GENETIC CODE AND GENE EXPRESSION

BY:

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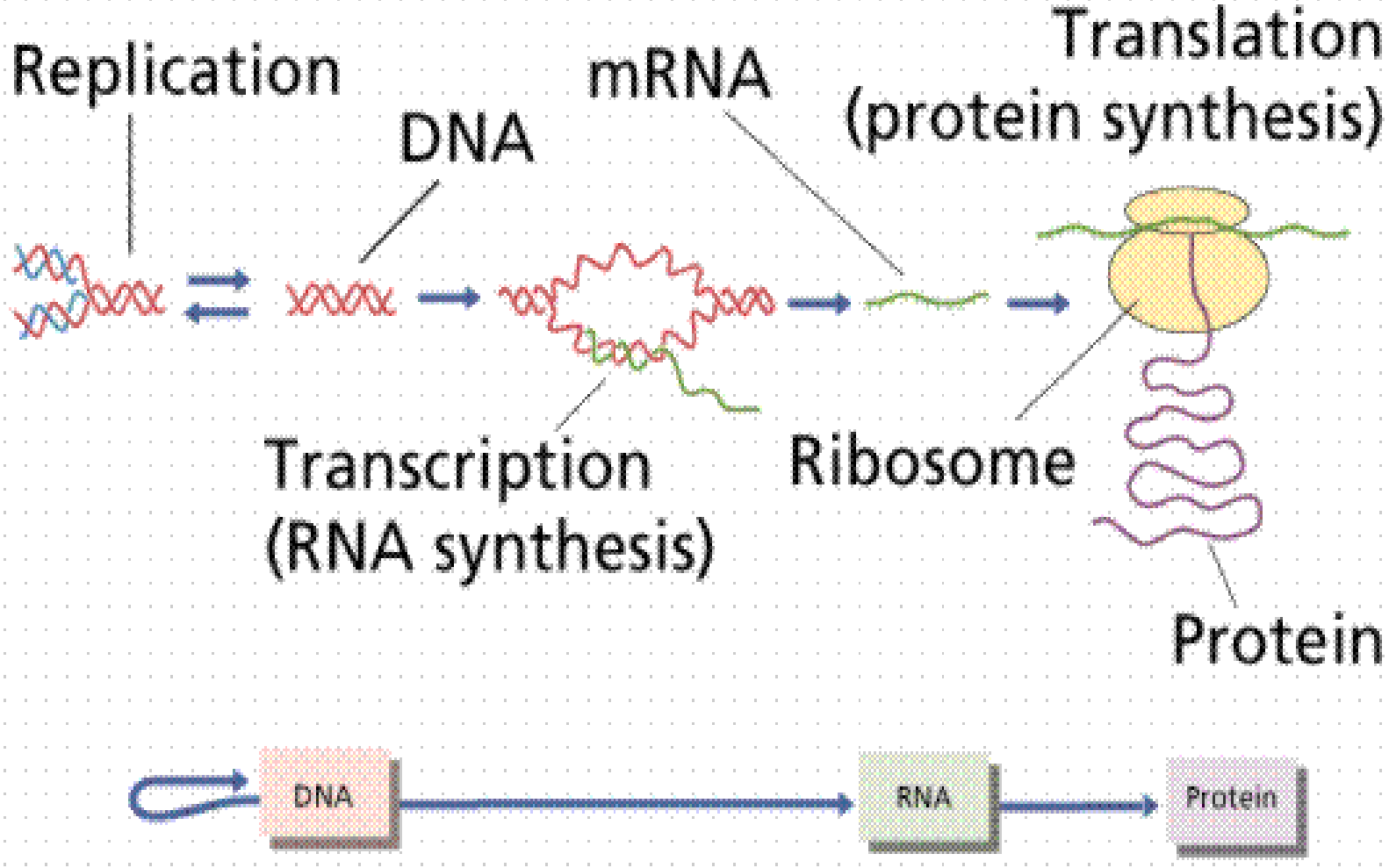
WHY GENETIC CODE?



