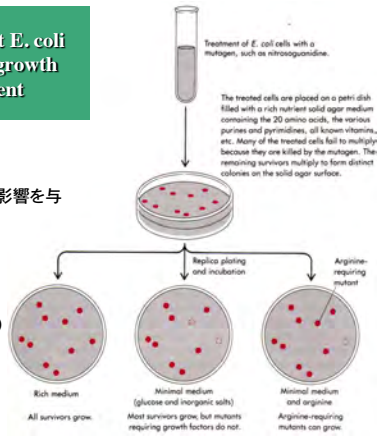
3. Isolation of mutant E. coli cells with a specific growth factor requirement

必須代謝物合成能に影響を与える変異体の分離

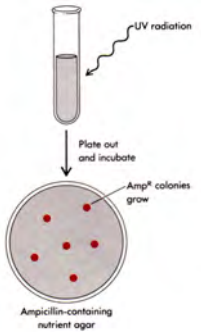
栄養要求株 (auxotroph)
原栄養株 (prototroph)

(1944年)

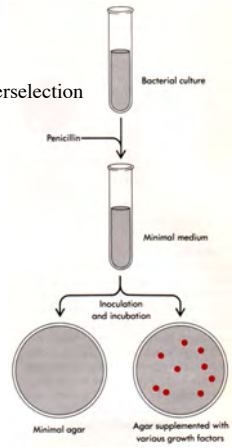


4. Enriching mutants I

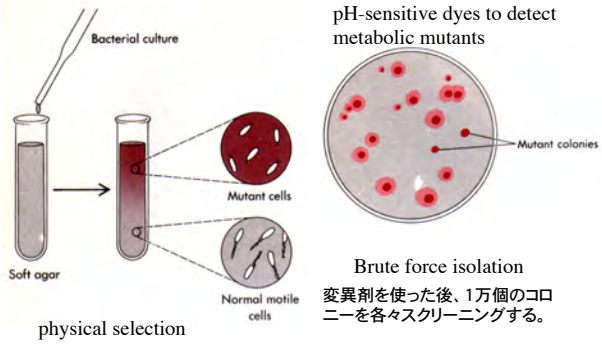
direct selection



counterselection



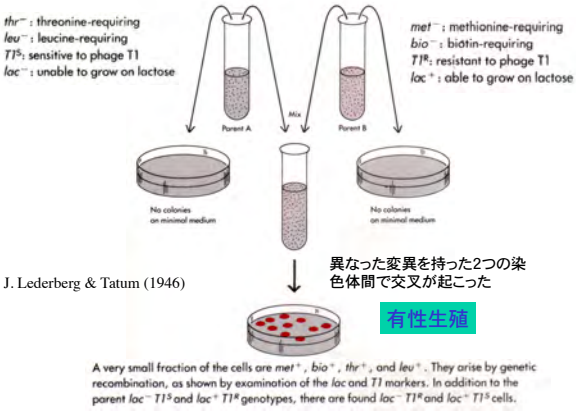
5. Enriching mutants II



physical selection

変異剤を使った後、1万個のコロニーを各々スクリーニングする。

8. The use of growth factor requirments to demonstrate sexuality in *E. coli*

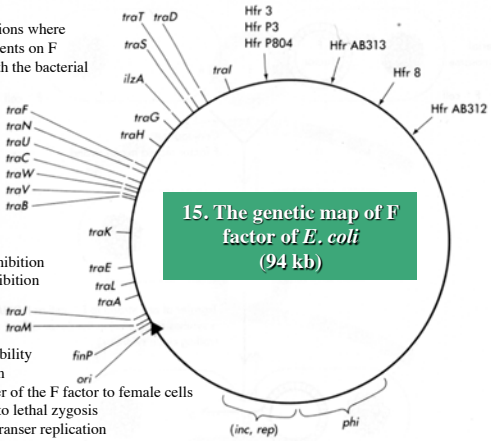


J. Lederberg & Tatum (1946)

異なった変異を持った2つの染色体間で交叉が起こった

有性生殖

