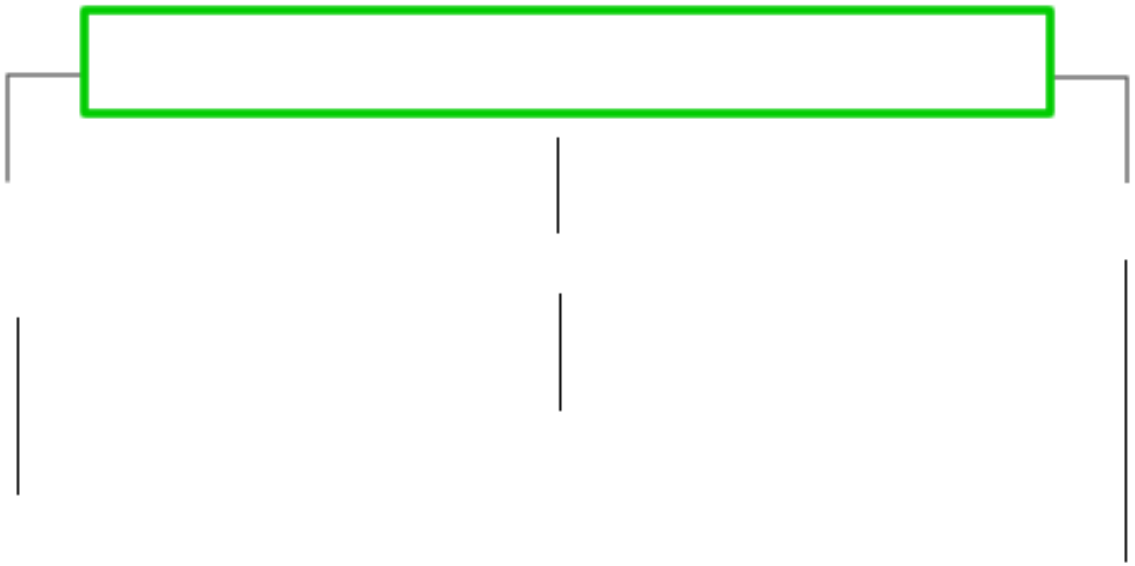
Lecture 17

Horizontal Gene Transfer **and Bacterial Recombination**

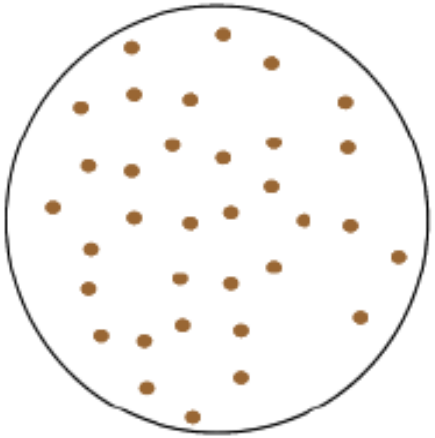
- A piece of donor DNA (the) enters a recipient cell and may become a stable part of the recipient genome (the) thus forming a cell.



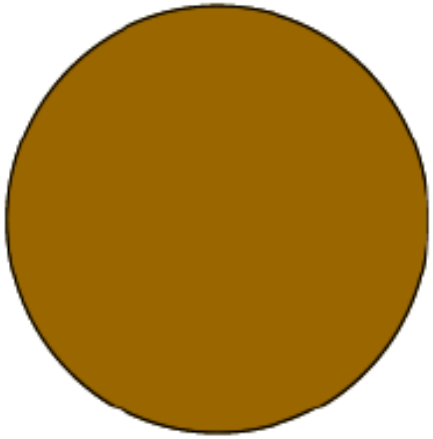
In horizontal gene transfer:

