Lecture 17
Horizontal Gene Transfer and Bacterial Recombination
- A piece of donor DNA (the ) enters a recipient cell and may become a stable part of the recipient genome (the ) thus forming a cell.
In horizontal gene transfer:

1. The transfer of DNA is - from donor to recipient.

2. If DNA transfer is chromosomal, of the chromosome is usually transferred.

3. DNA is transferred to no more than a of the possible recipient cells.

Remember our transformation plates:

- Isolated colonies
- A lawn of bacterial growth
Fates of the exogenote after horizontal gene transfer

1. If it contains a sequence that is homologous to that of the endogenote, it may into the genome of the recipient creating a recombinant genome.

2. It may outside of endogenote. This can sometimes produce partially diploid cells.

3. It may . This may make one cell partially diploid.

4. Host cell nucleases may it.
1. DNA transformation

**Remember**—either or DNA can be taken up during a transformation.

- The plasmid resides in the cytoplasm
a. Cells that are capable of being transformed are termed

b. A few bacterial genera are spp.

   Neisseria spp.

   spp.

c. Most cells have to be made competent by (e.g. Ca⁺⁺ ions) or by
d. Mechanism: linear DNA resulting in **nonreciprocal general recombination**.

1.) **Separation** of DNA
   
   A fragment of dsDNA binds to the cell surface.
   
   This strand

2.) **INTEGRATION** of DONOR DNA
   
   a.) Inside the cell, the piece of donor DNA is
       next to the complimentary region of recipient DNA. The
       two regions are said
   
   b.) **BREAKAGE = A nuclease**
       and releases it into the cytoplasm where it is
       degraded.
   
   c.) **REUNION = The donor DNA**
Donor DNA

The recipient DNA separates and endonucleases trim any excess donor DNA

recipient DNA

DNA ligase closes the gaps

An (at arrows) and it is degraded.
What were the two different types of phages that we discussed in lab?
2. Transduction

*Review bacteriophage as discussed in lab*

a. After phage infect the host cell, multiply and are released, some of them will

b. Phage-containing bacterial genes infect another bacterium and

During maturation of the lytic cycle, a phage is mistakenly packed with bacterial DNA. of the donor can be transferred.

An error is made during the lysogenic life cycle allowing the phage to take some the host DNA when it leaves the host chromosome. Thus, in this type of transduction, next to the point of integration may be transferred.
Generalized transduction:

- **Adsorption**: 
  - Viral DNA
  - E. coli host

- **Penetration**: 
  - Phage "hijacks" the host cell. Viral nucleic acids are manufactured.

- **Biosynthesis**: 
  - Phage components are manufactured.

- **Virus release**: 
  - With bacterial DNA will transfer this DNA to a recipient bacterium.
  - Cell lysis
  - Daughter phage
ds DNA from exogenote is into the endogenote's genome (cell is a partial diploid)
3. Conjugation
   a. Most important means of . Some plasmids are self-transmissable:
      1.) The plasmid
         a.) codes for the synthesis of a structure called the .
         b.) contains information required for its
         c.) cells (males) - contain the F plasmid ( ).
         d.) Recipient cells (females) - the F plasmid (F⁻).
         e.) can into the chromosome (called an episome).

     Plasmid transfer is

*Donor cells transfer the F plasmid but their chromosomal DNA.
The sex pilus of the donor cell binds to the recipient cell and pulls the two cells together.

Enzymes cleave the bottom strand of the F-plasmid. The end of replication is used during plasmid transfer.

A strand that is synthesized in the recipient cell.

*Note - both blue and green are equivalent DNA strand.
2.) R-plasmids
   a.) encode for . Allow for the resistance to widely used (may have as many as 8 resistance genes).
   b.) are
   c.) probably result from containing antibiotic-resistance genes that jumped into plasmids.
   d.) are into the host chromosome.

3.) Other conjugative plasmids contain genes that encode for the synthesis of virulence factors or proteins that degrade chemical toxins.
b. Chromosome transfer

1.) Sometimes the F plasmid becomes of an F+ cell via homologous recombination. This creates

2.) Chromosome transfer can now occur via a mechanism very similar to plasmid transfer.

3.) During chromosome transfer, the recipient and donor cells separate and since the part containing the integrated F plasmid is one of the last parts transferred, tl
Connection between Hfr cell and recipient cell is broken before transfer is complete. The majority of the F-plasmid is not transferred.

Hfr cell and recipient cell (F-)

Hfr cell and recipient cell (F-)

Hfr cell and recipient cell (F-)

Hfr chromosomal DNA may integrate