15. The genetic map of F factor of *E. coli* (94 kb)

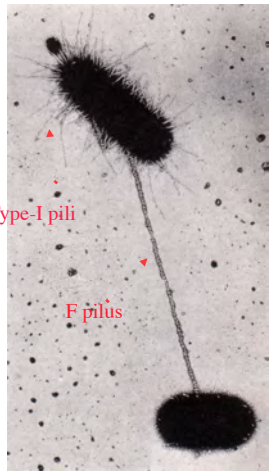


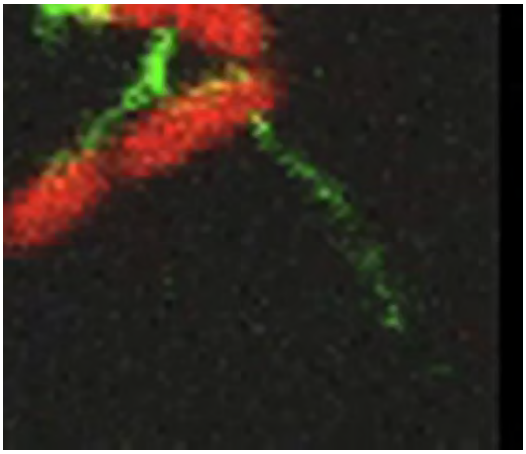
Hfr : the positions where insertion elements on F recombine with the bacterial chromosome

fin : fertility inhibition
phi : phage inhibition

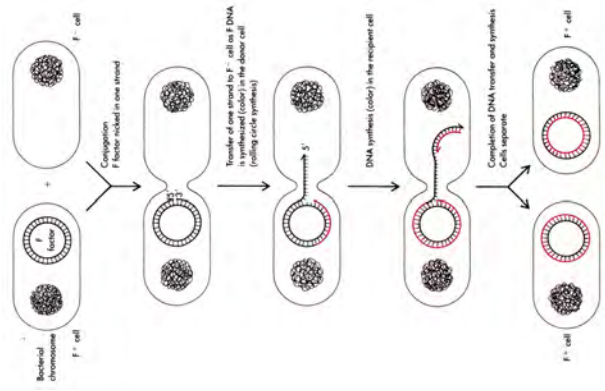
inc : incompatibility
rep : replication
tra : the transfer of the F factor to female cells
ilz : immunity to lethal zygosis
ori : origin of transer replication

16. The attachment of a male F pilus to the surface of a femail cell

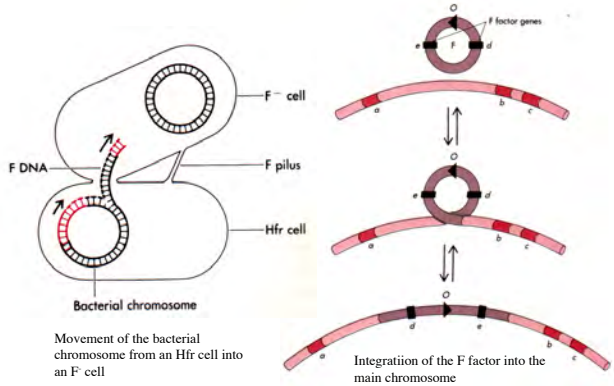




17. The transfer of F+ DNA to an F- cell



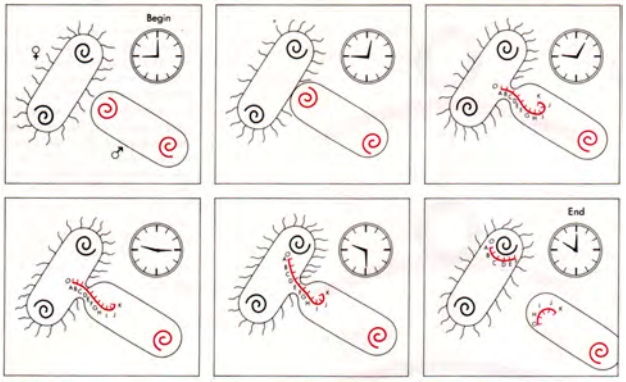
18. Hfr (high frequency of recombination)