GENETIC CODE

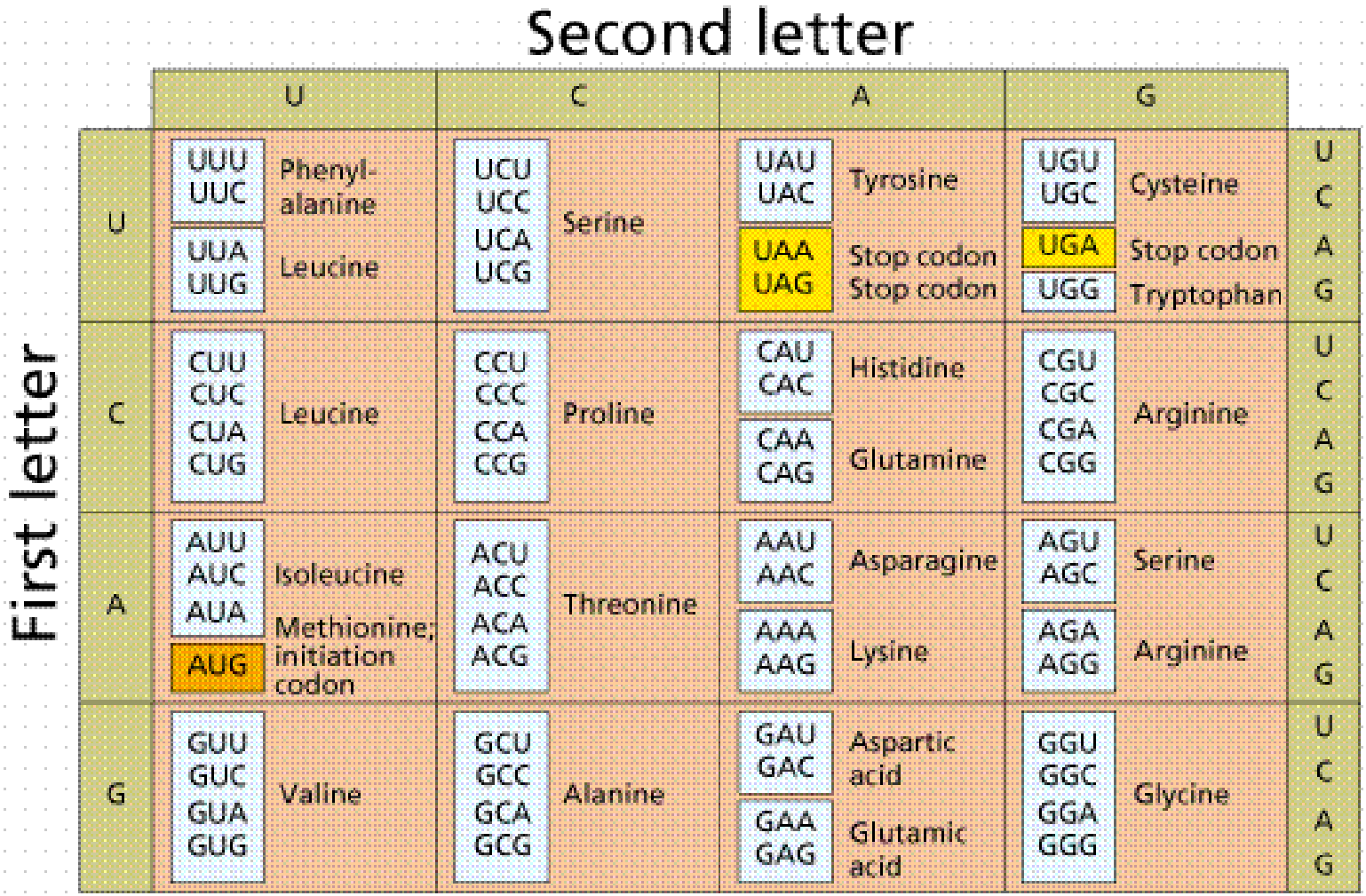
- SEQUENCE OF BASE TRIPLETS IN DNA

- INFORMATION FOR PROTEIN SYNTHESIS FLOWING FROM DNA EXISTING IN PARTICULAR SEQUENCE OF BASE IN DNA STRANDS.

- AMINO ACIDS=20, BASES=4
- SINGLE BASE CODING=4 A. ACIDS
- IF 2 BASES CODE THEN

	U	C	A	G
U	UU	UC	UA	UG
C	CU	CC	CA	CG
A	AU	AC	AA	AG
G	GU	GC	GA	GG

TRIPLET BASE CODE



CHARACTERISTICS OF GENETIC CODE

1.TRIPLET NATURE.

2. NO OVERLAPPING
AUGCCUGCACGCUUUAGAGGAUGA

3.NO PUNCTUATION

4.UNIVERSALITY OF GENETIC CODE

5.DEGENERACY- MORE THAN ONE CODE FOR ONE A.ACID

6.TERMINATOR CODONS- UAA,UAG& UGA

.