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



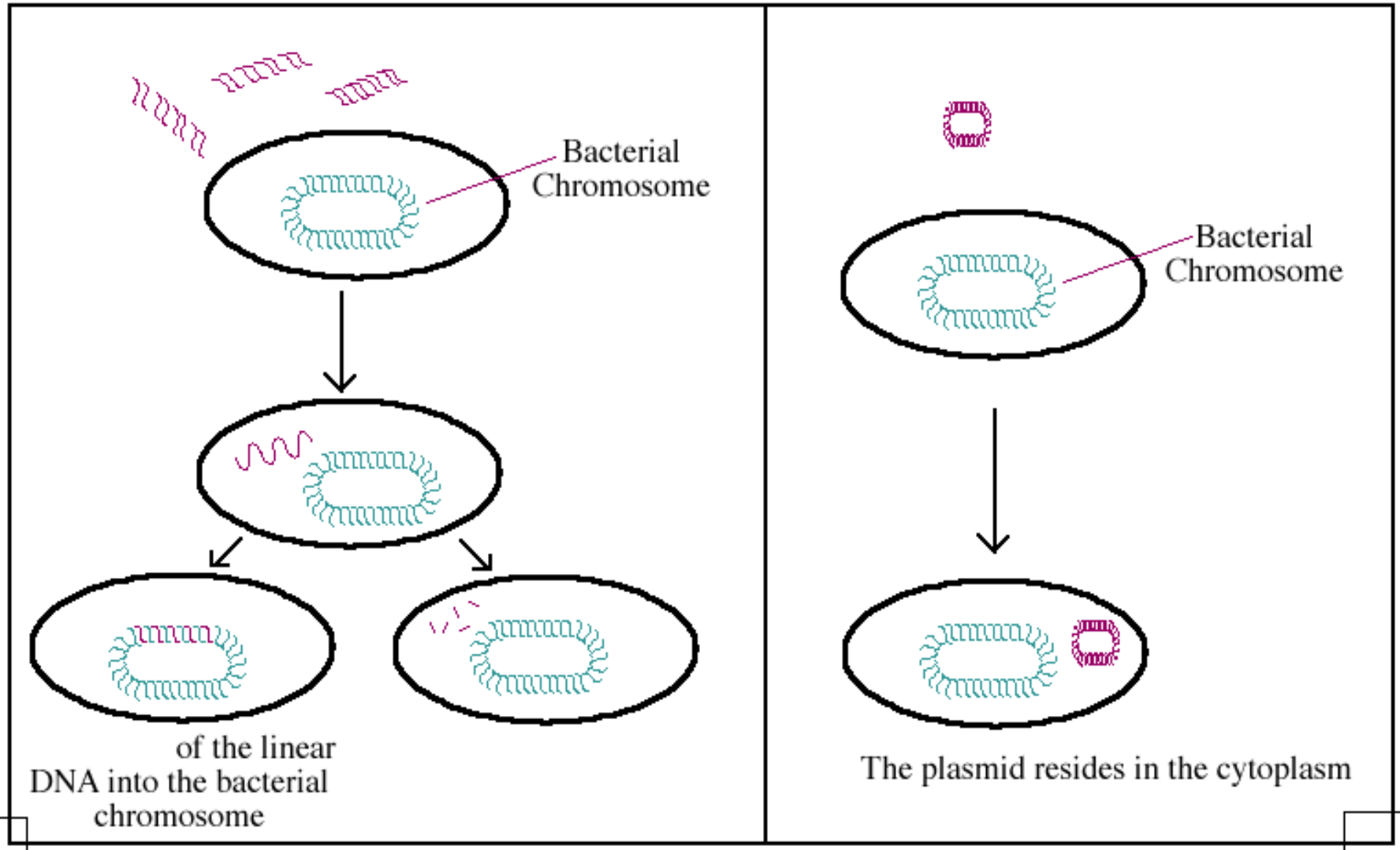
A lawn of bacterial growth

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.



a. Cells that are capable of being transformed are termed

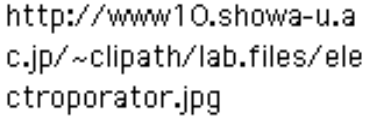
b. A few bacterial genera are :

spp.

