

Chapter 5: Conjugation

Conjugation: physical interaction between two bacteria resulting in the exchange of genetic information from a donor cell to a recipient cell

- Discovered in 1946 by Lederberg and Tatum by mixing together auxotrophic strains and selecting for prototrophs

- Transconjugant:

Strain A: *met bio thr⁺ leu⁺ thi⁺*

+

Strain B: *met⁺ bio⁺ thr leu thi*



Result: *met⁺ bio⁺ thr⁺ leu⁺ thi⁺*

Conjugation by the F plasmid

Self-transmissible:

- *tra* genes encode proteins involved in:

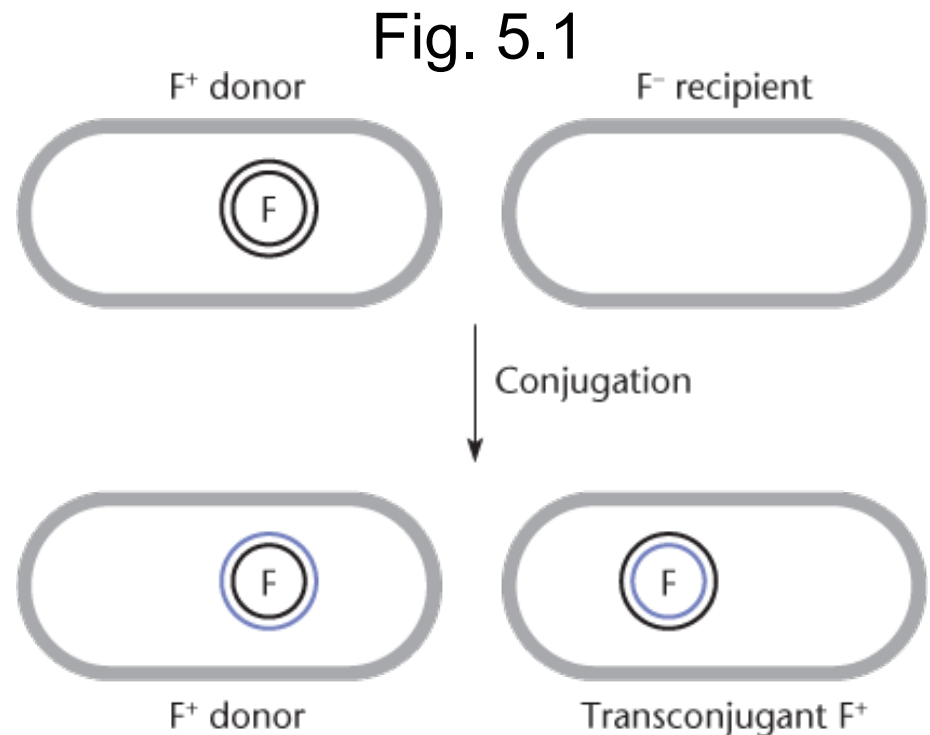
- Sex pilus synthesis and assembly

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- Processing the plasmid DNA for transfer



- *oriT*: sequence on F plasmid that is nicked by relaxase prior to DNA transfer through the conjugation bridge



Conjugation by the F plasmid

- *oriV*:

- *rep* genes:

- Insertion (IS) element:
transposons whose DNA sequences are complementary in sequence to regions of the *E. coli* genome

