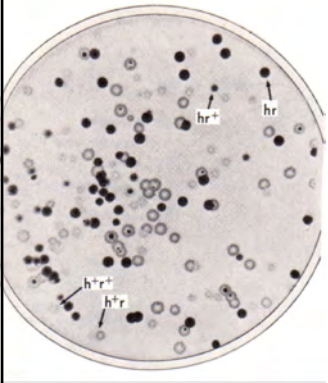
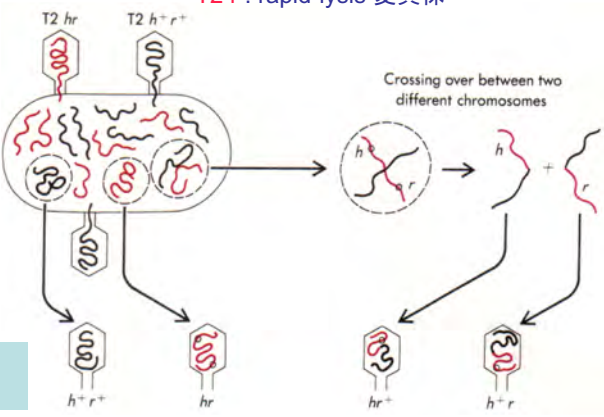


### 13. Phage recombination in cells infected with two different strains of phage T2



大腸菌B株とB/2株の混合菌でプラークを作らせることで、 $h^+r^+$ 、 $hr$ 、 $h^+r$ 、 $h^-r$ を区別

T2h:野生型T2が吸着できない大腸菌B/2に感染できる変異株  
T2 r : rapid-lysis 変異株

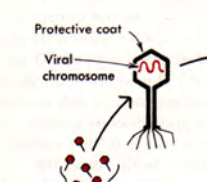


Crossing over between two different chromosomes

1945年: 変異株ファージ間での遺伝的組み換えの発見

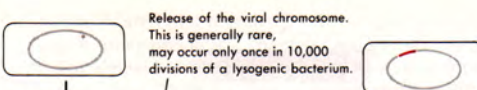
### 29. The life cycle of a lysogenic bacterial virus

The first step in the multiplication of a virus is its attachment to a host cell; more than one virus particle can simultaneously adsorb to a single cell.

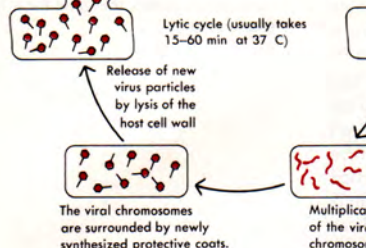


Protective coat  
Viral chromosome

Release of the viral chromosome. This is generally rare, may occur only once in 10,000 divisions of a lysogenic bacterium.



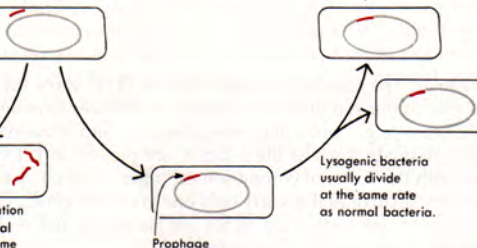
Lytic cycle (usually takes 15-60 min at 37 C)



Release of new virus particles by lysis of the host cell wall

The viral chromosomes are surrounded by newly synthesized protective coats.

Lysogenic bacteria usually divide at the same rate as normal bacteria.