Movement of the bacterial chromosome from an Hfr cell into an F⁻ cell

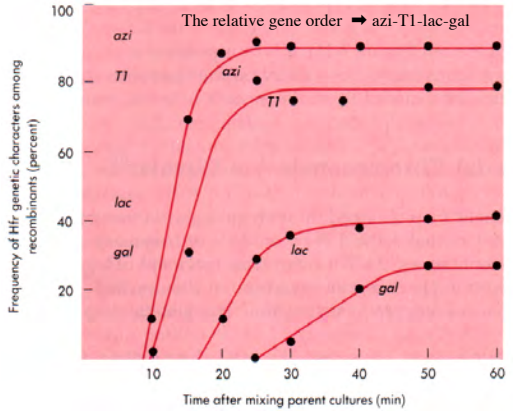
Integratiion of the F factor into the main chromosome

20. Conjugation between F⁻ and Hfr bacteria, as shown in a classic diagram



F. Jacob & E.L. Wollman, sexality and the Genetics of Bacteria, (1961)

21. The frequency fo donor Hfr marker genes

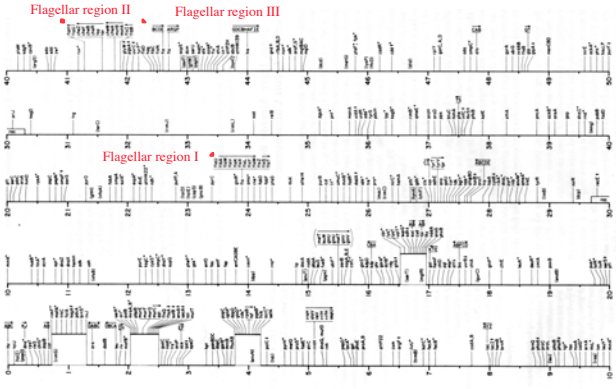


T1. Order of genes in conjugal transfer in different Hfr strains

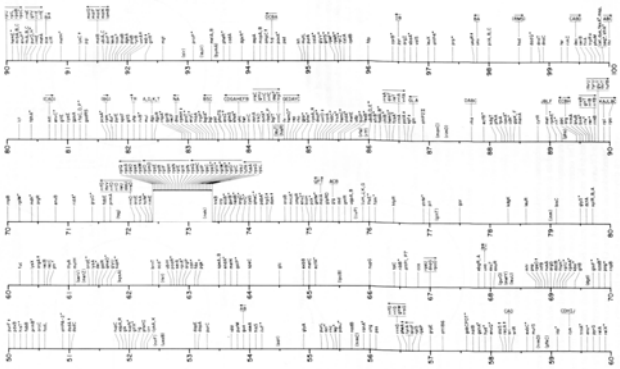
Hfr Strain	Order of Gene Transfer
Hayes	*O-thr-leu-azi-ton-pro-lac-pur-gal-trp-his-gly-str-mal-xyl-mtl-ile-met-thi*
Hfr 1	*O-leu-thr-thi-met-ile-mtl-xyl-mal-str-gly-his-trp-gal-pur-lac-pro-ton-azi*
Hfr 2	*O-pro-ton-azi-leu-thr-thi-met-ile-mtl-xyl-mal-str-gly-his-trp-gal-pur-lac*
Hfr 3	*O-pur-lac-pro-ton-azi-leu-thr-thi-met-ile-mtl-xyl-mal-str-gly-his-trp-gal*
Hfr 4	*O-thi-met-ile-mtl-xyl-mal-str-gly-his-trp-gal-pur-lac-pro-ton-azi-leu-thr*
Hfr 5	*O-met-thi-thr-leu-azi-ton-pro-lac-pur-gal-trp-his-gly-str-mal-xyl-mtl-ile*
Hfr 6	*O-ile-met-thi-thr-leu-azi-ton-pro-lac-pur-gal-trp-his-gly-str-mal-xyl-mtl*
Hfr 7	*O-ton-azi-leu-thr-thi-met-ile-mtl-xyl-mal-str-gly-his-trp-gal-pur-lac-pro*
AB311	*O-his-trp-gal-pur-lac-pro-ton-azi-leu-thr-thi-met-ile-mtl-xyl-mal-str-gly*
AB312	*O-str-mal-xyl-mtl-ile-met-thi-thr-leu-azi-ton-pro-lac-pur-gal-trp-his-gly*
AB313	*O-mtl-xyl-mal-str-gly-his-trp-gal-pur-lac-pro-ton-azi-leu-thr-thi-met-ile*

