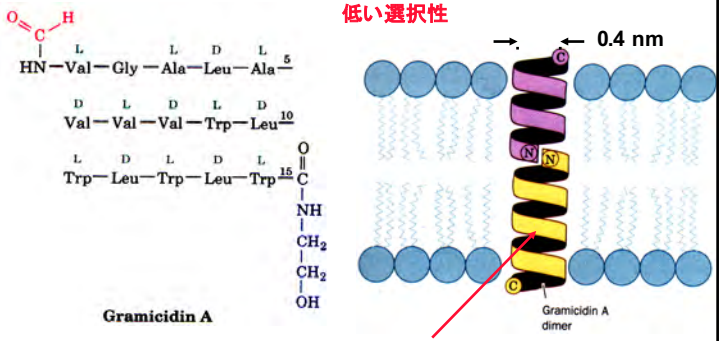
Na^+と結合する線状ポリエーテルカルボン酸



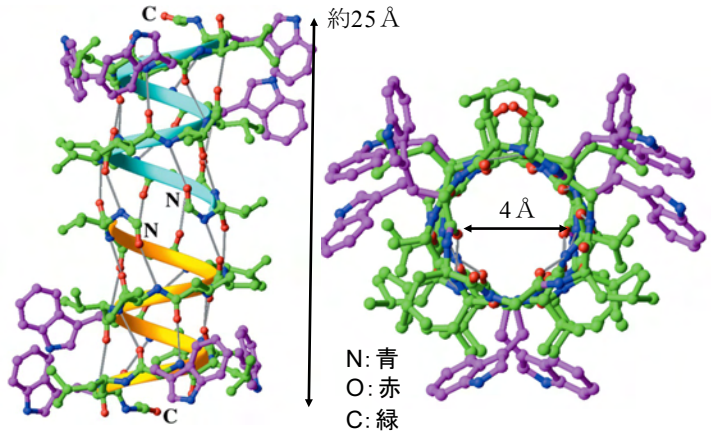
グラミシジン

15アミノ酸からなる直鎖ペプチド
チャネルを作って一価のカチオンを通す

10^7 K^+ イオン/secで輸送
低い選択性

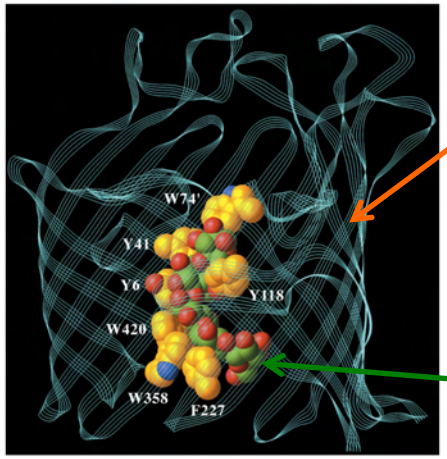


βヘリックス輸送
低い選択性



NMR structure of gramicidin A embedded in a dimyristoyl phosphatidylcholine bilayer.