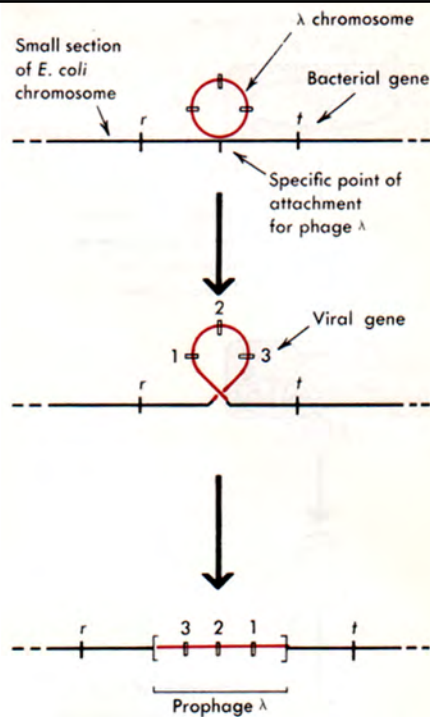


Multiplication of the viral chromosome

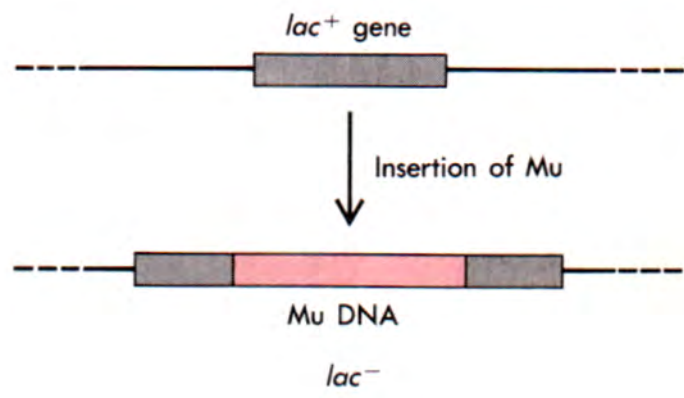
Prophage

溶原化ファージ⇨入ファージ⇨プロファージ

30. Insertion of the chromosome of phage  $\lambda$  into *E.coli* chromosome

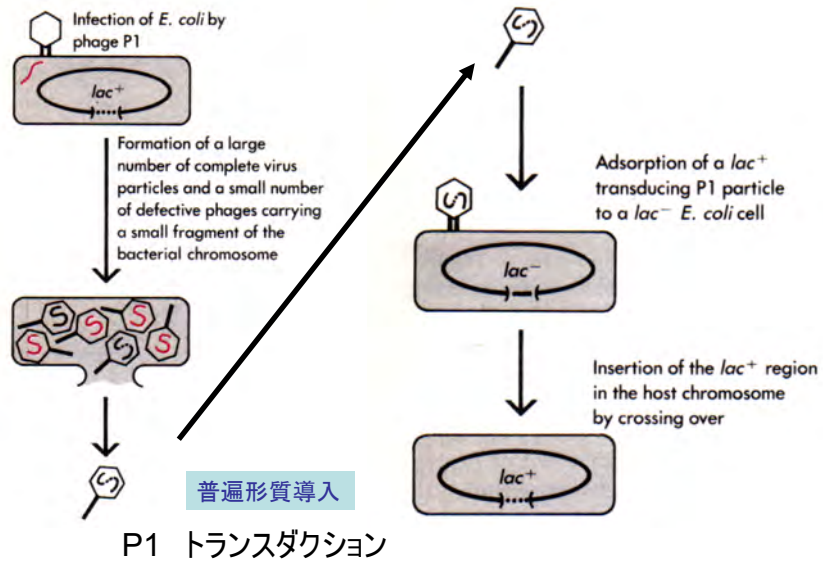


Insertion of Mu DNA



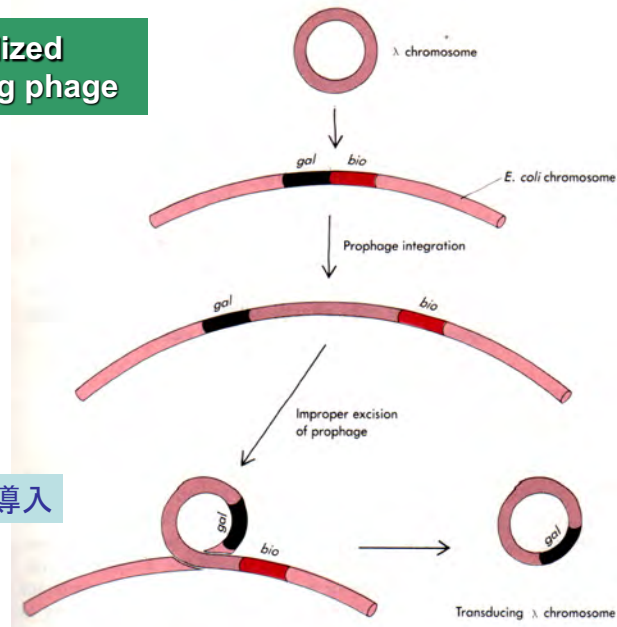
Muは $\lambda$ ファージと異なり、挿入が起こる場所はランダムである

**Transduction, the passive transfer of genetic material from one bacterium to another by means of carrier phage particles**

