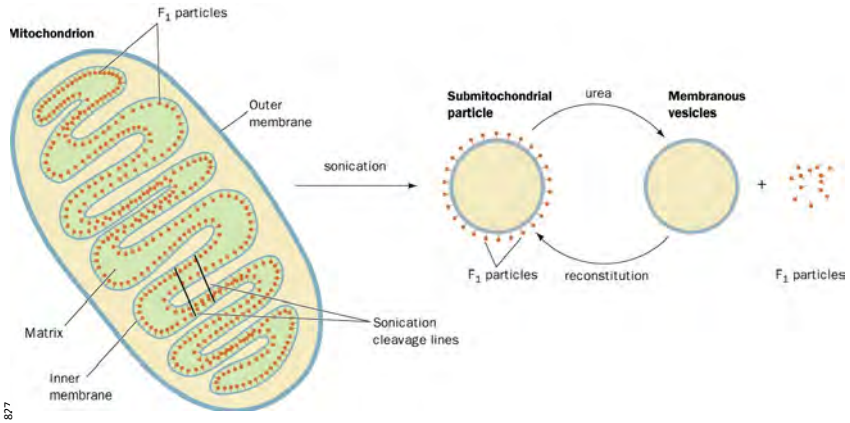

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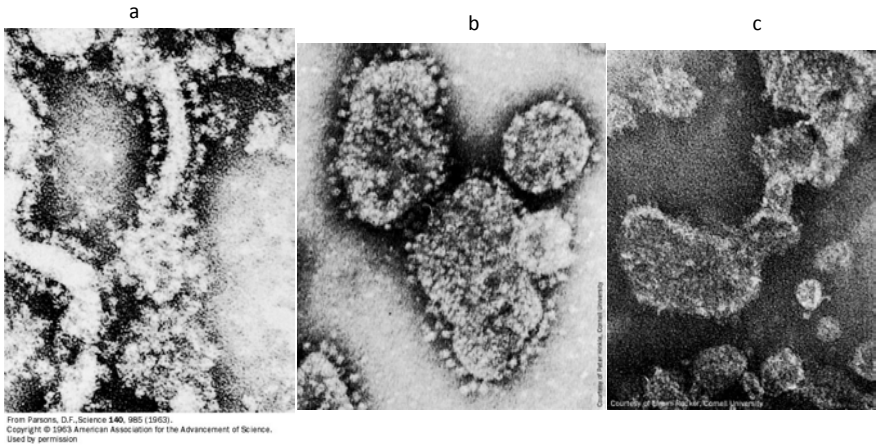
Interpretive drawings of the mitochondrial membrane at various stages of dissection.



From Parsons, D.F., Science **140**, 985 (1963).
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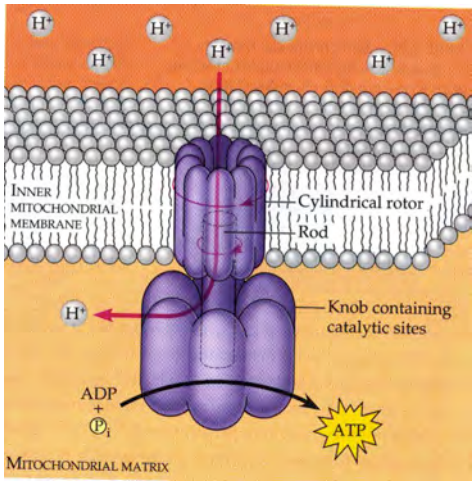
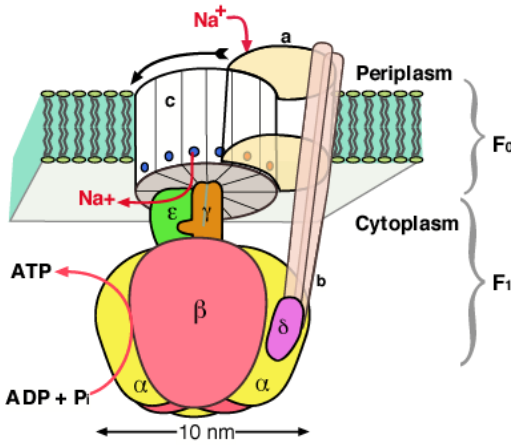
Electron micrographs of cristae from (a) intact mitochondria showing their F1 “lollipops” projecting into the matrix, (b) submitochondrial particles, showing their outwardly projecting F1 lollipops, and (c) submitochondrial particles after treatment with urea.

