グラミシン

15アミノ酸からなる直鎖ペプチド
チャネルを作ってイオンのカチオンを通す

10^9 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.

βロール構造

X-Ray structure of the KcsA K⁺ channel from Streptomyces lividans.
The Vision of the Pore
1998 Science

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

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

A schematic diagram of the KcsA K⁺ channel

Composite model of the KV channel.

電位依存KV channelのX線構造.
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".

Thermodynamic Principles
1）エンタルピーの定義：$\Delta H = U + PV$

（第一法則）

$\Delta H = \Delta U + \Delta V$

2）エンタロピー：$S = dQ/T$

(可逆過程)

$\Delta S = \int\frac{dQ}{T}$

水の沸点の$\Delta H_{vap} = 40.7 \text{kJ/mol}$で

$T = 373 ^\circ \text{K}$であるから

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

3）ギブスの自由エネルギー：$G = H - TS$

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

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

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

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

質量2 kgが1 m/sの速度で動いているもの

運動エネルギーに$1/2$が対応

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