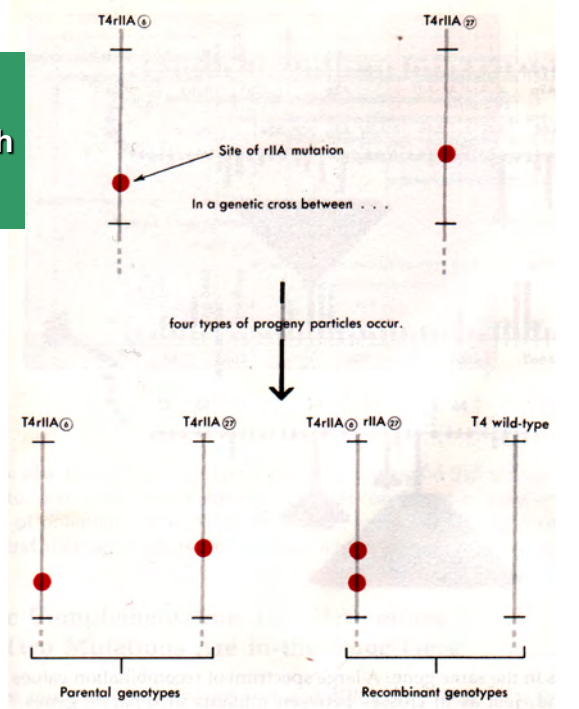


**Specialized transducing phage**

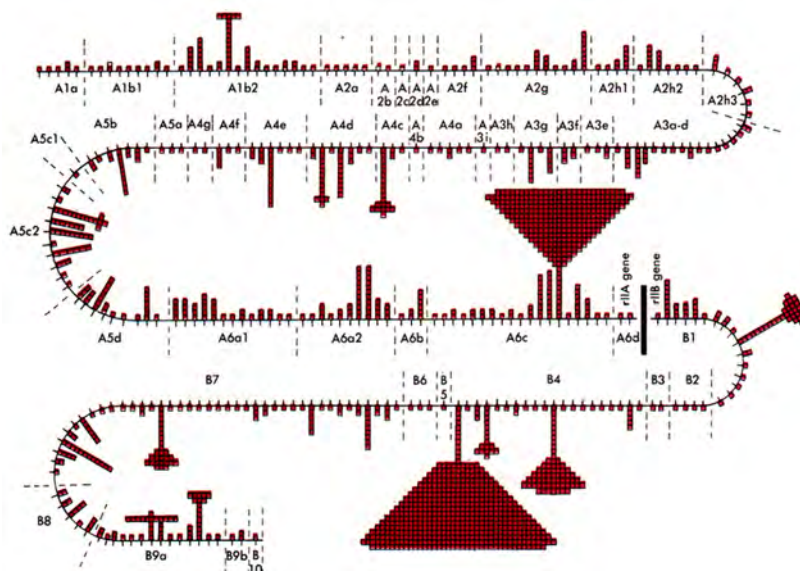
特殊形質導入



The demonstration of crossing over with in the gene



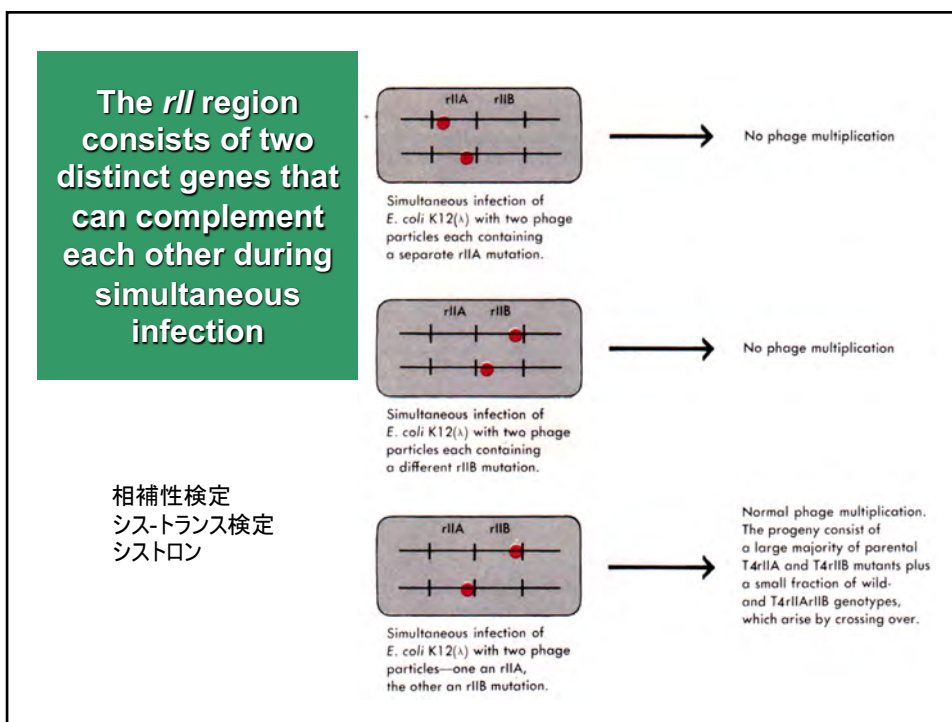
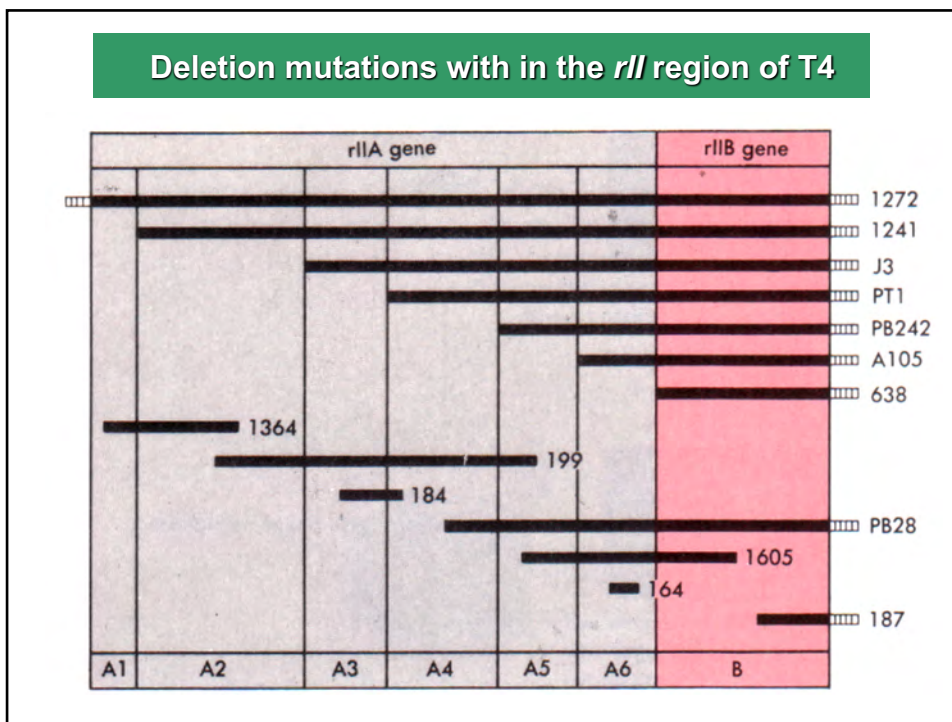
The genetic map of the rIIA and rIIB genes of phage T4