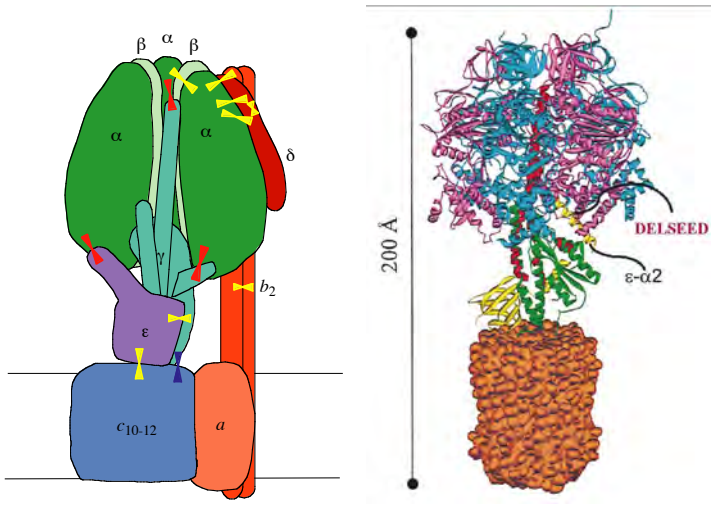
ATP synthase, a molecular machine

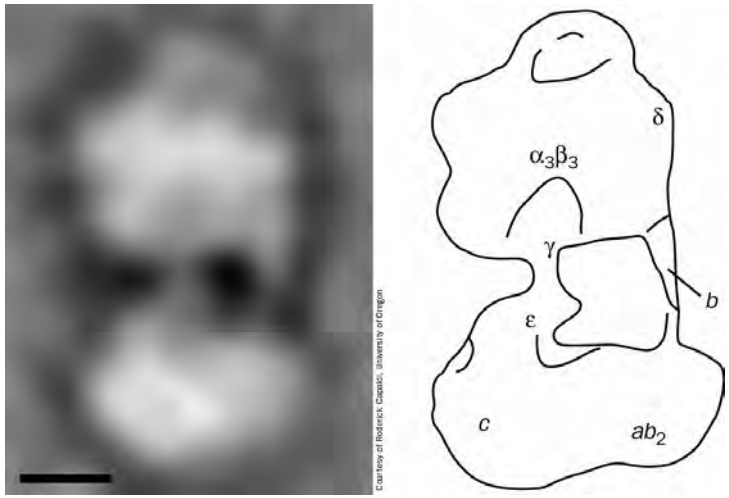


F型ATPaseモーターの構造



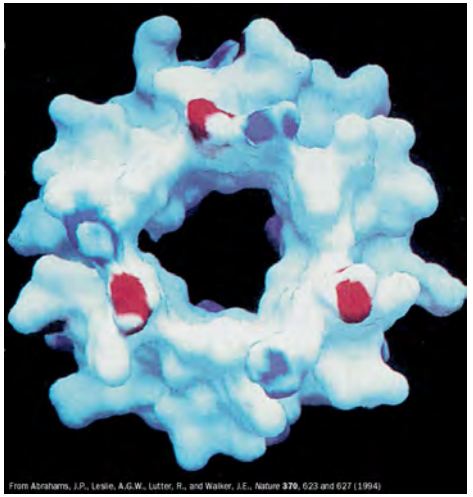
F型ATPase





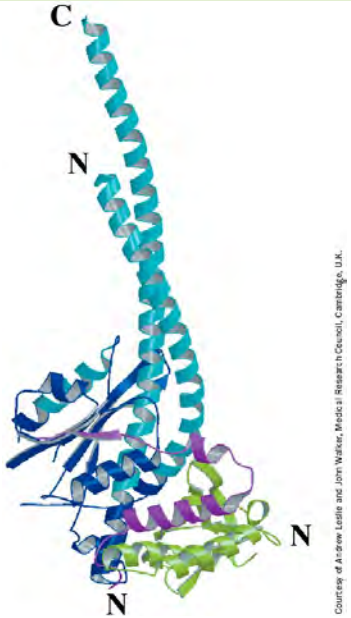
Electron microscopy–based image of *E. coli* F_1F_0–ATPase.

X-Ray structure of F_1–ATPase from bovine heart mitochondria.



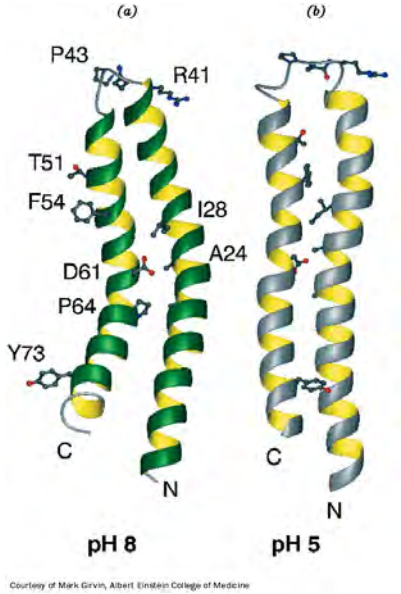
X-Ray structure of F_1–ATPase from bovine heart mitochondria.
The surface of the inner portion of the $\alpha_3\beta_3$ assembly.