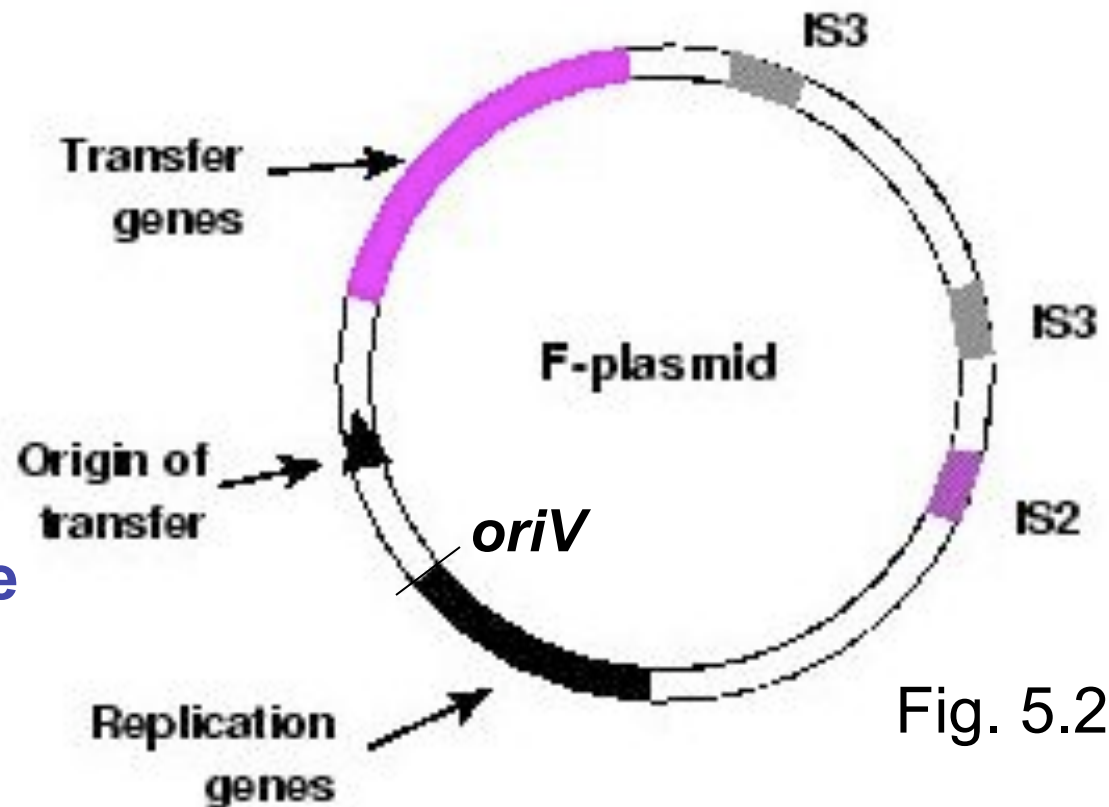


Fig. 5.2

Sequence of events in transfer of the F plasmid

1) Donor cell makes contact with recipient via the sex pilus

2)

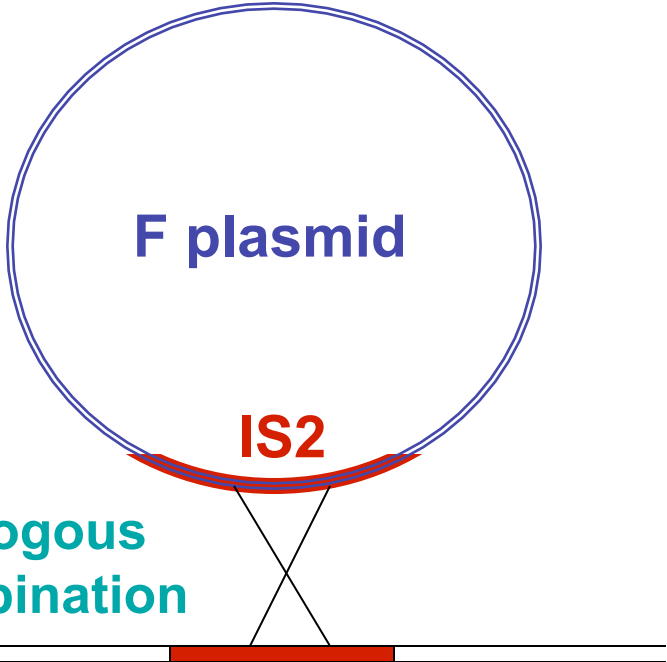
3) One strand of the F plasmid is nicked by relaxase at the *oriT* sequence

4)