S. Benzer, PNAS, (1961)

多くの変異部位を同定することで、遺伝子には変異する部位がたくさんありそれが線状に配列していることが分かった。





## The Genetic Systems Provided by *E. coli*

### Molecular Biology of the Gene

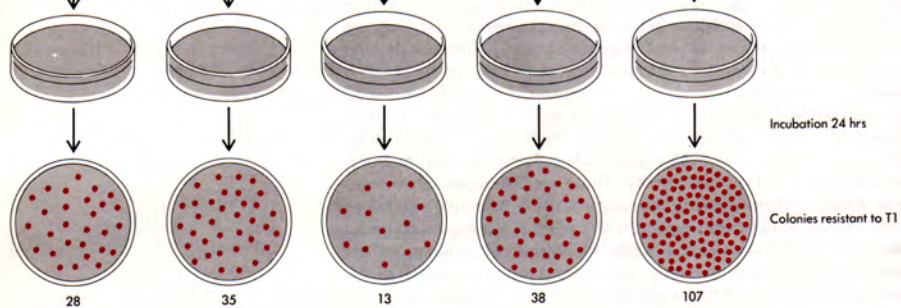
#### 1. Fluctuation analysis of bacterial resistance to phage

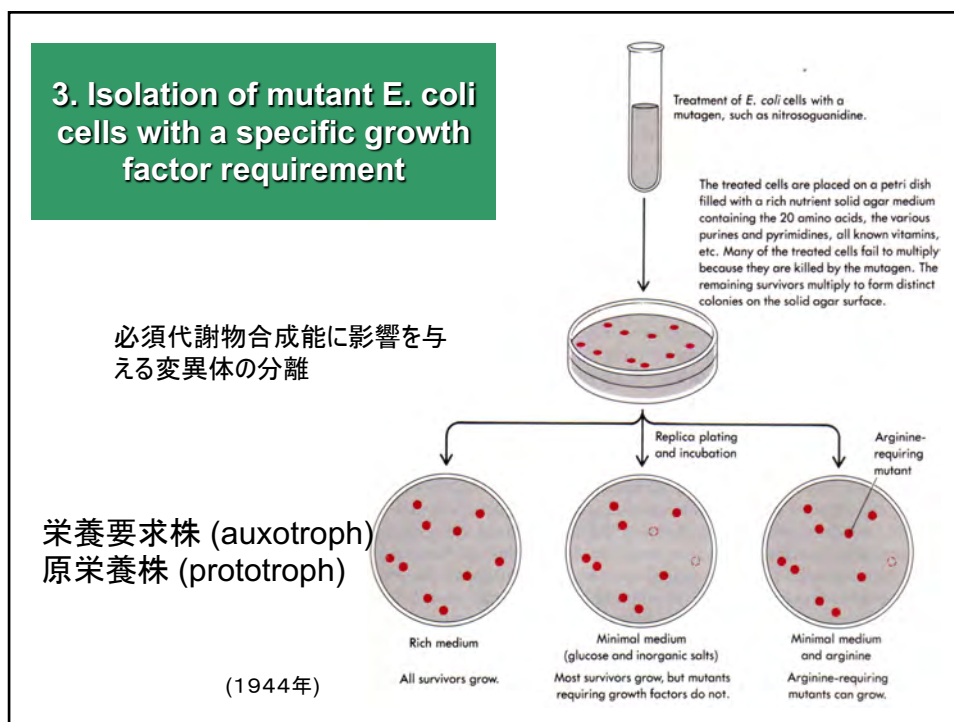
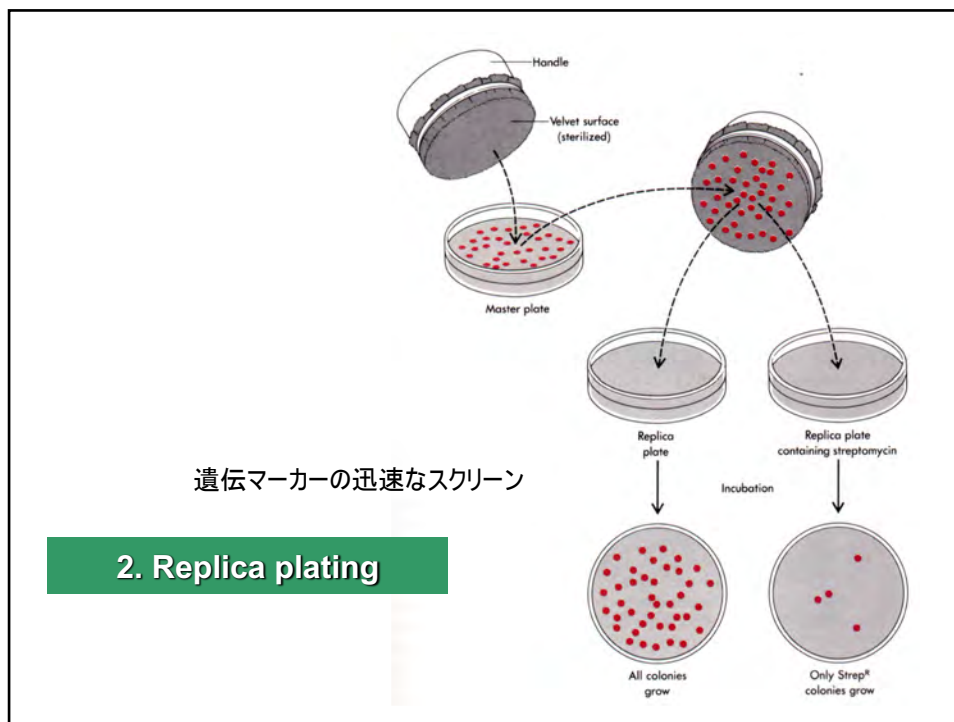
細菌の変異についての適応説  
(ラマルク説)は否定



Five separate  
*E. coli* B cultures are  
inoculated onto plates  
covered with phage T1

(1943年)

