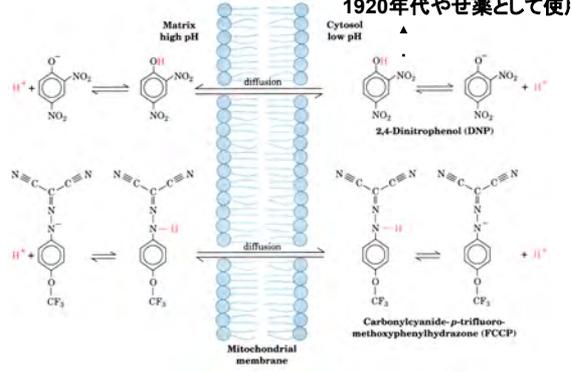
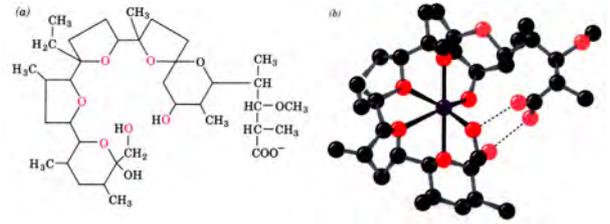


プロトフォア(脱共役剤)



モネンシン

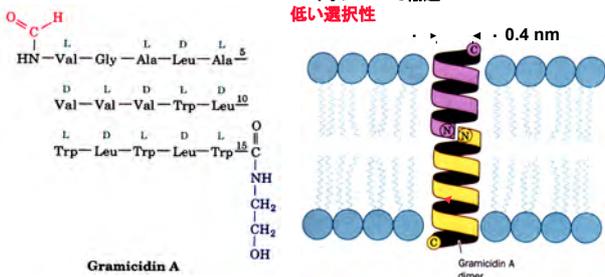
Na⁺と結合する線状ポリエーテルカルボン酸



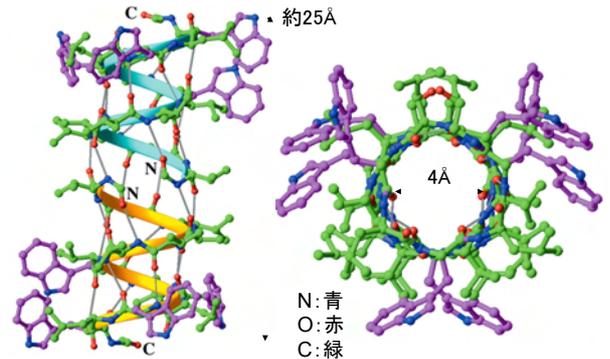
グラミシジン

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

10⁷ K⁺ イオン/secで輸送
低い選択性

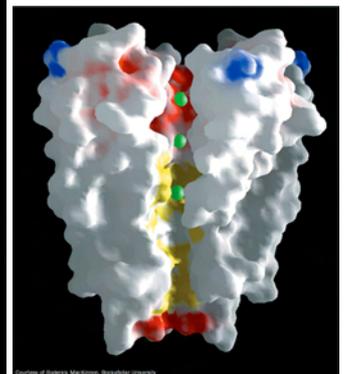
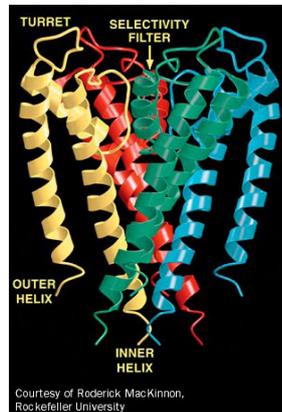
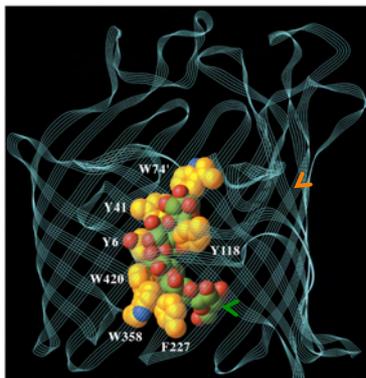