5) Rolling circle replication is used to generate the second strand of the F plasmid in both the donor and the recipient.

Two methods in which chromosomal genes can be transferred during conjugation

Fig. 514



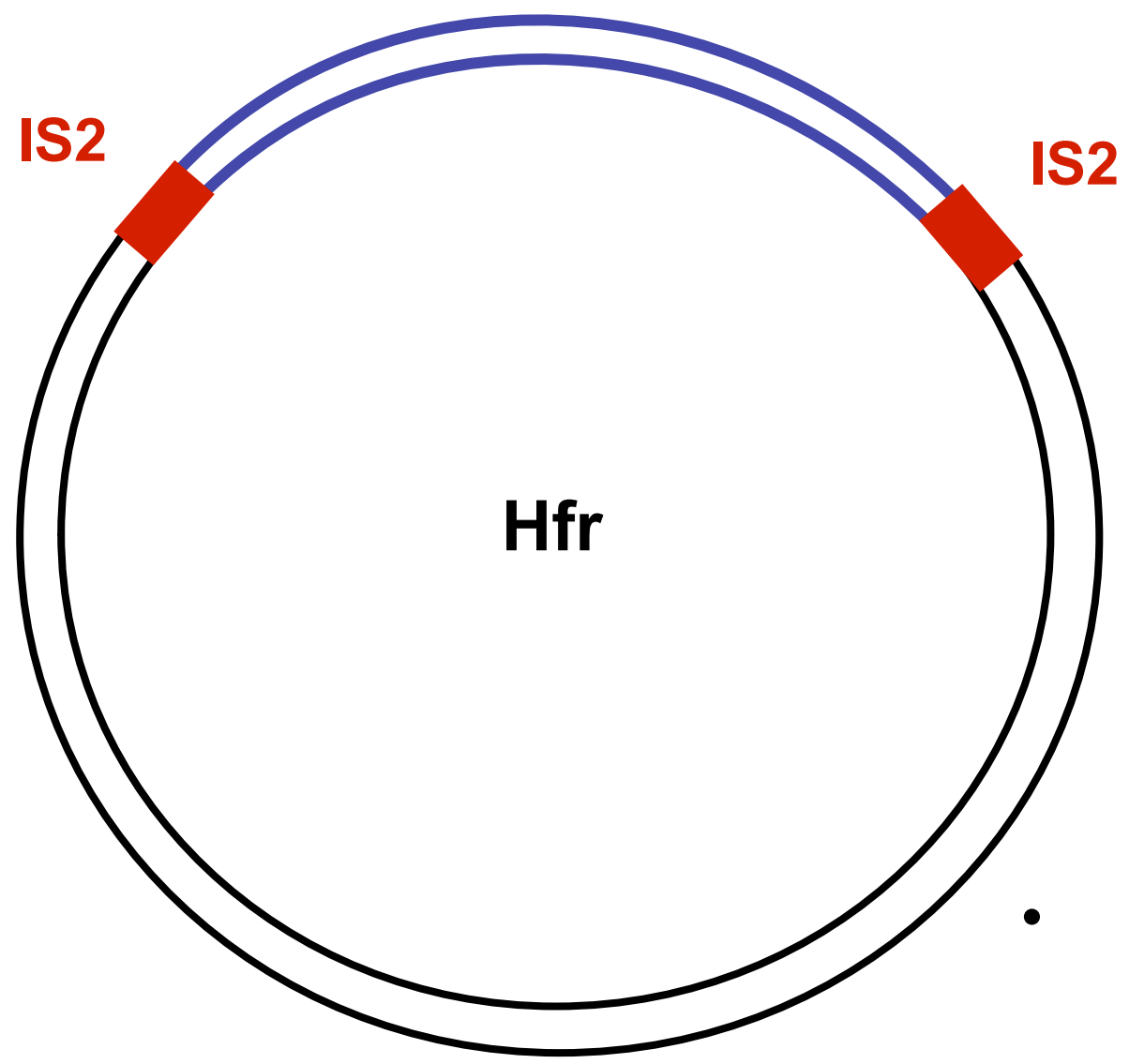
1) Hfr (High frequency recombination):