Neisseria spp.

spp.

c. Most cells have to be made competent by (e.g. Ca^{2+} ions) or by .

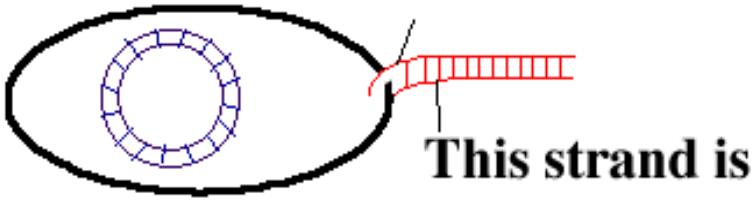

http://www10.showa-u.ac.jp/~clipath/lab.files/electroporator.jpg

d. Mechanism: linear DNA resulting in **nonreciprocal general recombination**.

1.) of DNA

A fragment of dsDNA binds to the cell surface.

This strand



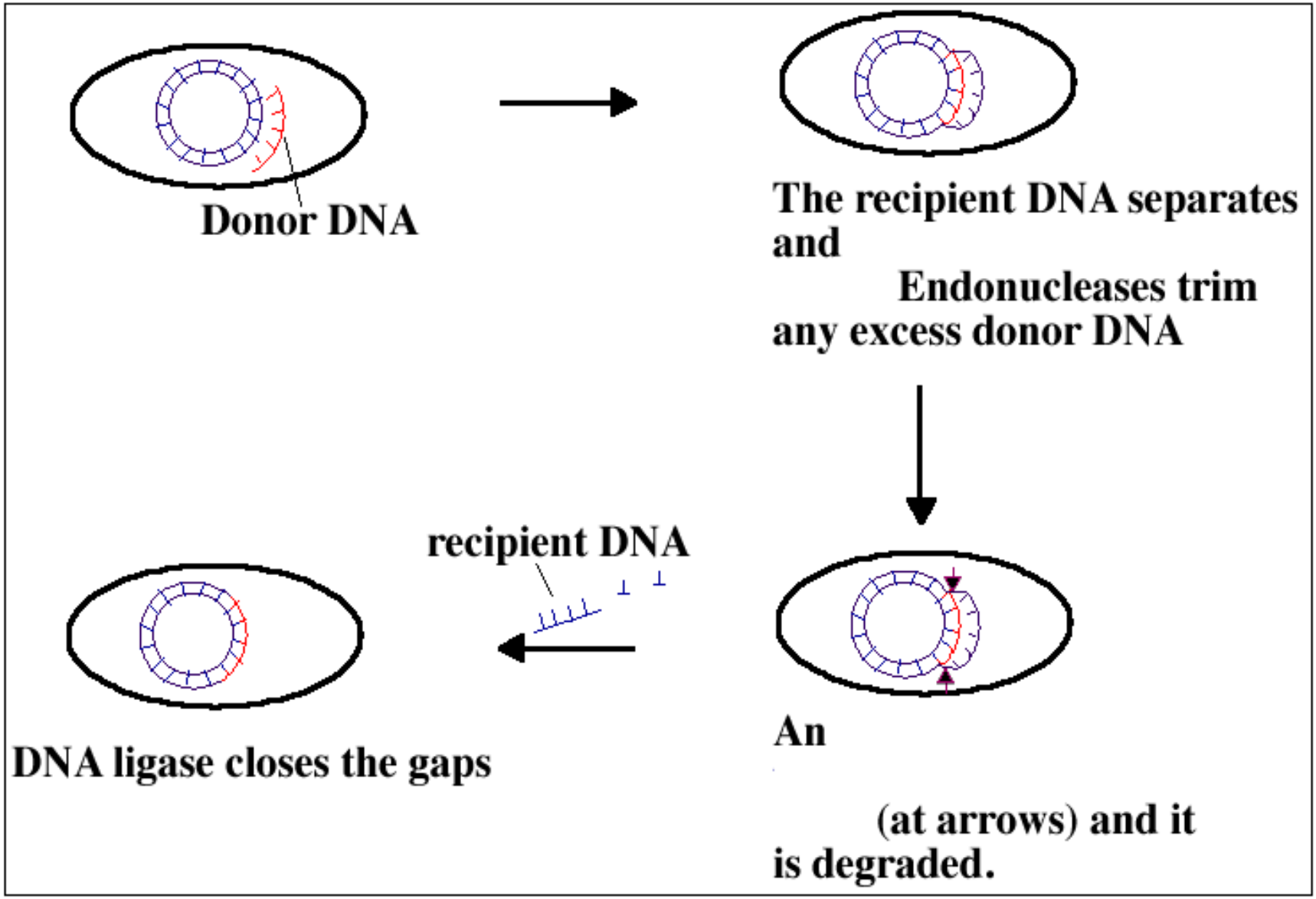
This strand is

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
An
(at arrows) and it is degraded.
DNA ligase closes the gaps

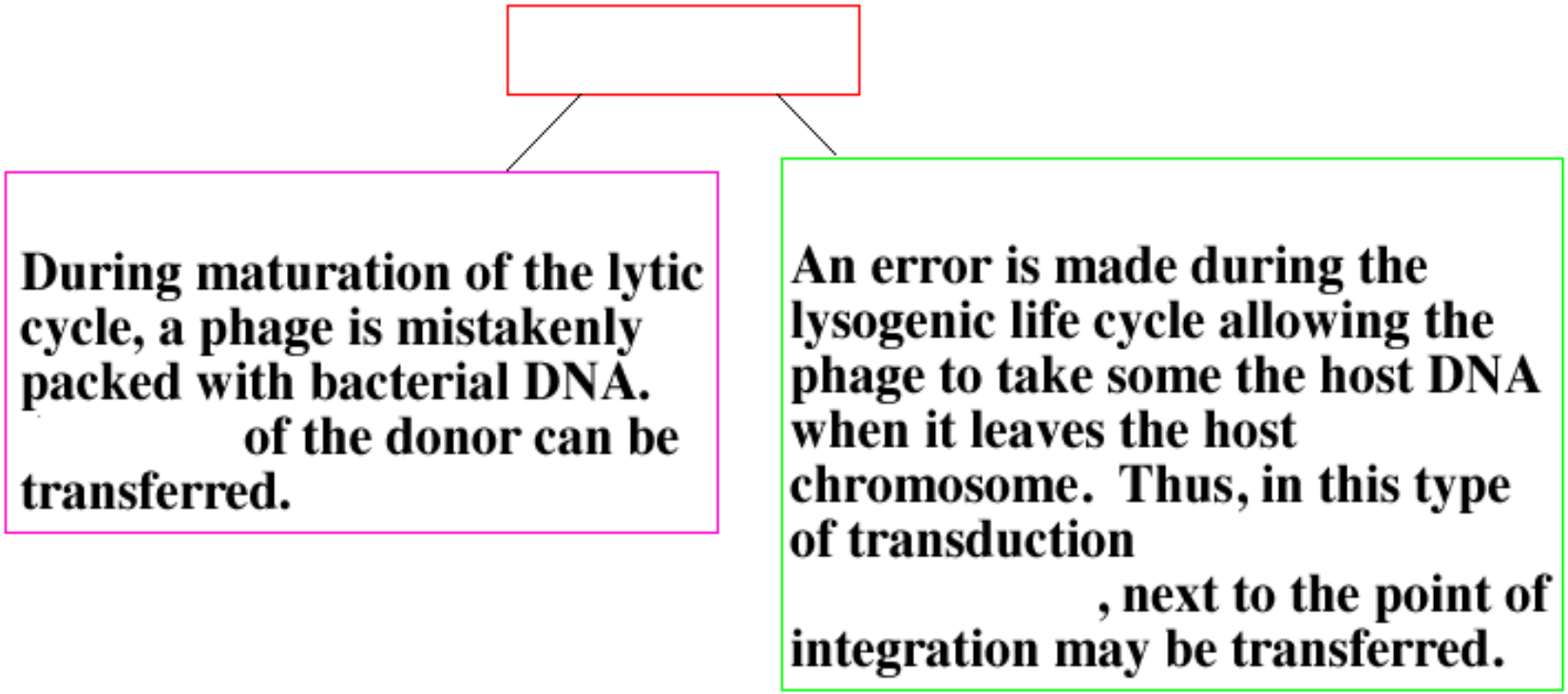
What were the two different types of phages that we discussed in lab?