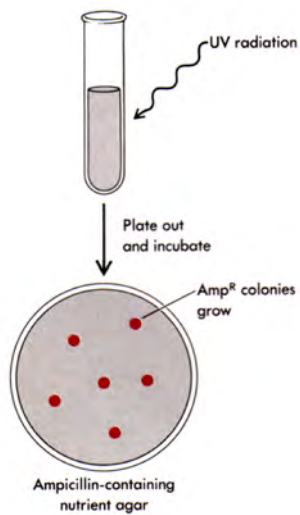




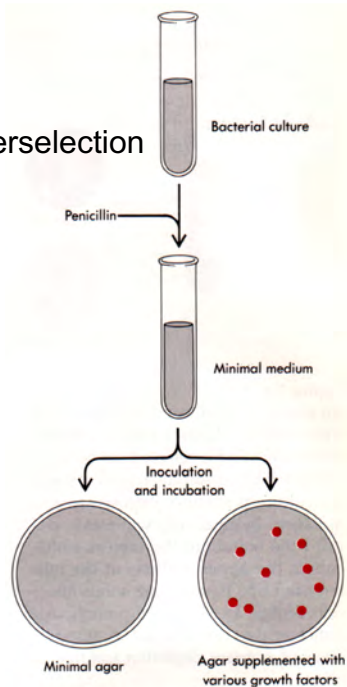


### 4. Enriching mutants I

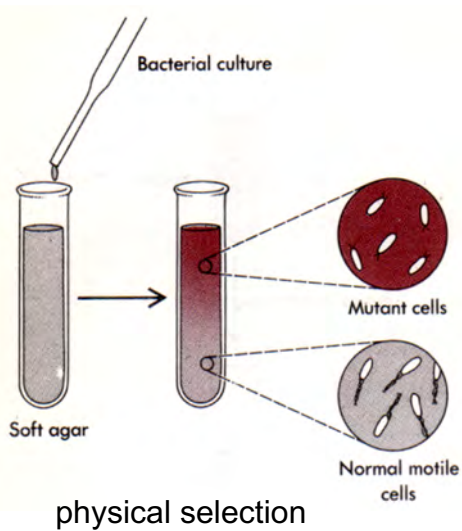
direct selection



counterselection



### 5. Enriching mutants II

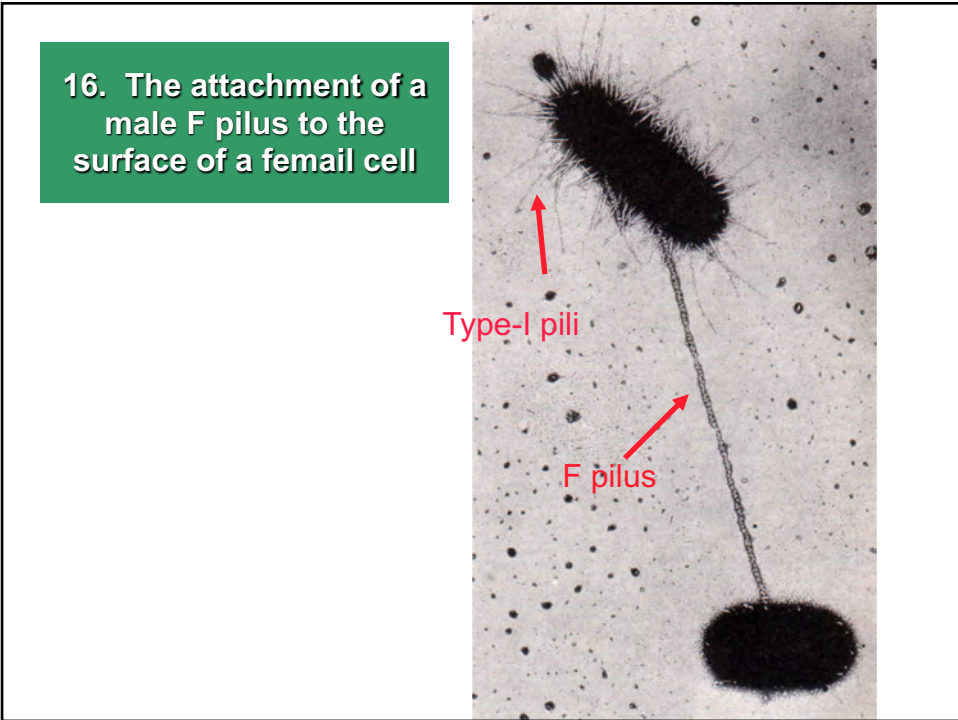
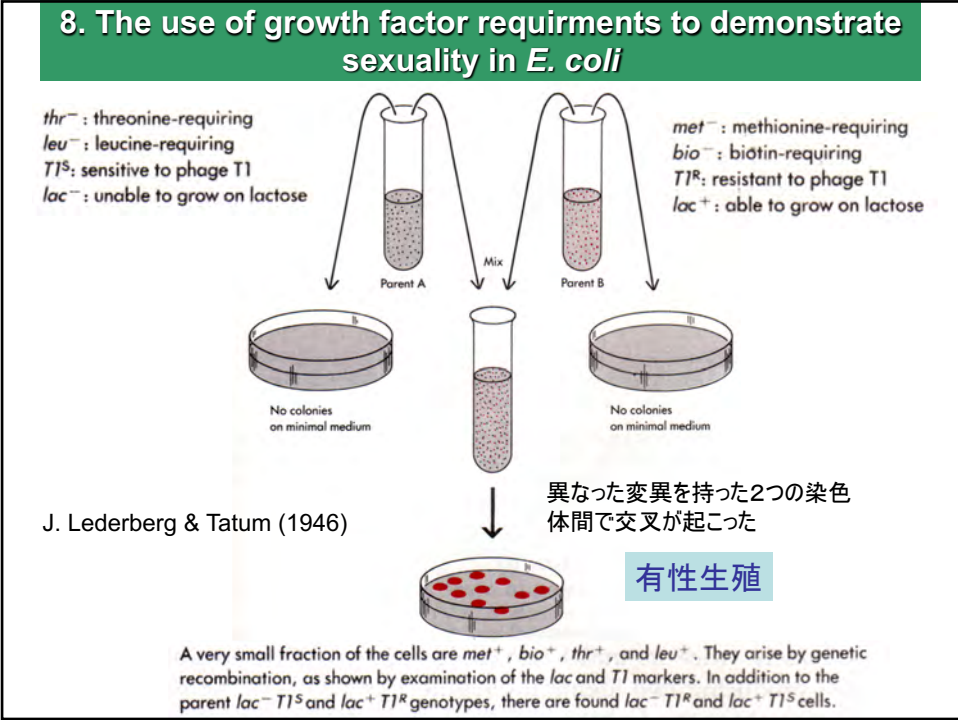