SOURCE: From F. Jacob and E. L. Wollman, *Sexuality and the Genetics of Bacteria* (New York: Academic Press, 1961).

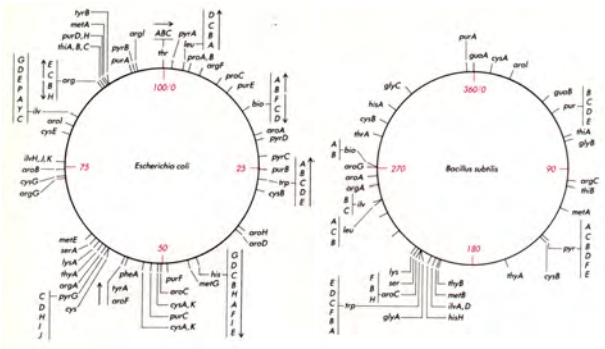
22-1. Complete genetic map of E. coli



22-2. Complete genetic map of E. coli



23. The genetic maps



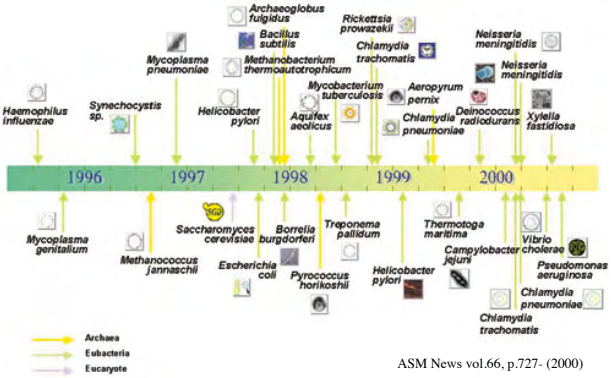
組み換えDAN技術からゲノム配列決定

1975年：カリフォルニアのアシロマにおいて、組換えDNA実験の安全性に関する激しい論争が、研究者の自主的な会議において展開され、組換えDNA実験の本格的な幕開けとなった。
1979年：3月我が国においても、組換えDNA実験の開拓に向け「大学等の研究機関等における組換えDNA実験指針」が文部省大臣告示。
1980年：東京大学医科学研究所および大阪大学微生物病研究所に、組換えDNA実験施設が設置された。
1983年：東京大学遺伝子実験施設を皮切りに、逐年、組換えDNA実験施設が整備されるようになった。（施設予定地から江戸時代の土器が出土）
1995年：独立生活を営む生物（細菌）の最初の完全なゲノム配列決定。
2003年：ヒトのゲノム配列完成版が発表される。
2010年：本間研のビブリオ菌株VIO5の全ゲノム配列を外注で決定。
2010年：本間研のVIO5変異体の変異部位を次世代シーケンサーで決定。