2. Transduction

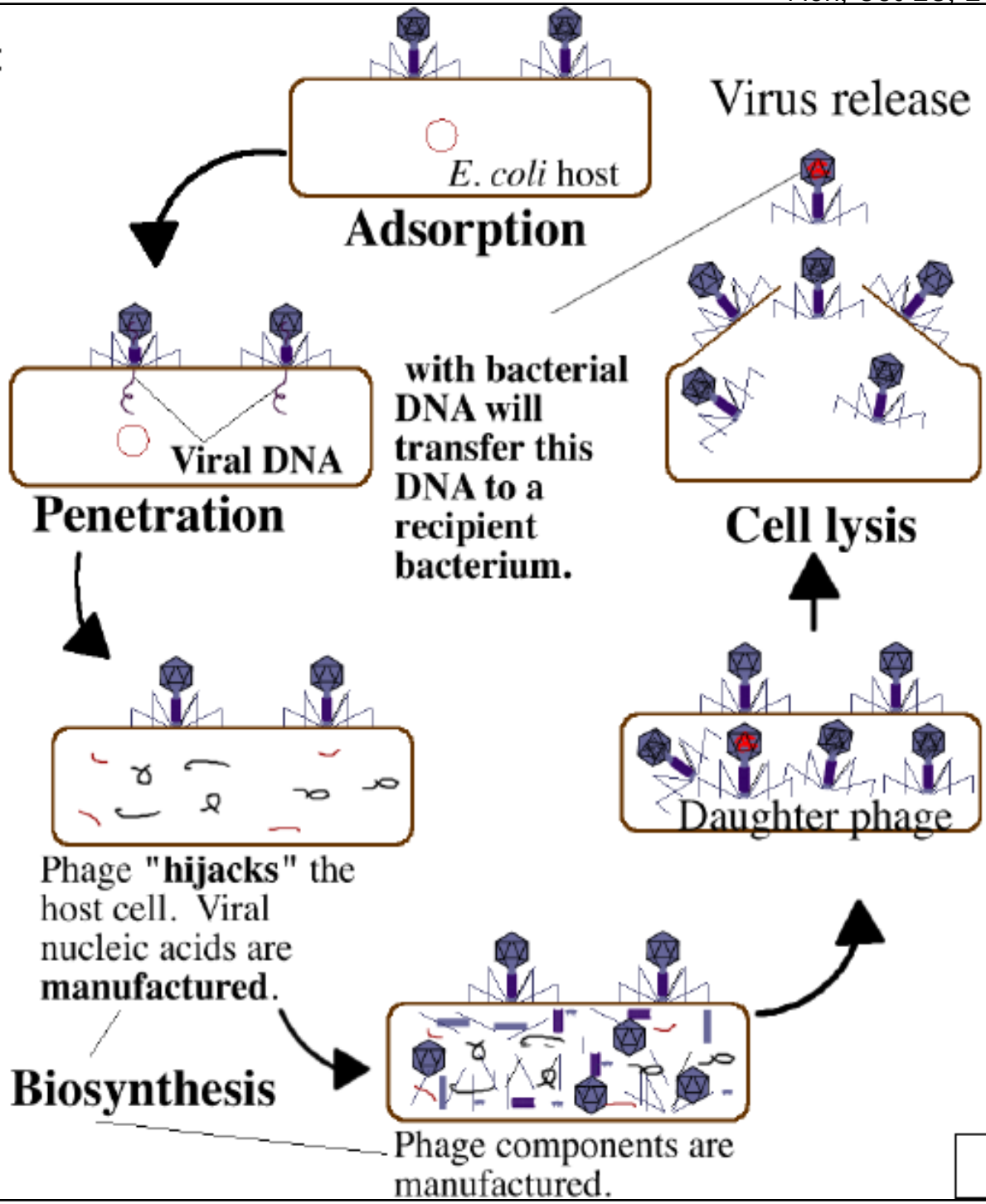
Review bacteriophage as discussed in lab