7.START CODON- AUG

8.COLINEARITY OF GENETIC CODE &POLYPEPTIDE

- GENE: UNIT OF INHERITANCE THAT SPECIFIES EXPRESSION OF A PARTICULAR TRAIT.

- GENE EXPRESSION: MOLECULAR MECHANISM BY WHICH A GENE SHOWS ITS POTENTIAL IN PHENOTYPE OF AN ORGANISM

- GENES EXPRESS CHARACTERISTICS THROUGH ENZYMES.

- IN AN ORGANISM ,EACH GENE PRODUCES A SPECIFIC ENZYME WHICH CONTROLS A SPECIFIC METABOLIC ACTIVITY.

- GENES PROVIDE INSTRUCTIONS FOR BUILDING NUCLEIC ACIDS AS WELL AS PEPTIDES.

- CONSISTS OF SYNTHESIS OF SPECIFIC RNA's,POLYPEPTIDES STRUCTURAL PROTEINS WHICH CONTROL THE STRUCTURE & FUNCTIONING OF SPECIFIC TRAITS .

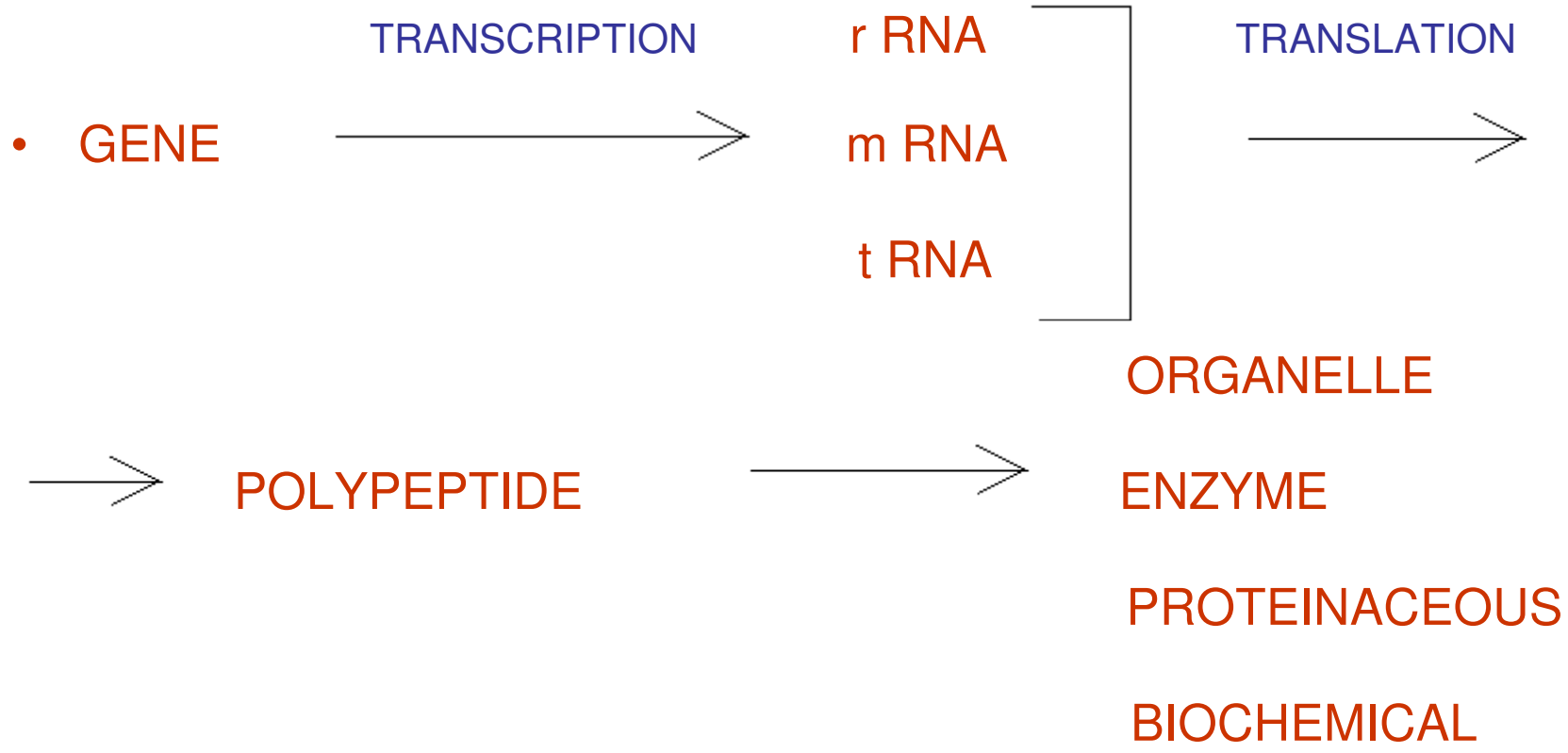
- GENETIC MATERIAL CONTAIN NUMBER OF GENES.