The γ, δ, and ε subunits in the X-ray structure of bovine F_1–ATPase.



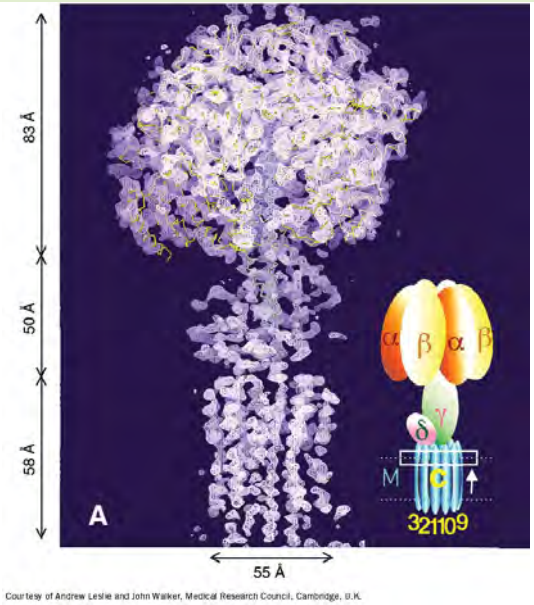
Courtesy of Andrew Leslie and John Walker, Medical Research Council, Cambridge, U.K.

NMR structures of the *c* subunit of *E. coli* F_1F_0–ATPase.

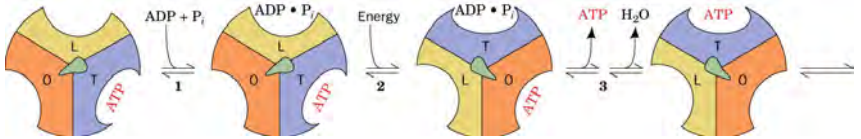


Courtesy of Mark Girvin, Albert Einstein College of Medicine

Electron density map of the yeast mitochondrial F_1–c_{10} complex.

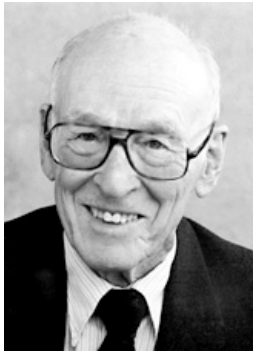


Courtesy of Andrew Leslie and John Walker, Medical Research Council, Cambridge, U.K.

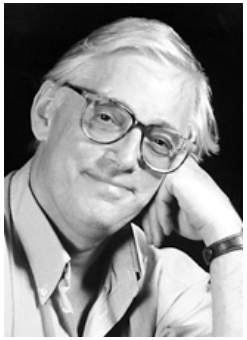


Energy-dependent binding change mechanism for ATP synthesis by proton-translocating ATP synthase.

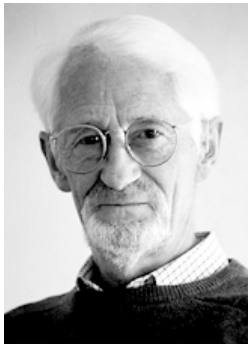
The Nobel Prize in Chemistry 1997



Paul D. Boyer



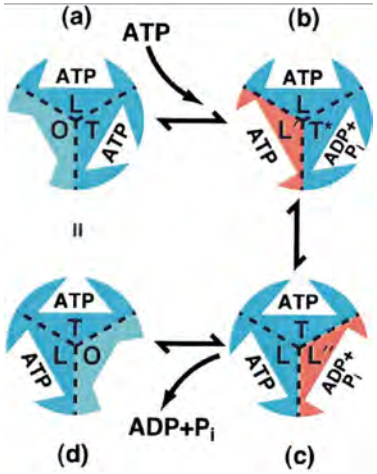
John E. Walker

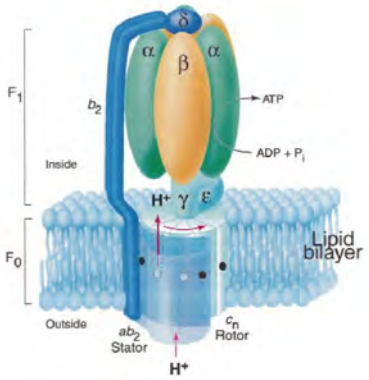


Jens C. Skou

The Nobel Prize in Chemistry 1997 was divided, one half jointly to Paul D. Boyer and John E. Walker *"for their elucidation of the enzymatic mechanism underlying the synthesis of adenosine triphosphate (ATP)"* and the other half to Jens C. Skou *"for the first discovery of an ion-transporting enzyme, Na^+, K^+ -ATPase"*.