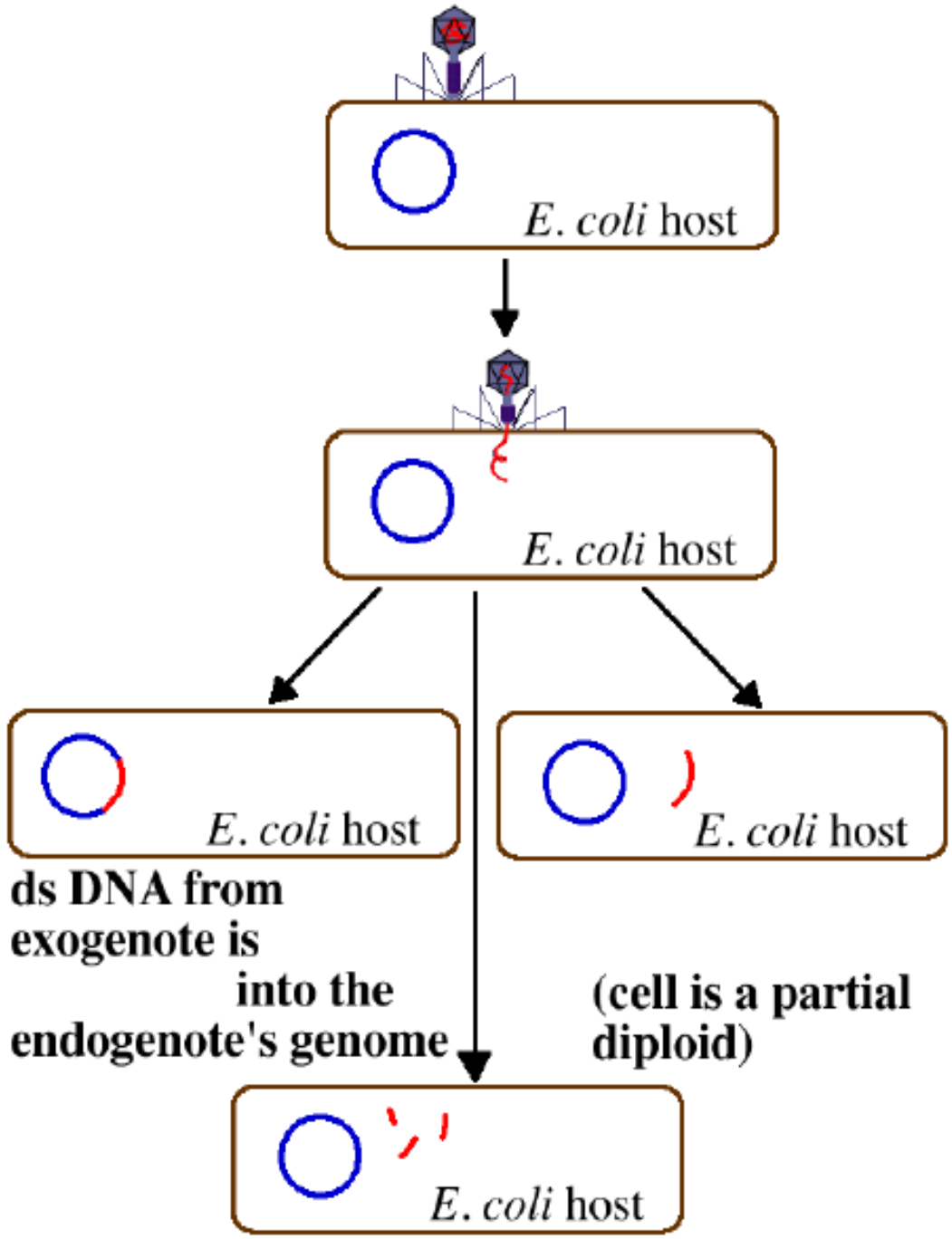
a. After phage infect the host cell, multiply and are released, some of them will