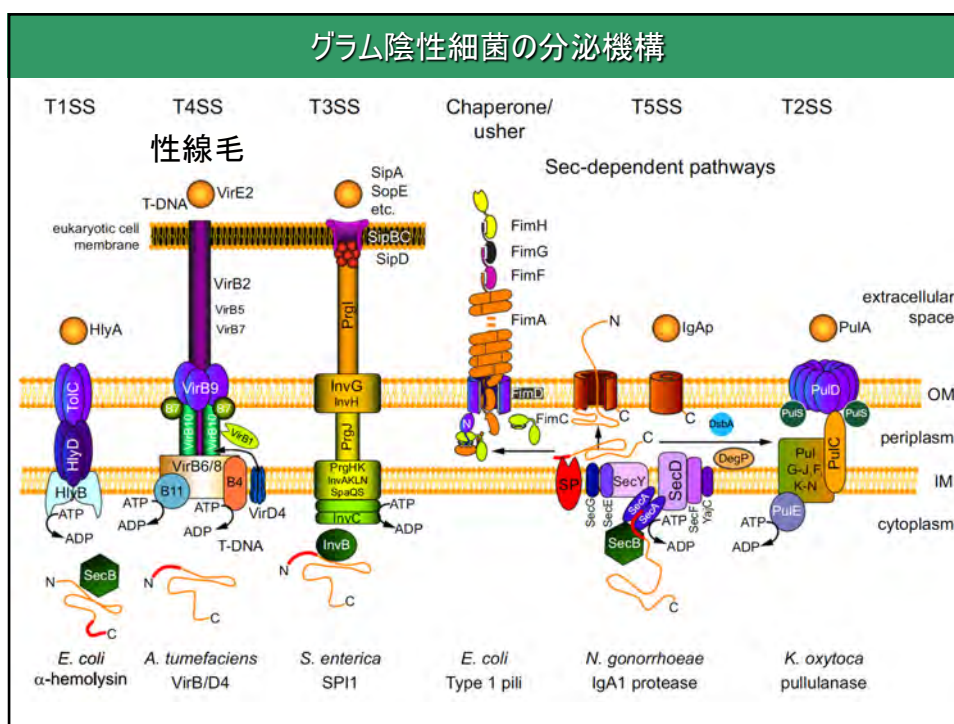
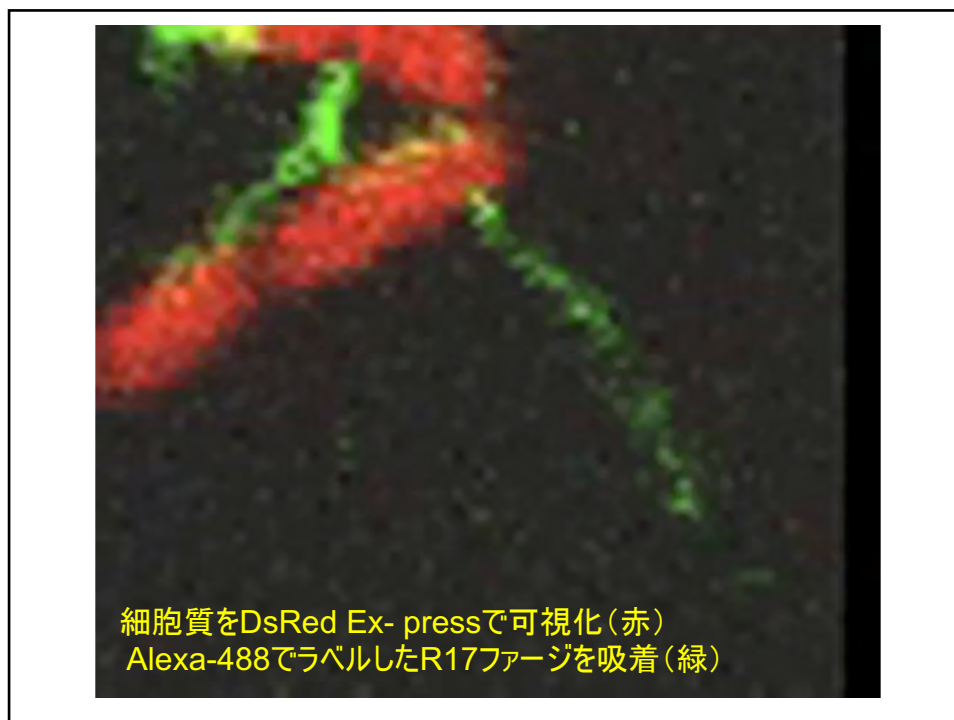
pH-sensitive dyes to detect metabolic mutants