ゲノミクス から プロテオミクス
配列解読 から インフォマティクス

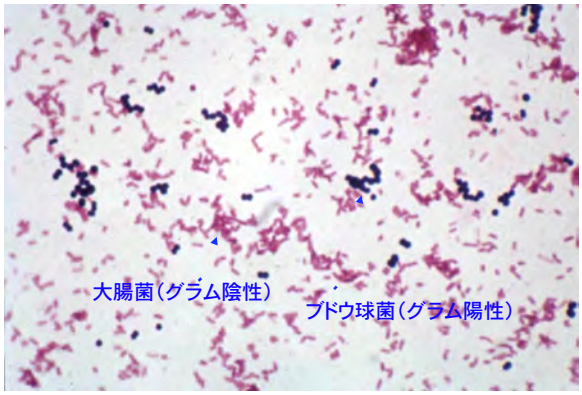
結局 生命現象理解のために、
タンパク質の機能解析をおこなう

細菌ゲノム決定のタイムテーブル



ASM News vol.66, p.727- (2000)

1. グラム染色



2. 細菌の形 I

ブドウ球菌

Staphylococcus

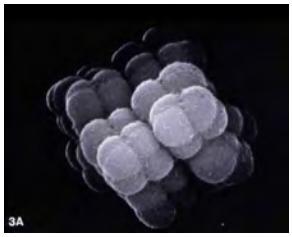
（*S. aureus*: 黄色ブドウ球菌）

レンサ球菌

Streptococcus

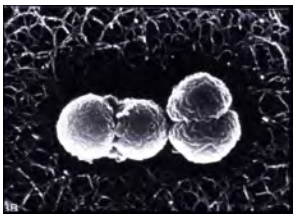
（*S. pneumoniae*: 肺炎レンサ球菌）

3. 細菌の形 II



ミクロコッカス（八連菌）

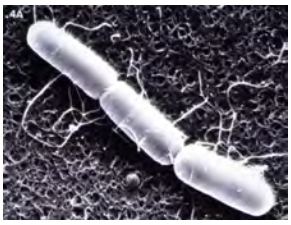
Micrococcus



淋菌（双球菌）

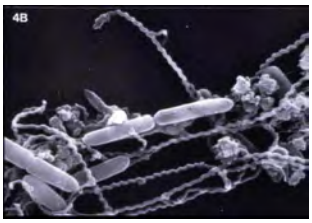
Neisseria gonorrhoeae

4. 細菌の形 III



枯草菌

Bacillus subtilis

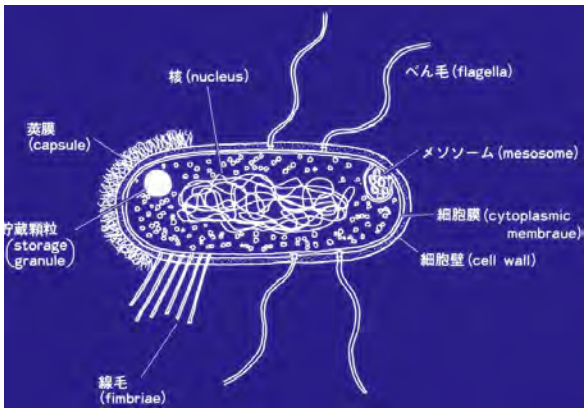


枯草菌とレプトスピラ

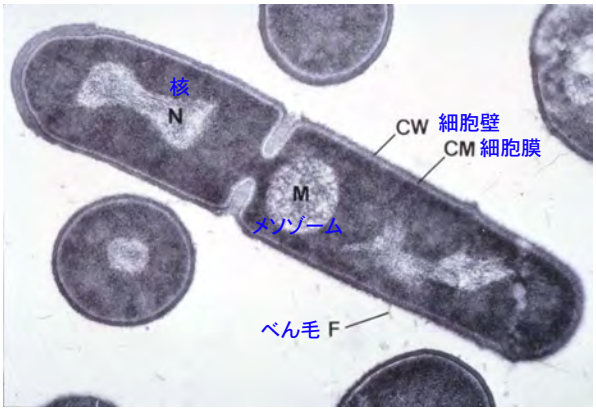
Leptospira

（スピロヘータ）

5. 細菌の構造



6. 枯草菌の超薄切片像



7. 超薄切片法で見た細胞壁の構造