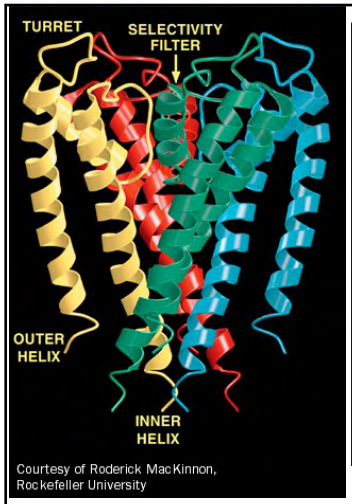
マルトポリンの構造

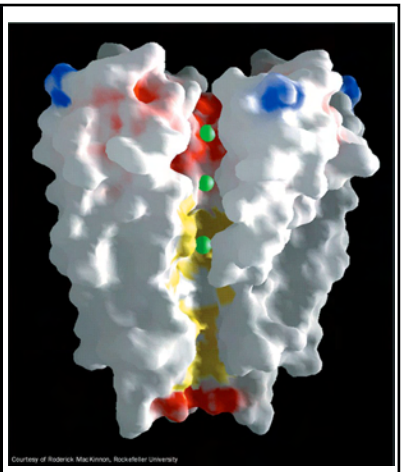


βバレル構造

糖

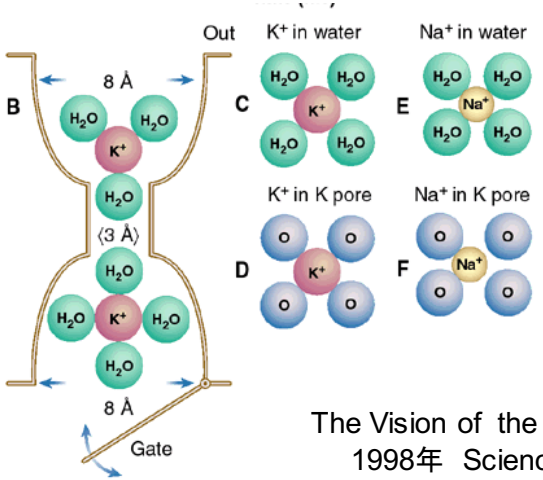
Figure 10-3



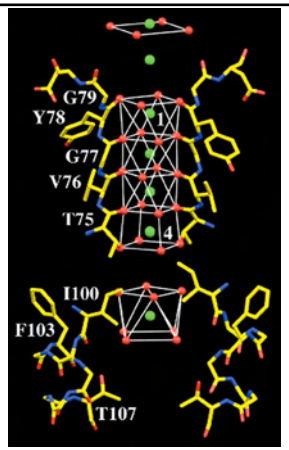


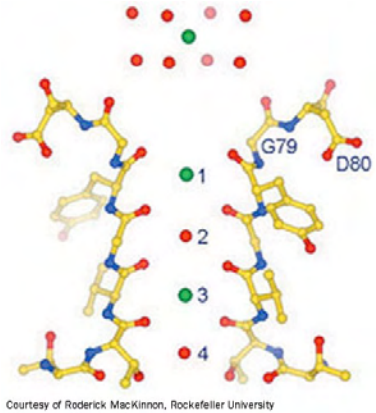
Science v. 280, p. 69 (1998)

X-Ray structure of the KcsA K⁺ channel from *Streptomyces lividans*.

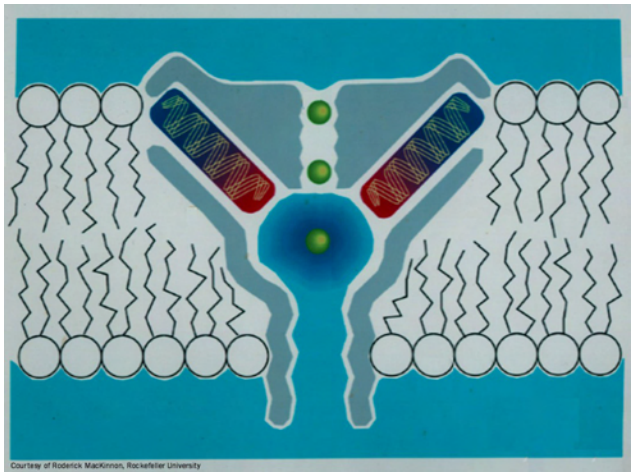


The Vision of the Pore
1998年 Science





Portions of the KcsA K⁺ channel responsible for its ion selectivity viewed similarly

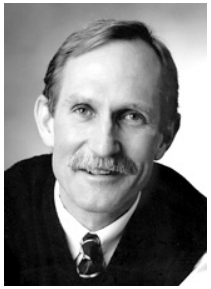


A schematic diagram of the KcsA K^+ channel

The Nobel Prize in Chemistry 2003

"for discoveries concerning channels in cell membranes"

"for the discovery of water channels"



Peter Agre

"for structural and mechanistic studies of ion channels"

Roderick MacKinnon

2014年1月名古屋大学豊田講堂にて