MICROBIAL GENETICS – CONJUGATION

Male, Fertility Factor, Donor
Female, absence of F Factor, Recipient

F+ Male, Sex Pili, Conjugation Bridge, Origin of Transfer, Nicking at oriT, Transfer of Single Strand, Complementary strand synthesis in male and female

Hfr Male (High Frequency of Recombination), Integration, Homologous Recombination, Selection of recombinants

F' Male, Illegitimate recombination, Partial diploids
CONJUGATION - MATING OF MALE 

E. coli + FEMALES

MALES: FERTILITY FACTOR
F PLASMID
~100,000 BASE PAIRS
MALE CHARACTERISTICS
CONTACT WITH FEMALE
DNA DONATION

FEMALES: F-
DNA RECIPIENT
ABSENCE OF F FACTOR

F FACTOR - DOUBLE STRAND DNA

IS2
INSERTION SEQUENCE

REPLICATION GENES
ORI
ORIGIN OF TRANSFER

TRANSFER GENES
F+ MALE

F PILUS

BINARY FISSION

CHROMOSOME AND F FACTOR Duplicated
F FACTOR TRANSFER

F+ x F- → F+ AND F+

CONJUGATION BRIDGE

NICK F AT ORIT
TRANSFER ONE STRAND

... = NEW SYNTHESIS

F+  F+
HFR [HIGH FREQUENCY RECOMBINANT]
MALES TRANSFER CHROMOSOME [FRAGMENTS]

A. FORMING HFR
F INTEGRATES INTO CHROMOSOME; F+ BECOMES HFR

\[ \text{HOMOLOGOUS RECOMBINATION BETWEEN IS2} \]

\[ \text{HFR MALE} \]
B. HFR x F^- $\rightarrow$ RECOMBINANTS

HFR \text{ PRO}^+ \text{ STR}^R \times F^- \text{ PRO}^- \text{ STR}^R \rightarrow \text{ RECOMBINANT PRO}^+ \text{ STR}^R

PROLINE

\text{CONJUGATION BRIDGE BREAKS}

\text{NEW SYNTHESIS}
Consider recipient cell only

Homologous recombination twice left + right of mutation

Linear fragment degradation

Pro+ Str-R Recombinant
Demonstration:

$\sim 10^8$ HFR
PRO$^+$ STR$^-$

$\sim 10^8$ F$^-$
PRO$^-$ STR$^-$

Mix

$\sim 10^8$ HFR
$\sim 10^8$ F$^-$

PRO$^+$ STR$^-$ Recombinants
HFR can excise F factor precisely to regenerate F\(^+\) male

HFR

Homologous recombination between IS2's

\[\text{IS2} \quad \text{IS2}\]

F\(^+\) male

\[\text{IS2} \quad \text{IS2}\]
F' MALE: F PLUS CHROMOSOME GENE(S)

HFR

PRO+  STR-S

LOOPING

PRO+

ILLEGITIMATE RECOMBINATION

F' MALE

DELETION PRO+

STR-S
F' mating: F' × F^− → F' + New F'

F' STR-S F' PRO^+

F− PRO^− STR-R

→

NEW F' MALE PARTIAL DIPLOID
F' Transfer in Lab

~10^8 F' PRO^+ (on F factor)
Pro deletion (on chromosome)
STR-S

~10^8 F-
PRO^- STR-R

Mix
F' PRO^+ STR-S
F^- PRO^- STR-R

Pro^- STR-R
F'PRO^+