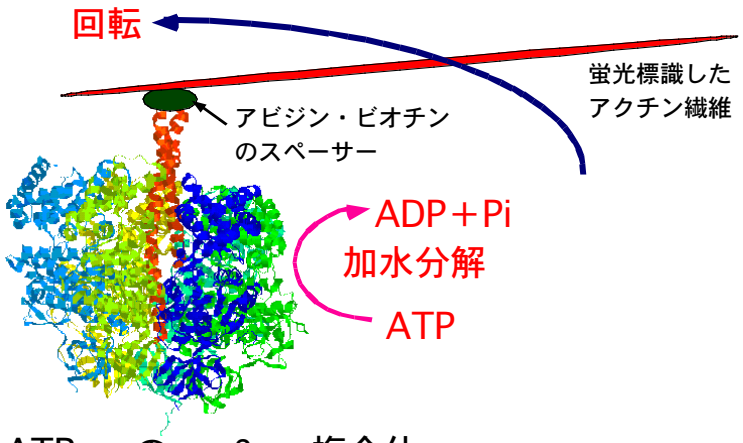
ATPaseの構造変化と触媒活性モデル





O(オープン)型：触媒不活性で基質・生成物に親和性なし
L(ルーズ)型：弱い親和性をもつが、触媒活性なし
T(タイト)型：強い親和性をもち、触媒活性をもつ

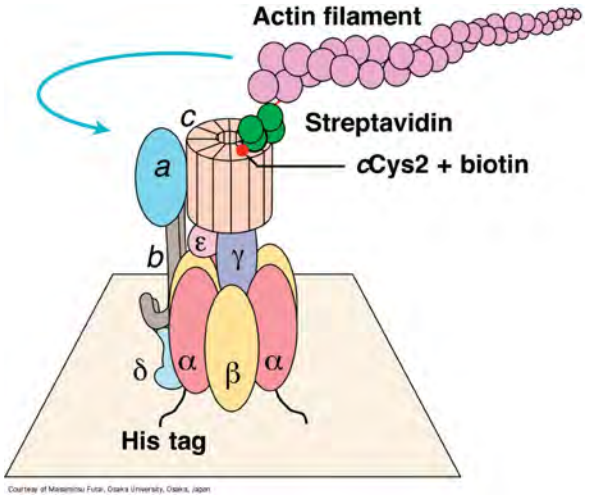
F型ATPase回転実証の実験系

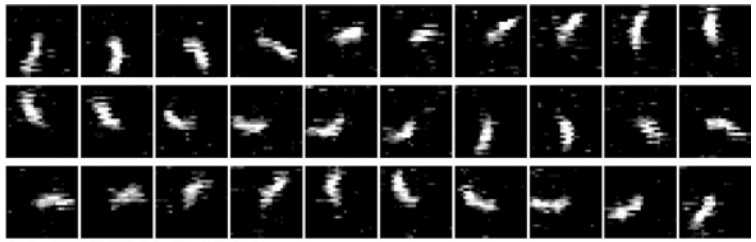


ATPaseのα　β　γ複合体

Noji et al. (1997) Nature

Rotation of the *c*-ring in *E. coli* F_1F_0–ATPase



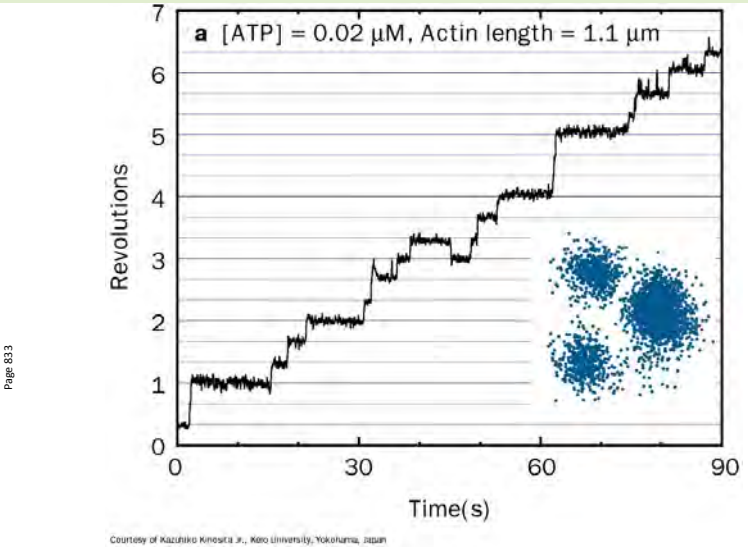


Courtesy of Masamitsu Futai, Osaka University, Osaka, Japan

Rotation of the *c*-ring in *E. coli* F_1F_0–ATPase. (*b*) The rotation of a 3.6-μm-long actin filament in the presence of 5 m*M* MgATP.