Strain in which the F plasmid is incorporated into the *E. coli* genome via recombination between IS sites

Hfr generation



F plasmid DNA



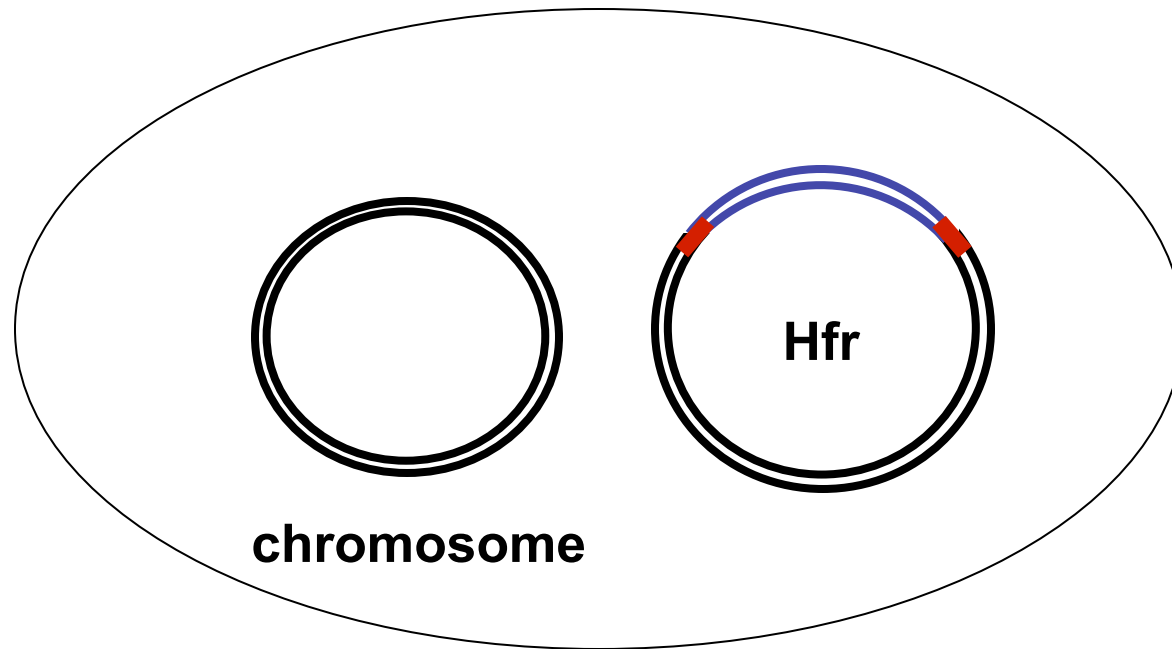
IS2

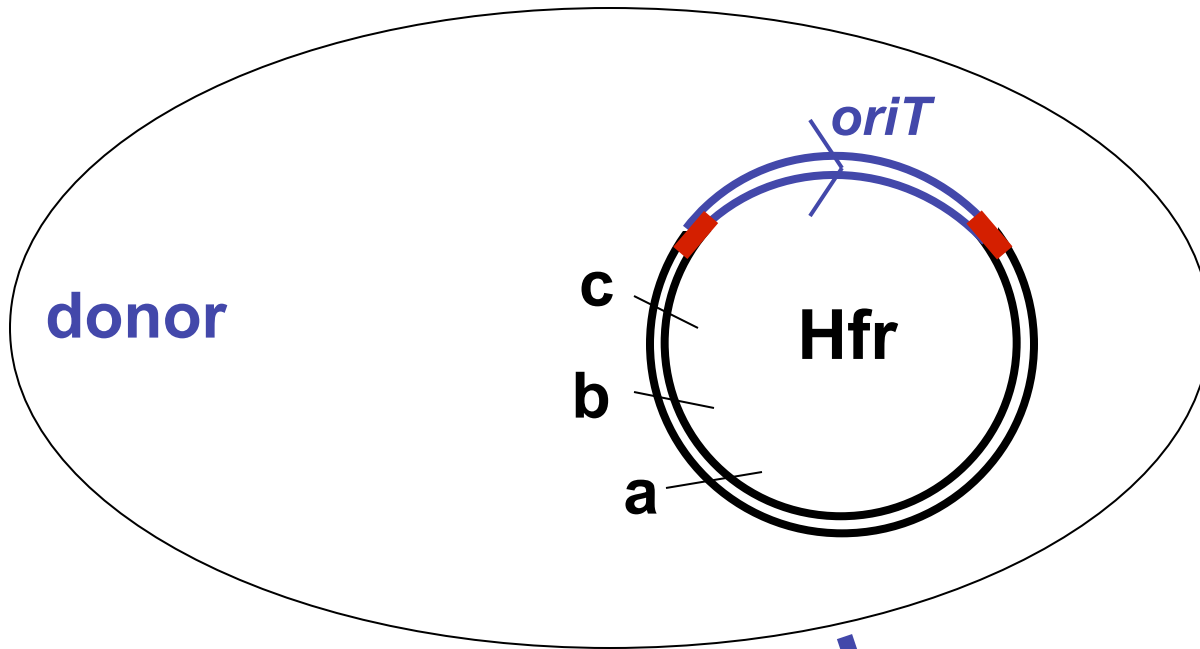
IS2

Hfr

chromosomal DNA

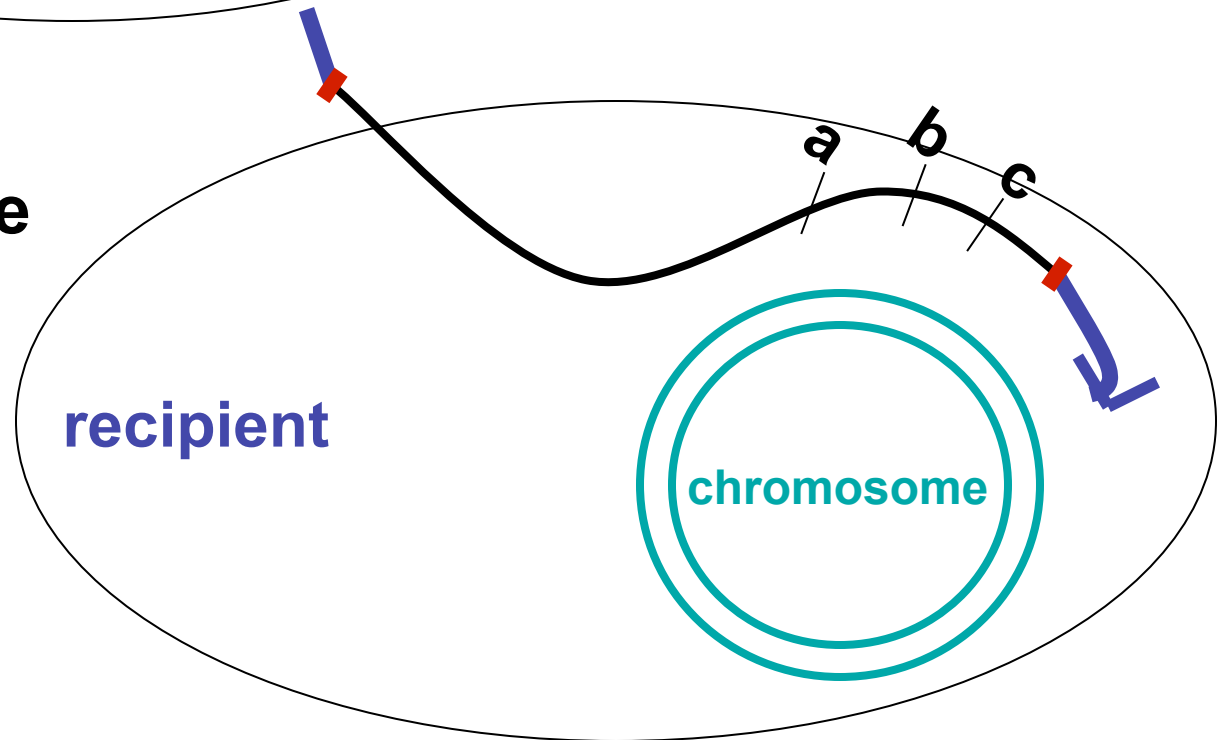
Is the result of conjugation between a Hfr cell and a recipient cell depicted below?