b. Phage-containing bacterial genes infect another bacterium and



Generalized transduction:




E. coli host
E. coli host
E. coli host
E. coli host
ds DNA from exogenote is into the endogenote's genome
(cell is a partial diploid)
E. coli host

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^-).

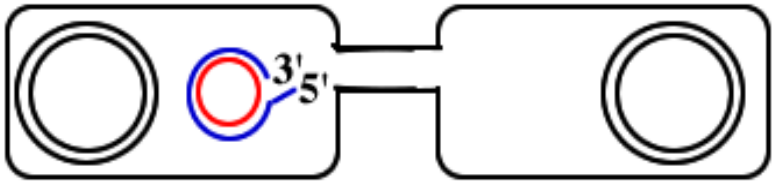
e.) can into the chromosome (called an episome).

Plasmid transfer is

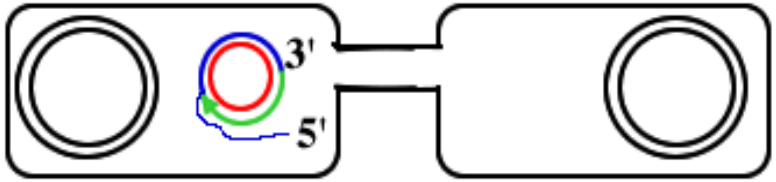
***Donor cells transfer the F plasmid**

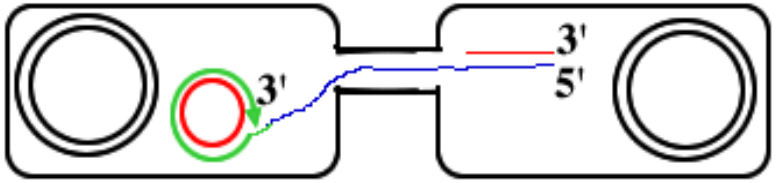
but their chromosomal DNA.

The sex pilus of the donor cell binds to the recipient cell and pulls the two cells together.

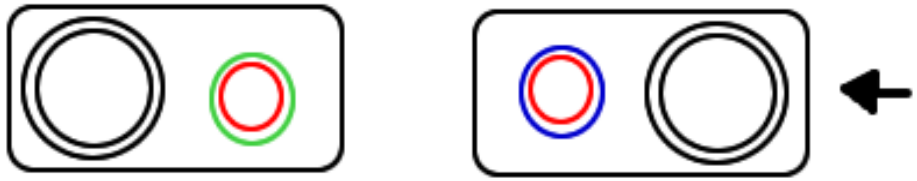


Enzymes cleave the bottom strand of the F-plasmid. The of replication is used during plasmid transfer.





A strand that is 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.