抗体

Stepwise rotation of the γ subunit of F_1 relative to an immobilized $\alpha_3\beta_3$ unit at low ATP concentration.



Courtesy of Kazuhiko Kinosita Jr., Keio University, Yokohama, Japan

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一次と2次の免疫応答

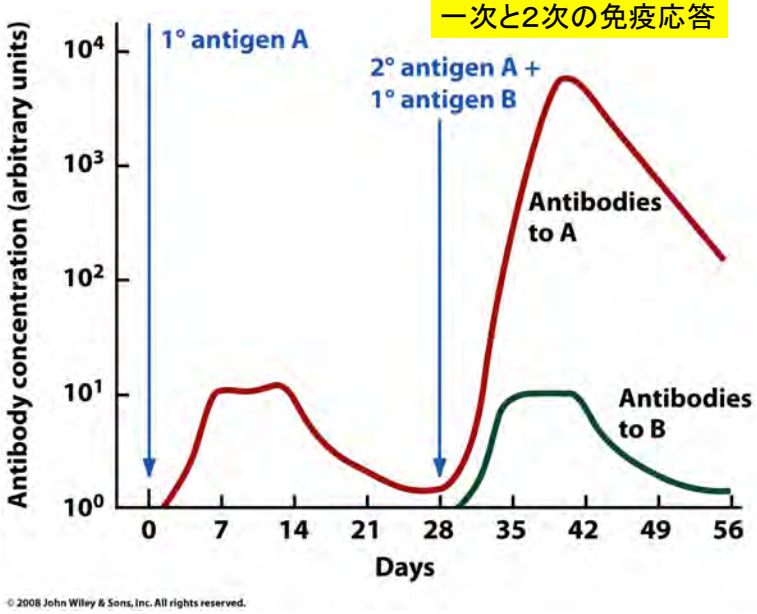
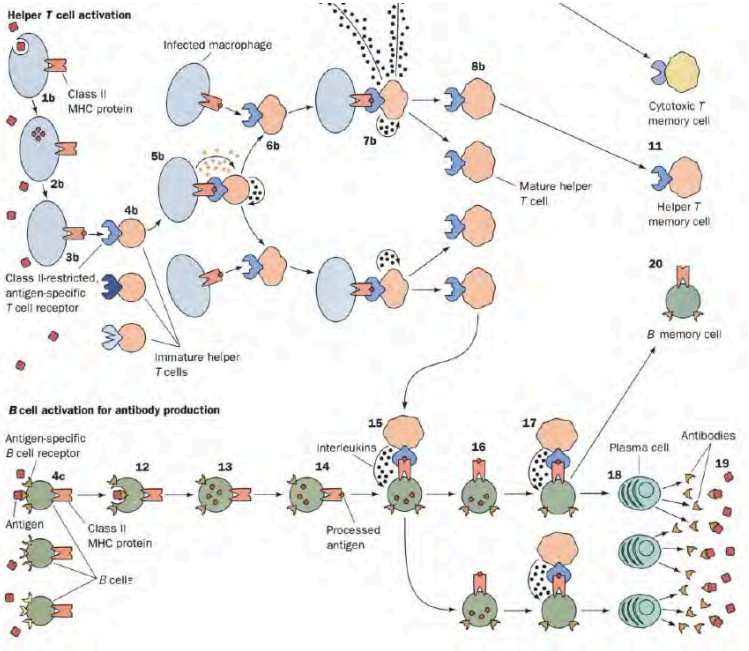
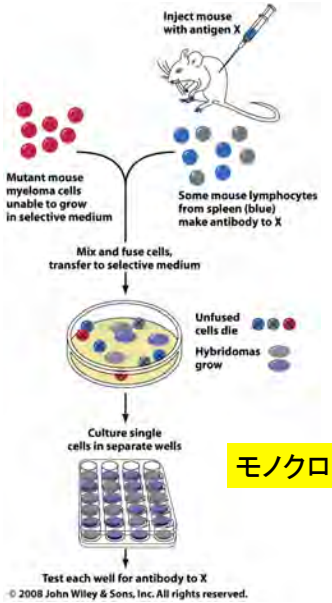


