Genetic Recombination & Mapping in Bacteria

- Three methods of Recombination in Bacteria:
  - Conjugation
  - Transformation
  - Transduction: Generalized transduction & Specialized transduction

Bacterial Growth

- physical process
- F plasmid
- Sex pilus
- F+ and F- cells
- evidence for physical contact
Conjugation

**Figure 16.5** An electron micrograph of conjugation between an F' E. coli cell and an F cell. The sex pilus linking them is clearly visible.

**Legend**
- **F Factor**
- Chromosome
- Conjugation between recipient and donor cell
- One strand of the chromosome in recipient cell is transferred to the donor cell
- The F factor is integrated into the recipient cell
- The F factor is lost during replication
- The recipient cell becomes F-

**Procedure**
- Plate F' (Strain A) on minimal medium and incubate
- Plate F' (Strain B) on minimal medium and incubate
- Medium passes back and forth across filter; cells do not
- Pressure/suction alternately applied

**Results**
- No growth
- No growth (no photograph)
- Only mit (no/low) and mit (no/low) cells grow occurring at a frequency of 1/100 of total cells
- No growth (no photograph)
Hfr recombination

- plasmid incorporated
- same process as F+ cell
- longer period, not all genes transferred
- F- cell remains F-

Merozygotes

- Partial diploid cells (merozygotes)
- Used in gene regulation studies
Mapping

- **Relative frequency of recombination**

- **Time map**

- **Order of transfer**

<table>
<thead>
<tr>
<th>Hfr strain</th>
<th>Order of transfer</th>
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<tbody>
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<td>ton &lt; azi &lt; leu &lt; thr &lt; thi &lt; gal &lt; lac</td>
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Transformation

- Exogenous DNA
- Competence of cells
- Linkage and gene transfer

Transformation

- Linked genes
- Simultaneous gene transfer
- Second experiment using single gene mutants
- Double Transformation 25X fewer
Transduction: Generalized

- Virus mediated
- lytic cycle of virus
- incorporation of bacterial DNA (random)

Transduction: Specialized

- lysogenic cycle of virus
- incorporates into bacterial genome
- excises out; can carry bacterial genes
- more specific genes