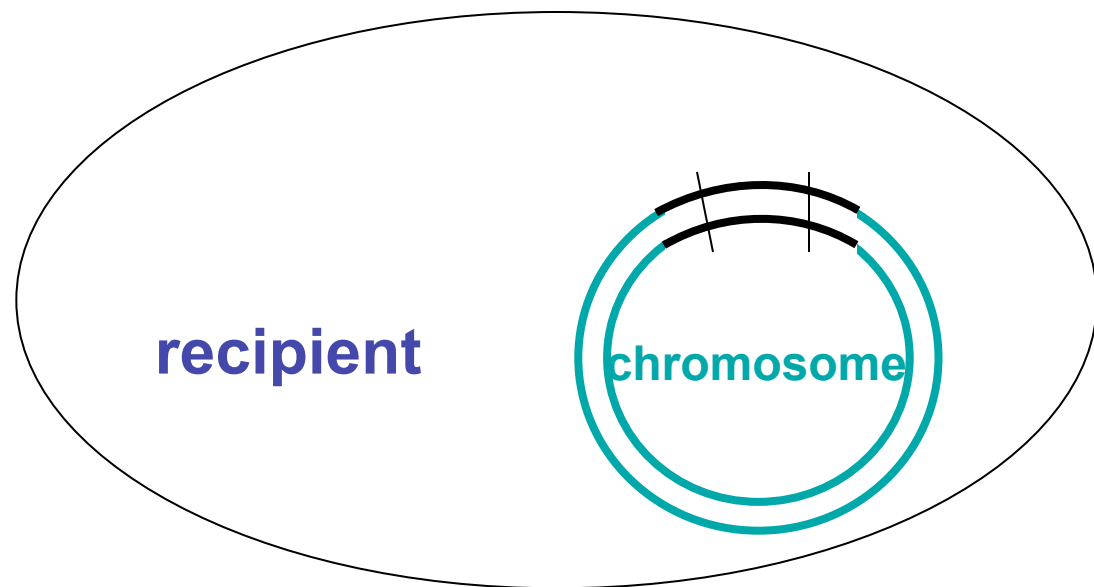
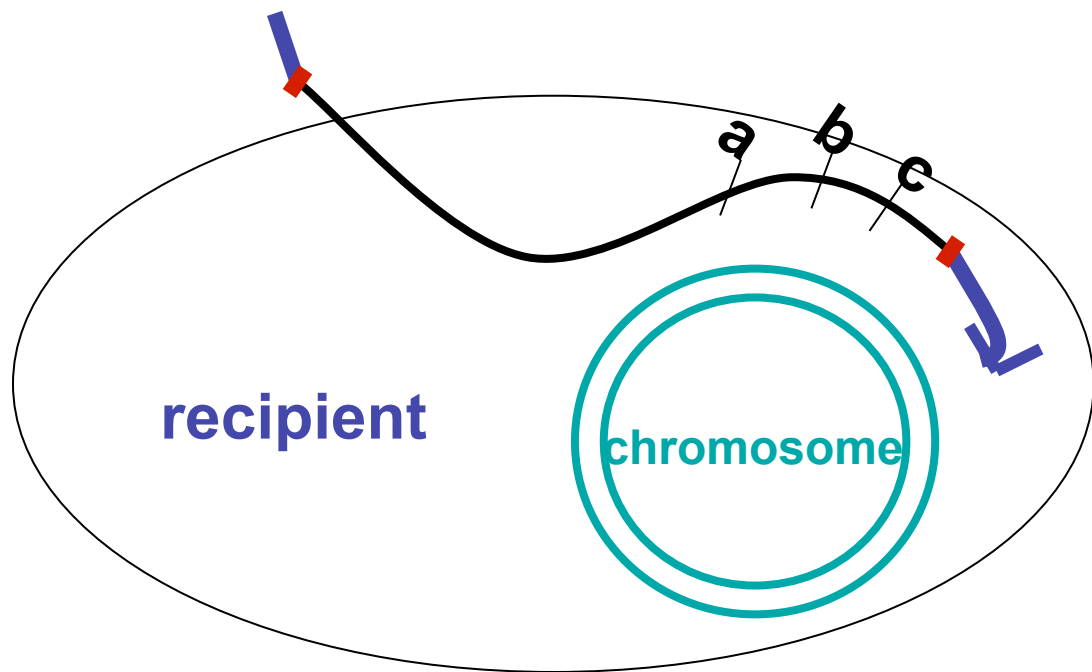