Figure 7-37

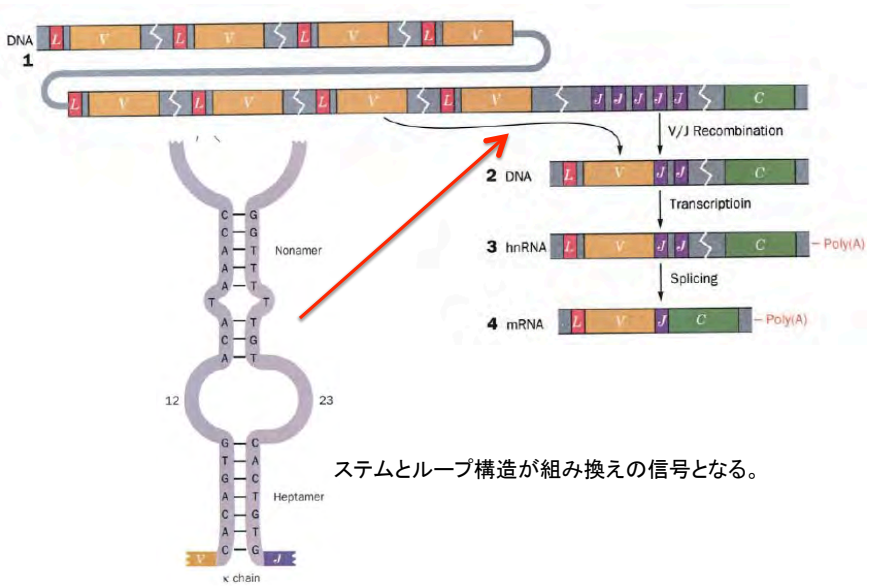




Box 7-5

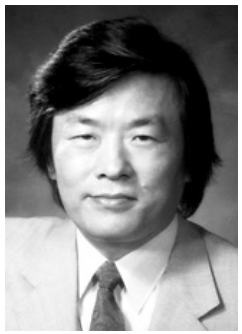
モノクローナル抗体の生成

マウス軽鎖遺伝子群の並び方と多様性生成機構



ステムとループ構造が組み換えの信号となる。

The Nobel Prize in Physiology or Medicine 1987



Susumu Tonegawa

経歴

1939年 愛知県生まれ
1963年 京都大学理学部化学科卒業
1968年 カリフォルニア大学サンディエゴ校博士課程修了
1971年 スイス・バーゼル免疫学研究所主任研究員
1981年 マサチューセッツ工科大学（MIT）教授
1984年 文化勲章受章
1987年 ノーベル生理学・医学賞受賞
現在はMIT記憶と学習研究センター所長として活躍

The Nobel Prize in Physiology or Medicine 1987 was awarded to Susumu Tonegawa *"for his discovery of the genetic principle for generation of antibody diversity"*.

Table 7-2 Classes of Human Immunoglobulins

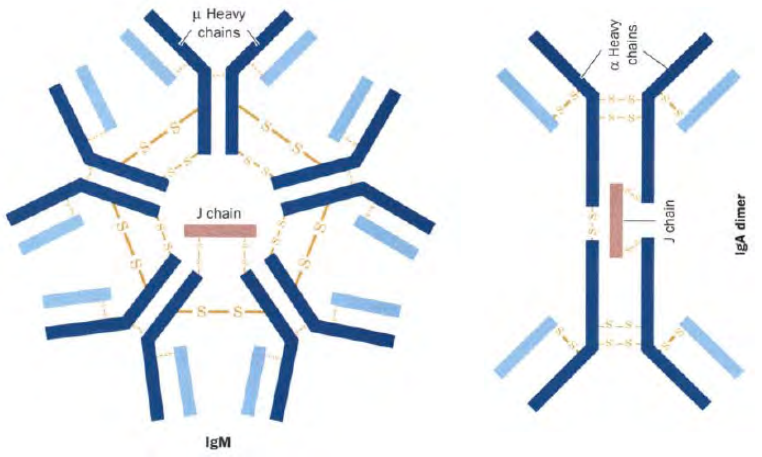
Class	Heavy Chain	Light Chain	Subunit Structure	Molecular Mass (kD)
IgA	α	κ or λ	$(\alpha_2\kappa_2)_nJ^a$ or $(\alpha_2\lambda_2)_nJ^a$	360–720
IgD	δ	κ or λ	$\delta_2\kappa_2$ or $\delta_2\lambda_2$	160
IgE	ε	κ or λ	$\varepsilon_2\kappa_2$ or $\varepsilon_2\lambda_2$	190
IgG[b]	γ	κ or λ	$\gamma_2\kappa_2$ or $\gamma_2\lambda_2$	150
IgM	μ	κ or λ	$(\mu_2\kappa_2)_5J$ or $(\mu_2\lambda_2)_5J$	950

[a] n = 1, 2, or 3.