βヘリックス輸送
低い選択性



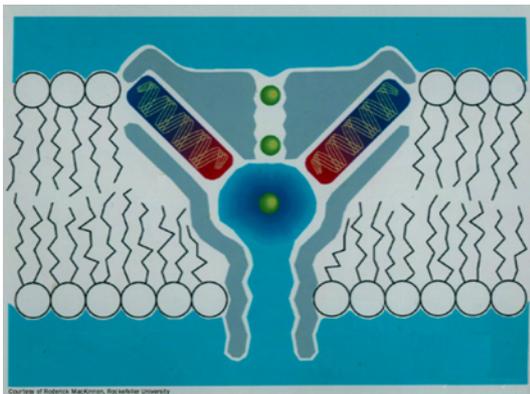
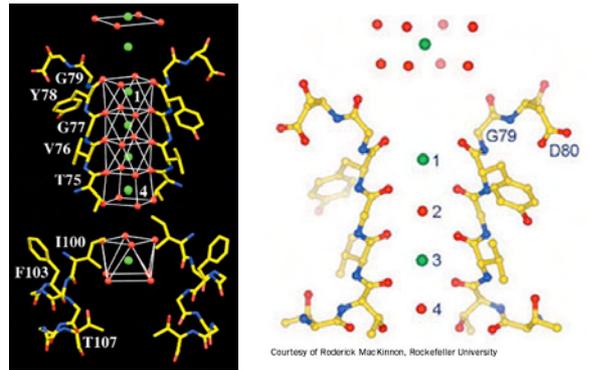
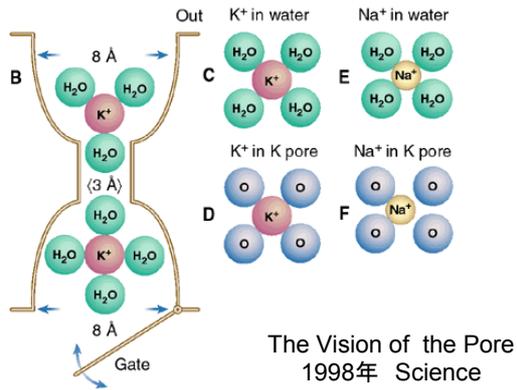
NMR structure of gramicidin A embedded in a dimyristoyl phosphatidylcholine bilayer.

マルトポリンの構造

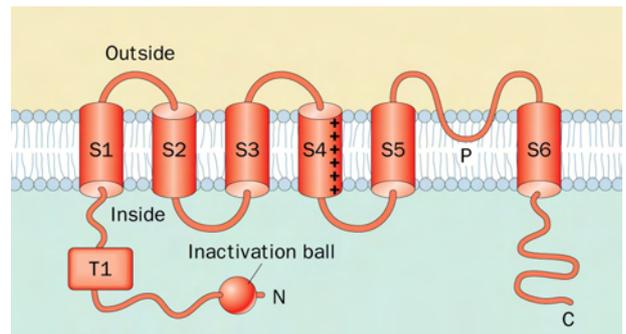


Science v. 280, p. 69 (1998)

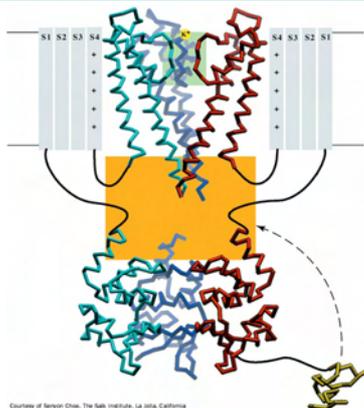
X-Ray structure of the KcsA K⁺ channel from *Streptomyces lividans*.



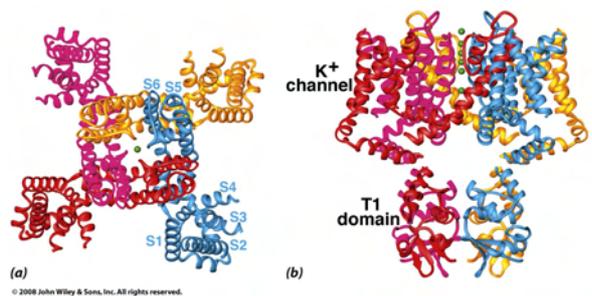
Predicted secondary structure and membrane orientation of voltage-gated K⁺ channels.