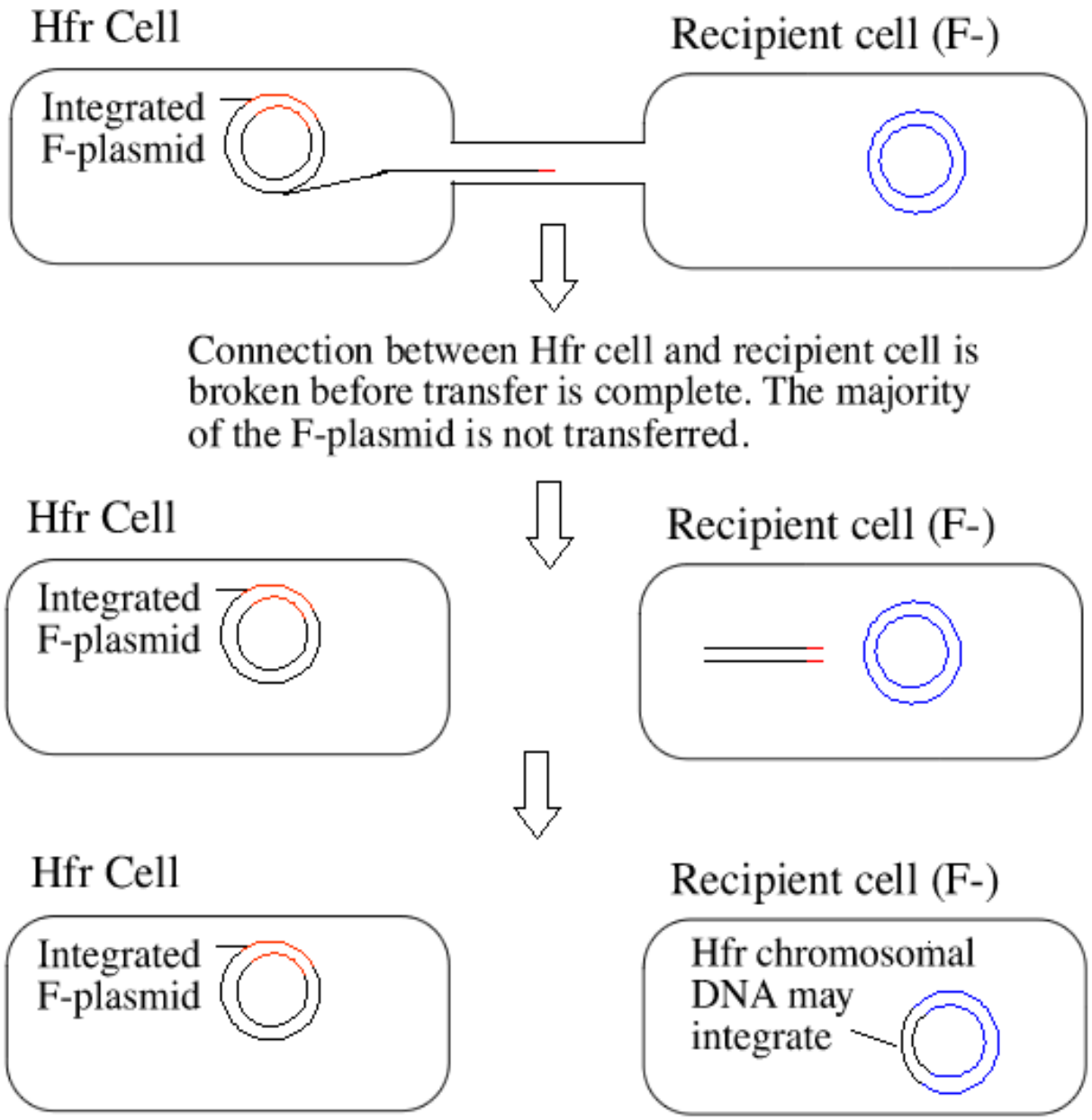
3.) Other conjugative plasmids contain genes that encode for the synthesis of virulence factors or proteins that degrade chemical toxins.

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


Hfr Cell
Integrated
F-plasmid
Recipient cell (F-)
Connection between Hfr cell and recipient cell is broken before transfer is complete. The majority of the F-plasmid is not transferred.
Hfr Cell
Integrated
F-plasmid
Recipient cell (F-)
Hfr Cell
Integrated
F-plasmid
Recipient cell (F-)
Hfr chromosomal
DNA may
integrate