Arrow indicates direction of transfer

Probability of chromosomal gene transfer

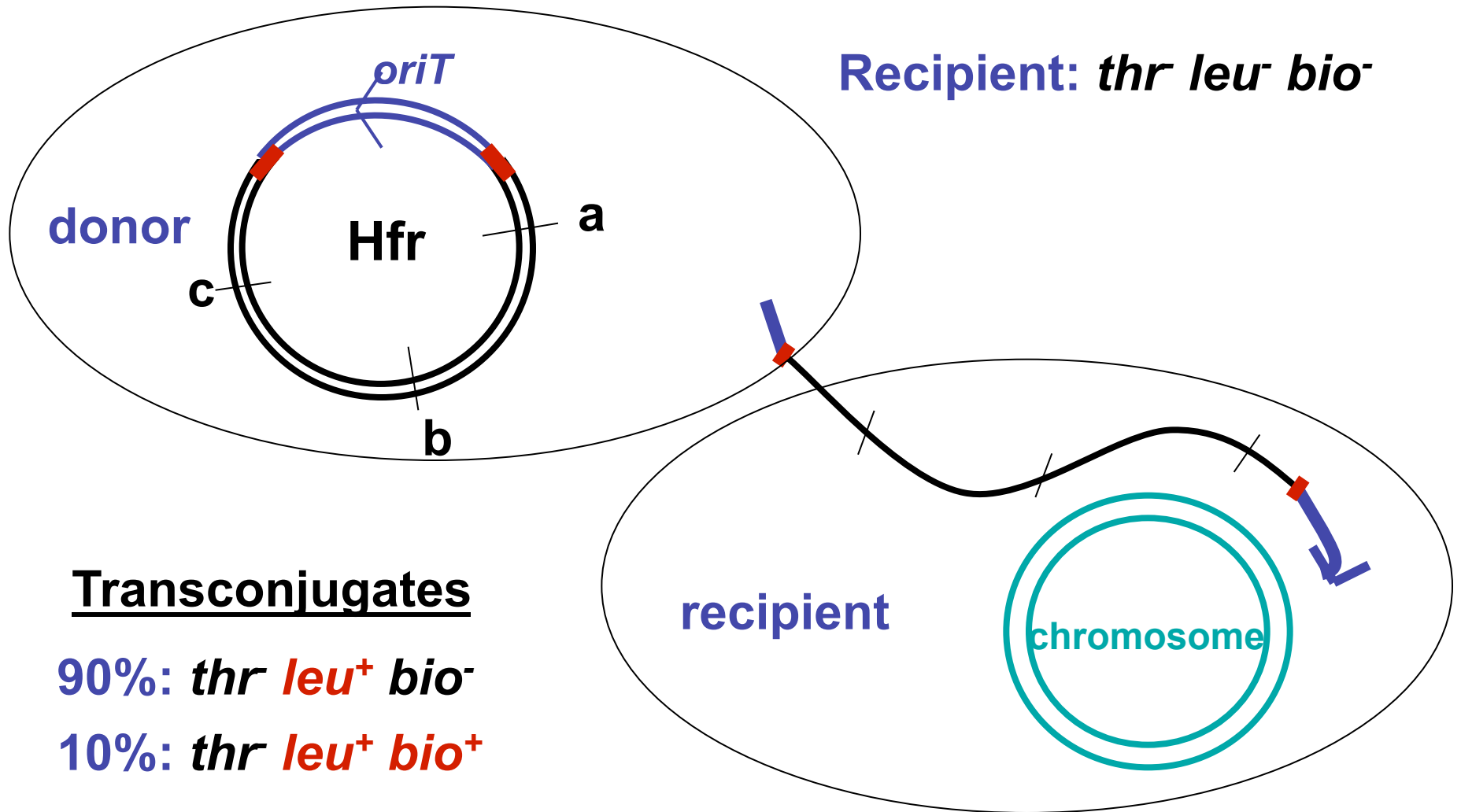




Hfr Conjugation Mapping