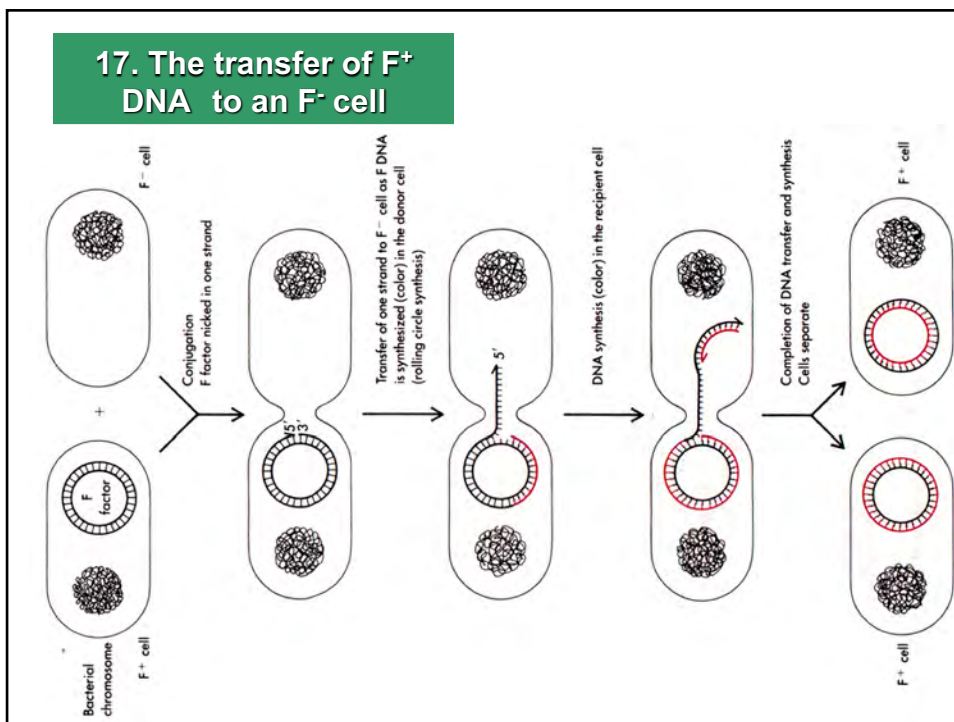
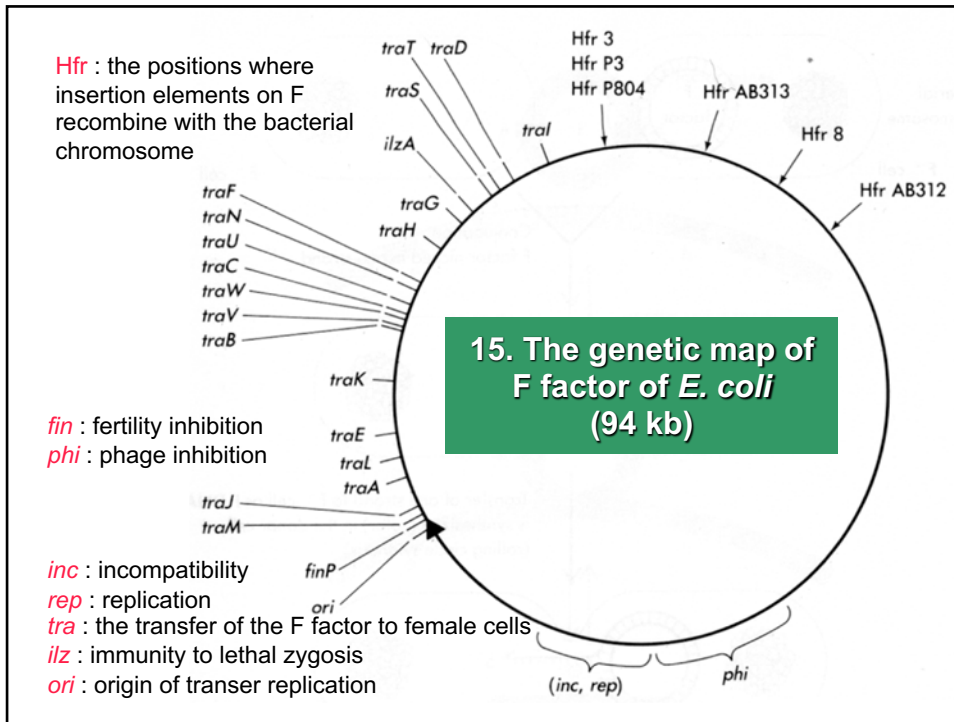


