

Recombination in Bacteria

1. Conjugation

DNA from a donor cell is transferred to a recipient cell through a conjugation tube (pili).

2. Transformation

Uptake of naked DNA molecule from remains of one bacterium (donor cell) by another bacterium (recipient cell).

3. Transduction

Bacterial genes are carried from a donor cell to a recipient cell by a bacteriophage.

{ Generalized

{ Specialized

Conjugation

- Ability to conjugate located on the F-plasmid
- F+ Cells act as donors
- F- Cells act as recipients
- F+/F- Conjugation:
 - { F Factor “replicates off” a single strand of DNA.
 - { **New strand** goes through pili to recipient cell.
 - { **New strand** is made double stranded.
 - { If entire F-plasmid crosses, then recipient cell becomes F+, otherwise nothing happens

Conjugation with Hfr

- Hfr cell (High Frequency Recombination) cells have F-plasmid integrated into the Chromosome.
- Integration into the Chromosome is unique for each F-plasmid strain.
- When F-plasmid material is replicated and sent across pili, Chromosomal material is included.

(Figure 6.10 in Klug & Cummings)

- When chromosomal material is in recipient cell, recombination can occur:

{ Recombination is double stranded.

{ Donor genes are recombined **into** the recipient cell.

{ Corresponding genes from recipient cell are recombined **out** of the chromosome and reabsorbed by the cell.

Interrupted Mating Mapping

1. Allow conjugation to start

Genes closest to the origin of replication site (in the direction of replication) are moved through the pili first.

2. After a set time, interrupt conjugation

Only those genes closest to the origin of replication site will conjugate. The longer the time, the more that is able to conjugate.

3. Notice which genes are recombined

Genes that recombine are within X distance (conjugation time-distance) of the origin of replication.

Conjugation Mapping

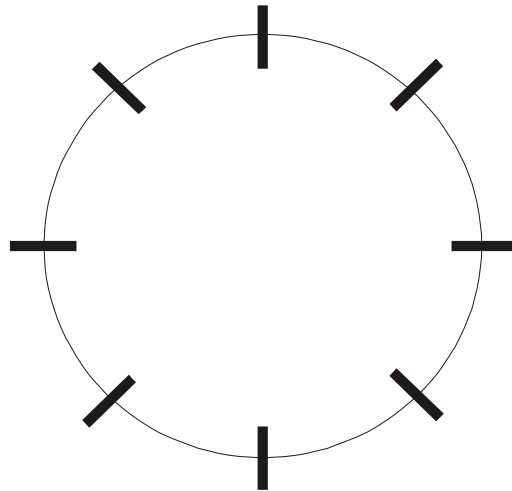
Using different strains of F-plasmids and the interrupted mating technique, we can determine the order of genes on the Chromosome.

1. For a strain of Hfr, use the interrupted mating technique to determine the **order** of the genes in the region of the chromosome near the plasmid insertion point.
2. Obtain the order of the genes using various strains & the interrupted mating technique (as in 1).
3. Using these orders, a map of the chromosome can be deduced.

Hfr Mapping

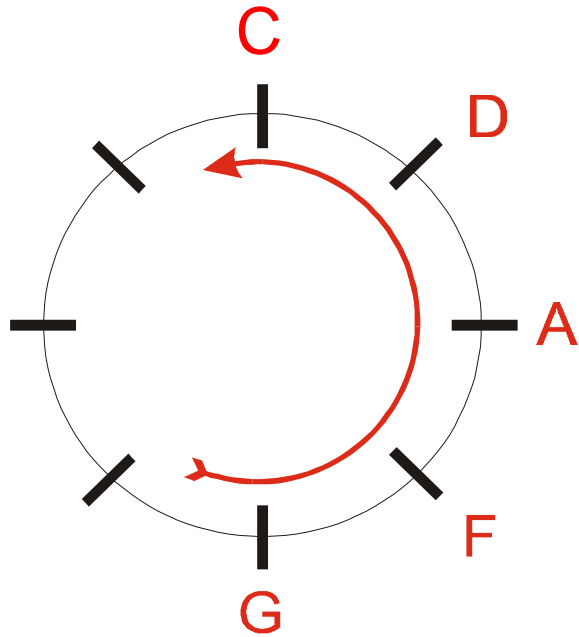
Here are the data from an Hfr mapping experiment:

Hfr Strain	Earliest (First)			Latest (Last)	
1	C	D	A	F	G
2	B	H	G	F	A
3	D	C	E	B	H
4	G	H	B	E	C



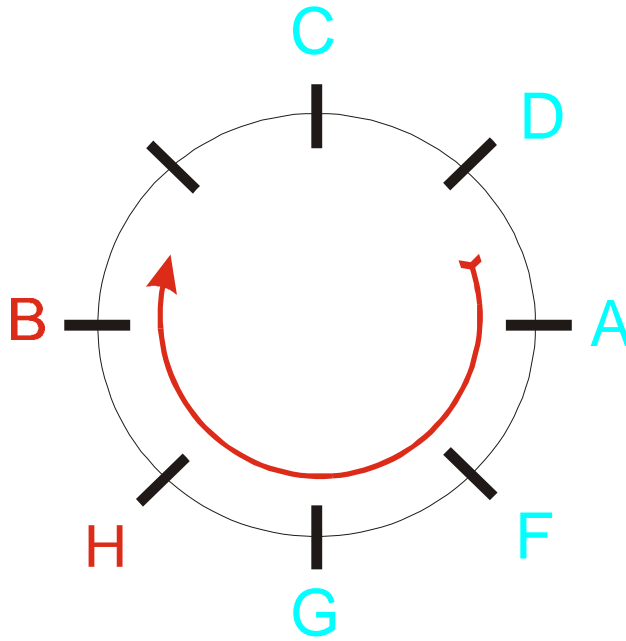
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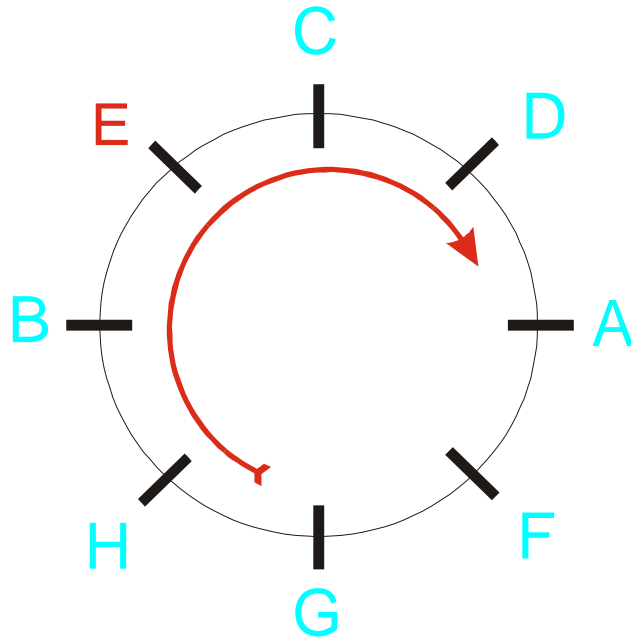
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