Donor: *thr*⁺ *leu*⁺ *bio*⁺

Recipient: *thr* *leu* *bio*⁻



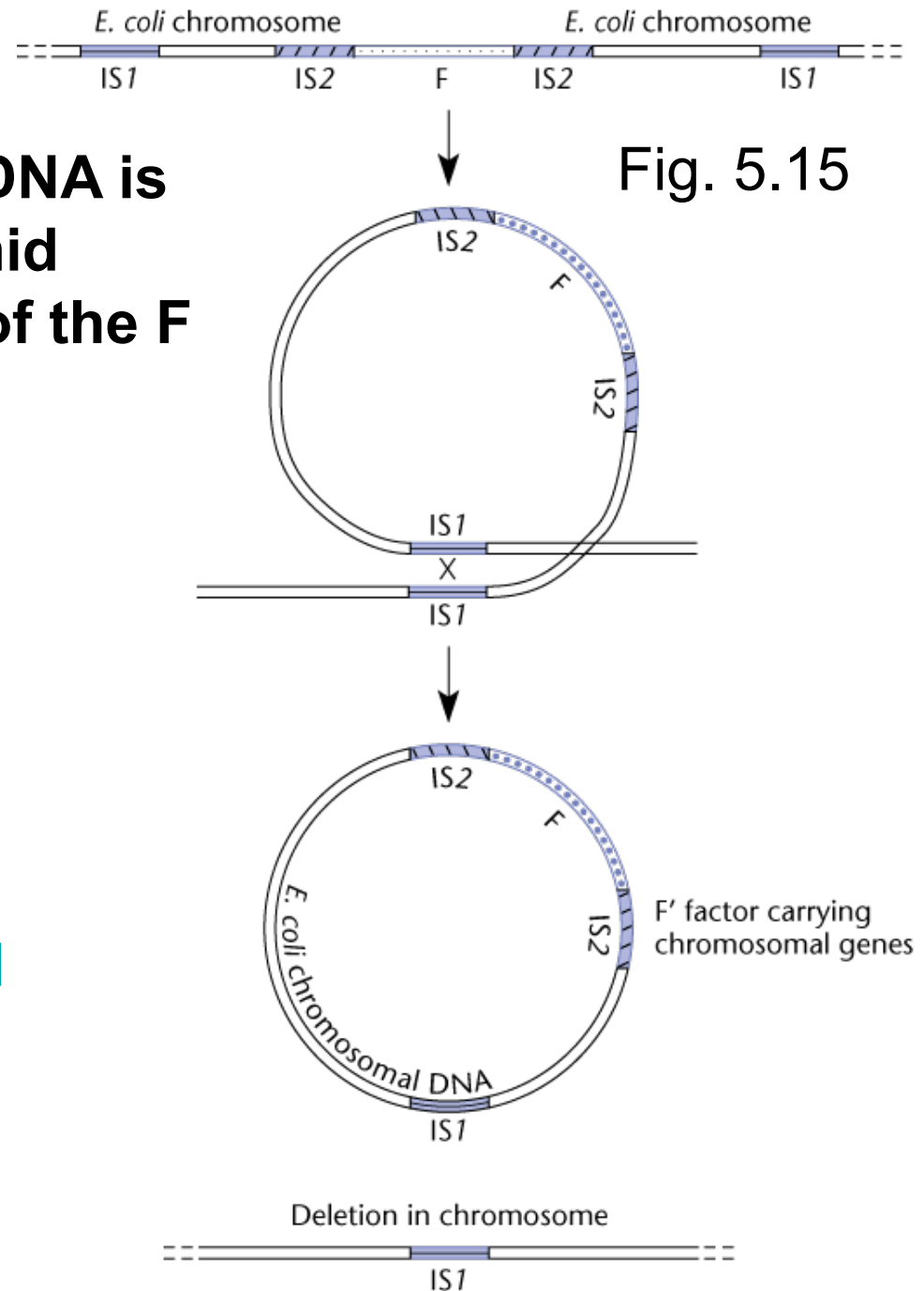
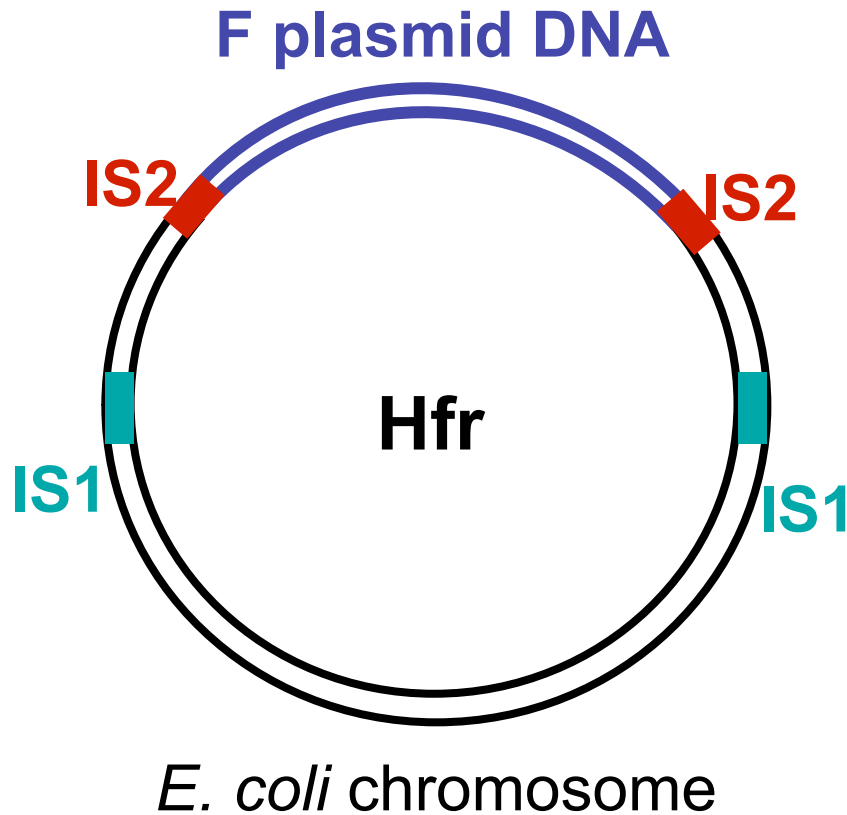
Transconjugates