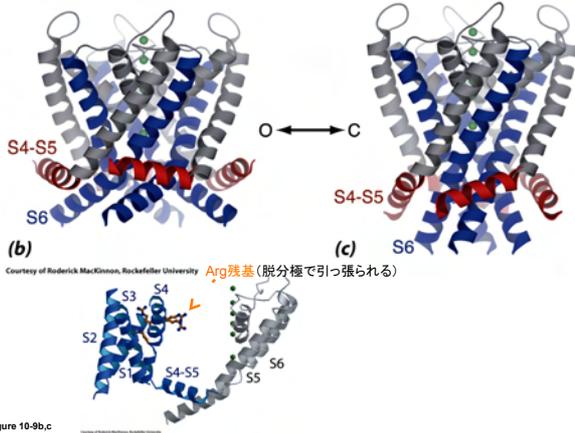
Composite model of the KV channel.



電位依存KV channelのX線構造.



電位依存KV channelの膜貫通ドメインの動き.

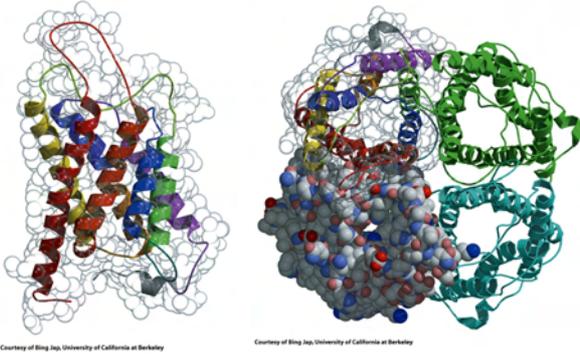


Peter Agre

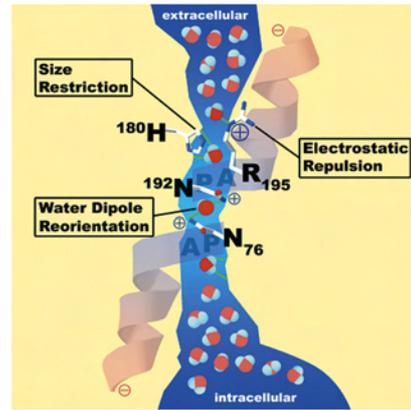
Roderick MacKinnon

The Nobel Prize in Chemistry 2003 was awarded for "for discoveries concerning channels in cell membranes" jointly with one half to Peter Agre "for the discovery of water channels" and with one half to Roderick MacKinnon "for structural and mechanistic studies of ion channels".

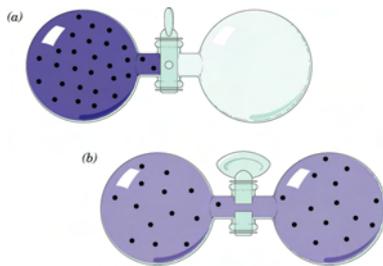
ウシ赤血球アクアポリンAQP1のX線構造



アクアポリンAQP1の水分子透過機構のモデル



Thermodynamic Principles



熱力学の法則

1) エンタルピーの定義: $H = U + PV$

$$\Delta H = \Delta U + P\Delta V, \quad \Delta U = \Delta Q - \Delta W$$

(第一法則)

$$\Delta H = \Delta Q - \Delta W + P\Delta V = \Delta Q - \Delta W'$$

2) エントロピー: $dS = dQ/T$ (可逆過程)

水の蒸発の $\Delta H_{vap} = 40.7 \text{ kJmol}^{-1}$ で $T = 373 \text{ K}$ であるから

蒸気になるときの
エンタルピー変化

$$\Delta S_{vap} = 109.1 \text{ JK}^{-1}$$

3) ギブスの自由エネルギー: $G = H - TS$

$$\Delta G = \Delta H - T\Delta S \text{ (等温条件)}$$

$$1/2 \cdot mv^2 = 1/2 \cdot (2 \text{ kg}) \cdot (1 \text{ m} \cdot \text{s}^{-1})^2 = 1 \text{ Kg} \cdot \text{m}^2 \cdot \text{s}^{-2} = 1 \text{ Nm}$$

質量 2 kg が $1 \text{ m} \cdot \text{s}^{-1}$ の速さで動いているものの
運動エネルギーに 1J が対応

U: エネルギー
P: 圧力
V: 体積
Q: 熱
W: 仕事

$$1 \text{ N} = 1 \text{ Kg} \cdot \text{m} \cdot \text{s}^{-2}$$

$$[\text{N} \cdot \text{m}] = [\text{J}]$$

$$0.24 \text{ cal} = 1 \text{ J} = 1 \text{ Kg} \cdot \text{m}^2 \cdot \text{s}^{-2}$$