Brute force isolation

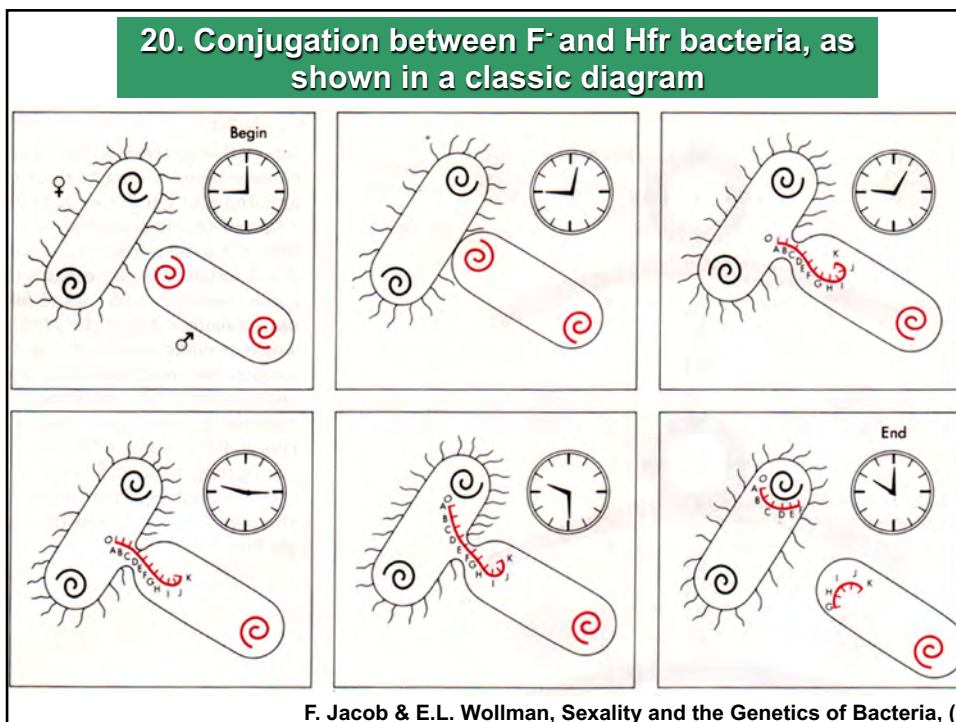
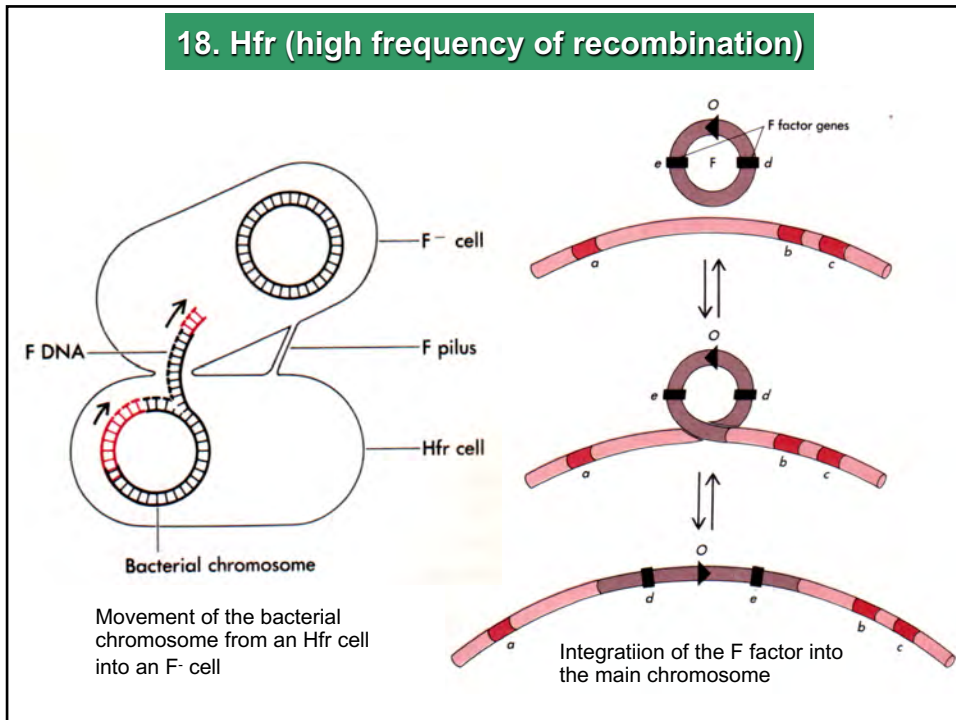
変異剤を使った後、1万個のコロニーを各々スクリーニングする。





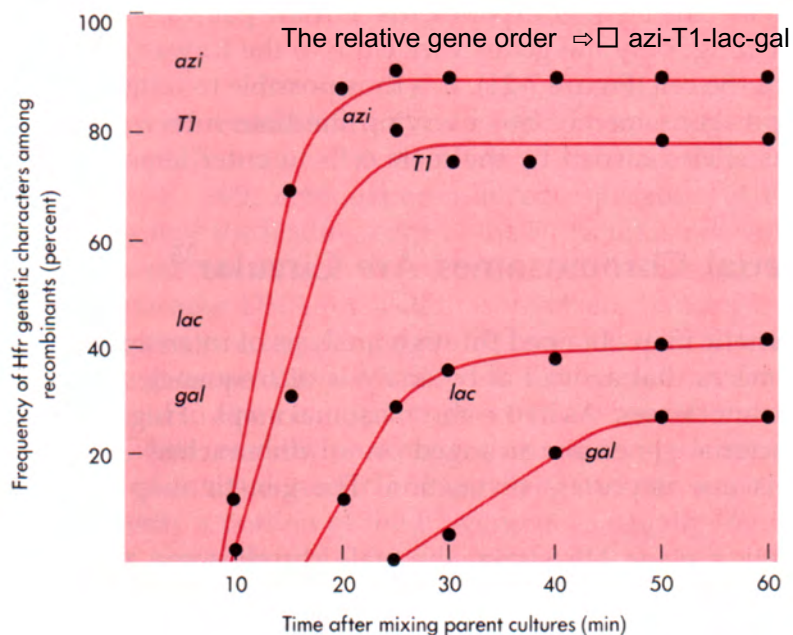








## 21. The frequency of donor Hfr marker genes



## 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).



23. The genetic maps