90%: *thr* *leu*⁺ *bio*⁻

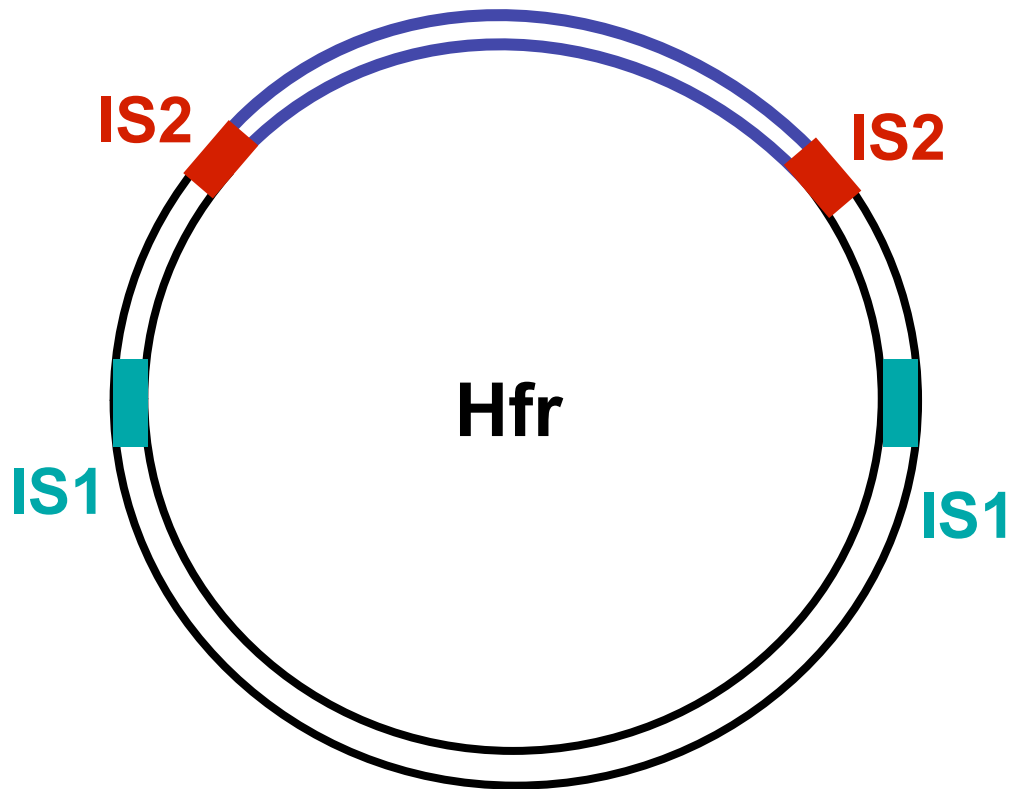
10%: *thr* *leu*⁺ *bio*⁺

2) F' plasmid (episome):

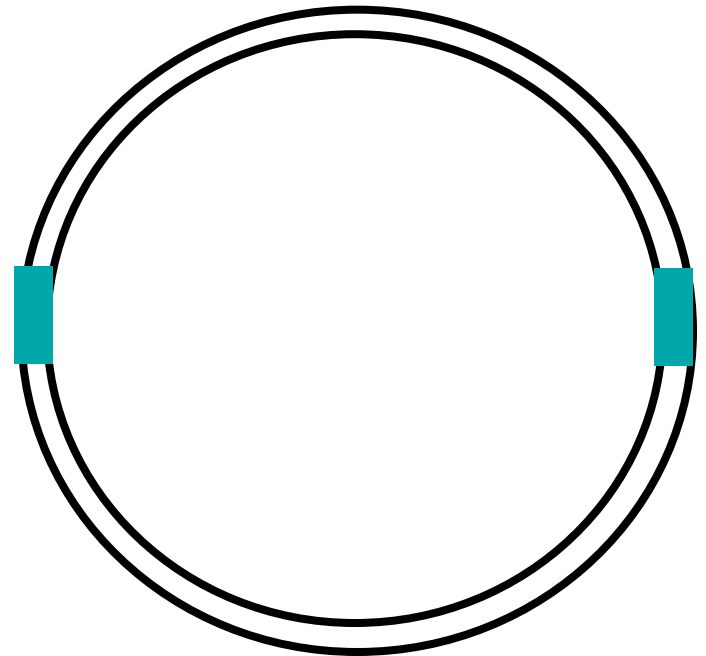
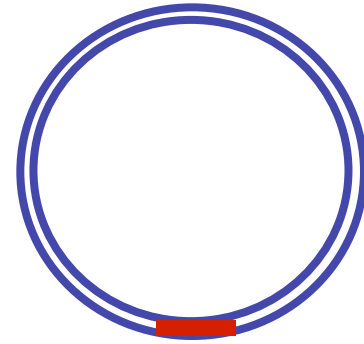
occurs when chromosomal DNA is incorporated into the F plasmid following improper excision of the F plasmid from a Hfr strain



F plasmid DNA



E. coli chromosome



Ti plasmid: DNA transfer between kingdoms

Agrobacterium tumefaciens: bacterium that causes crown gall tumors in plants

Ti plasmid: Important in designing transgenic plants

1) Self transmissible between bacteria

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- bacterial *oriT*
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2) DNA transfer to plants

- 2 plant *oriT* sequences
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