[b] IgG has four subclasses, IgG1, IgG2, IgG3, and IgG4, which differ in their γ chains

Table 7-2

S-S結合によって作られる抗体の多量体構造



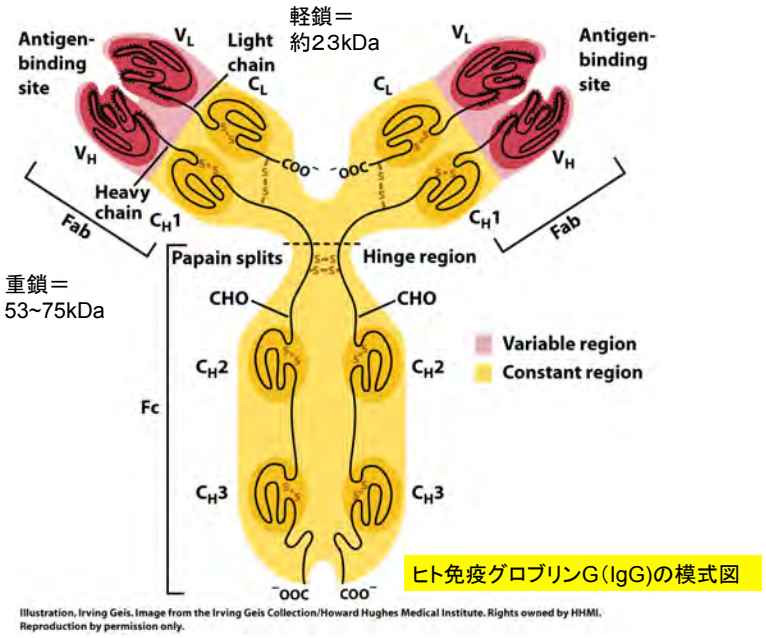


Figure 7-39

軽鎖の免疫グロブリンフォールド

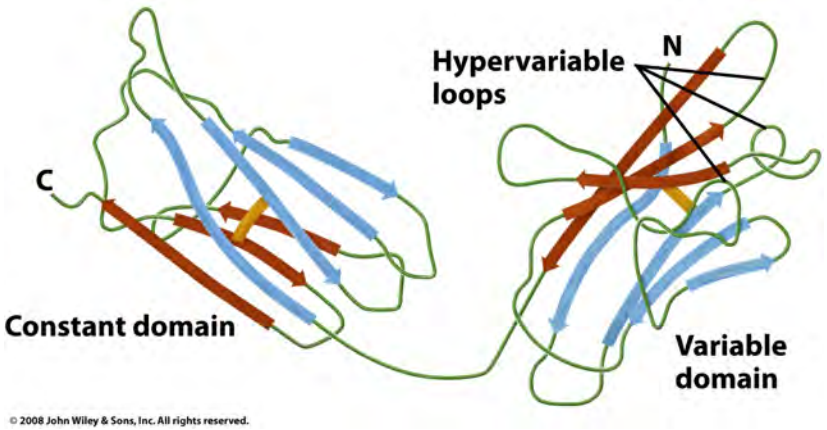
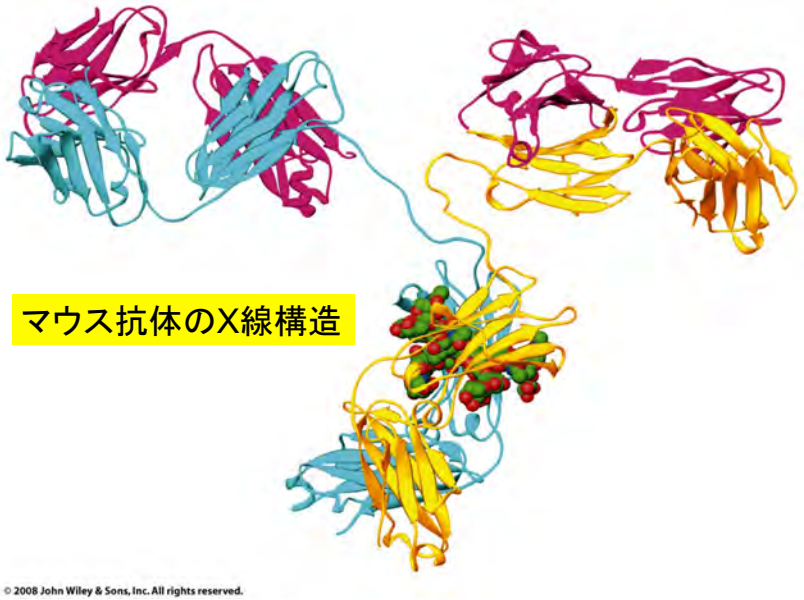


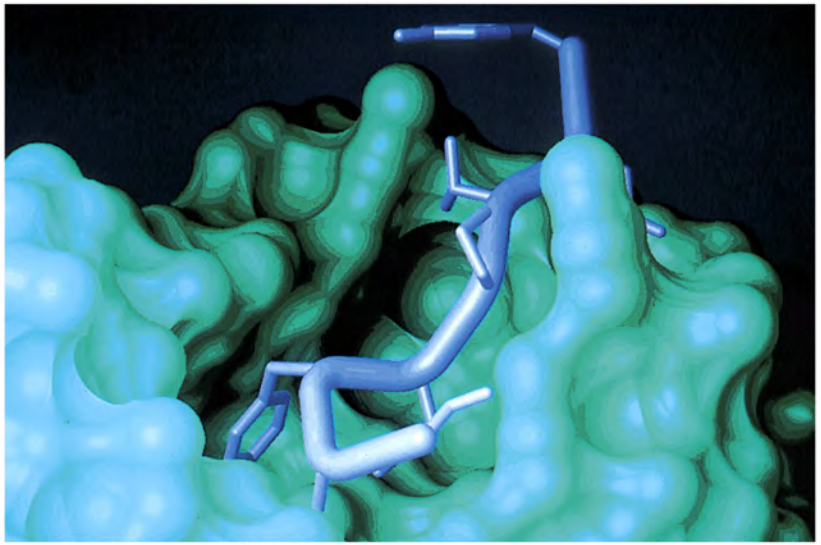
Figure 7-40



マウス抗体のX線構造

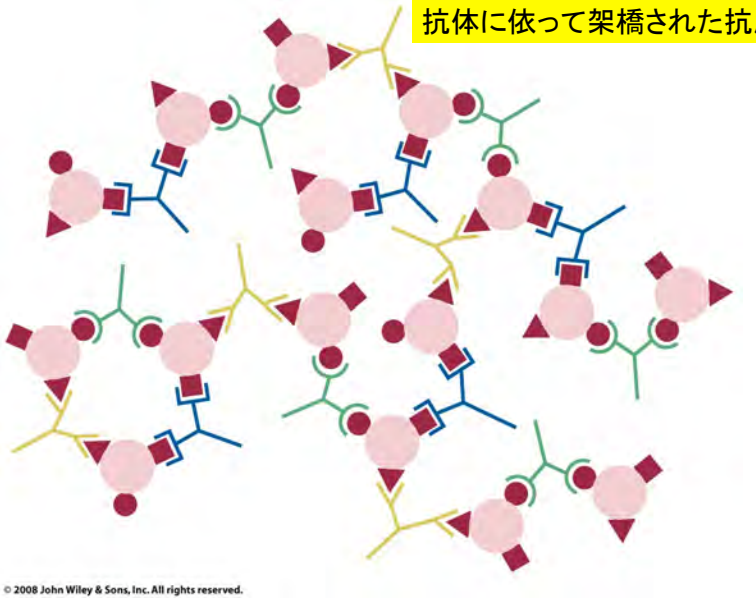
Figure 7-38

ペプチド抗原と抗体の相互作用



Courtesy of Ian Wilson, The Scripps Research Institute, La Jolla, California. PDBid 1HMM.

Figure 7-41



抗体に依って架橋された抗原

Figure 7-42

Table 7-3 Some Autoimmune Diseases

Disease	Target Tissue	Major Symptoms
Addison's disease	Adrenal cortex	Low blood glucose, muscle weakness, Na^+ loss, K^+ retention, increased susceptibility to stress
Crohn's disease	Intestinal lining	Intestinal inflammation, chronic diarrhea
Graves' disease	Thyroid gland	Oversecretion of thyroid hormone resulting in increased appetite accompanied by weight loss
Insulin-dependent diabetes mellitus	Pancreatic β cells	Loss of ability to make insulin
Multiple sclerosis	Myelin sheath of nerve fibers in brain and spinal cord	Progressive loss of motor control
Myasthenia gravis	Acetylcholine receptors at nerve–muscle synapses	Progressive muscle weakness
Psoriasis	Epidermis	Hyperproliferation of the skin
Rheumatoid arthritis	Connective tissue	Inflammation and degenerationof the joints
Systemic lupus erythematosus	DN A, phospholipids, other tissue components	Rash, joint and muscle pain, anemia, kidney damage,mental dysfunction

Figure 7-3