- REPLICATION & EXPRESSION ARE TWO CHARACTERISTIC OF GENETIC MATERIAL.

MECHANISM OF GENE EXPRESSION

- GENE CONTAINS BLUE PRINT OR CODE FOR POLYPEPTIDE IN FORM OF SEQUENCE OF BASE PAIRS.
- TRANSFERS ITS CODE TO mRNA BY TRANSCRIPTION.
- mRNA BINDS TO RIBOSOMES & WITH SUITABLE tRNA SELECTS REQUIRED A. ACIDS & LINK TO FORM PARTICULAR PROTEIN BY TRANSLATION.
- POLYPEPTIDE CHAIN MAY ACT AS STRUCTURAL PROTEINS OR PHENOTYPIC CHARACTER.

- POLYPEPTIDE CONTRIBUTES TO MORPHOLOGICAL OR PHENOTYPIC CHARACTERS OF A CELL & ORGANISM.

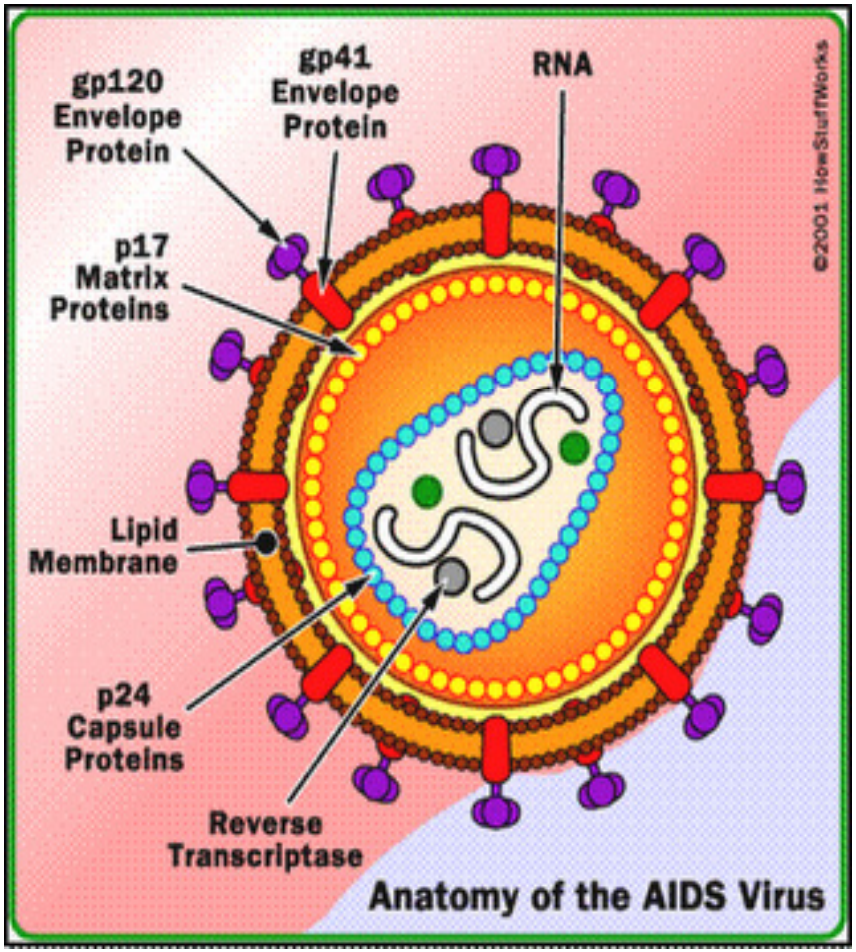


GENE EXPRESSION IN VIRUSES

- **VIRUS STRUCTURE:**
- **ENVELOPE:** OUTER LOOSE COVERING COMPOSED OF PROTEINS .

- **CAPSID:**PROTEIN COAT THAT SURROUNDS THE NUCLEOID & ENZYME .

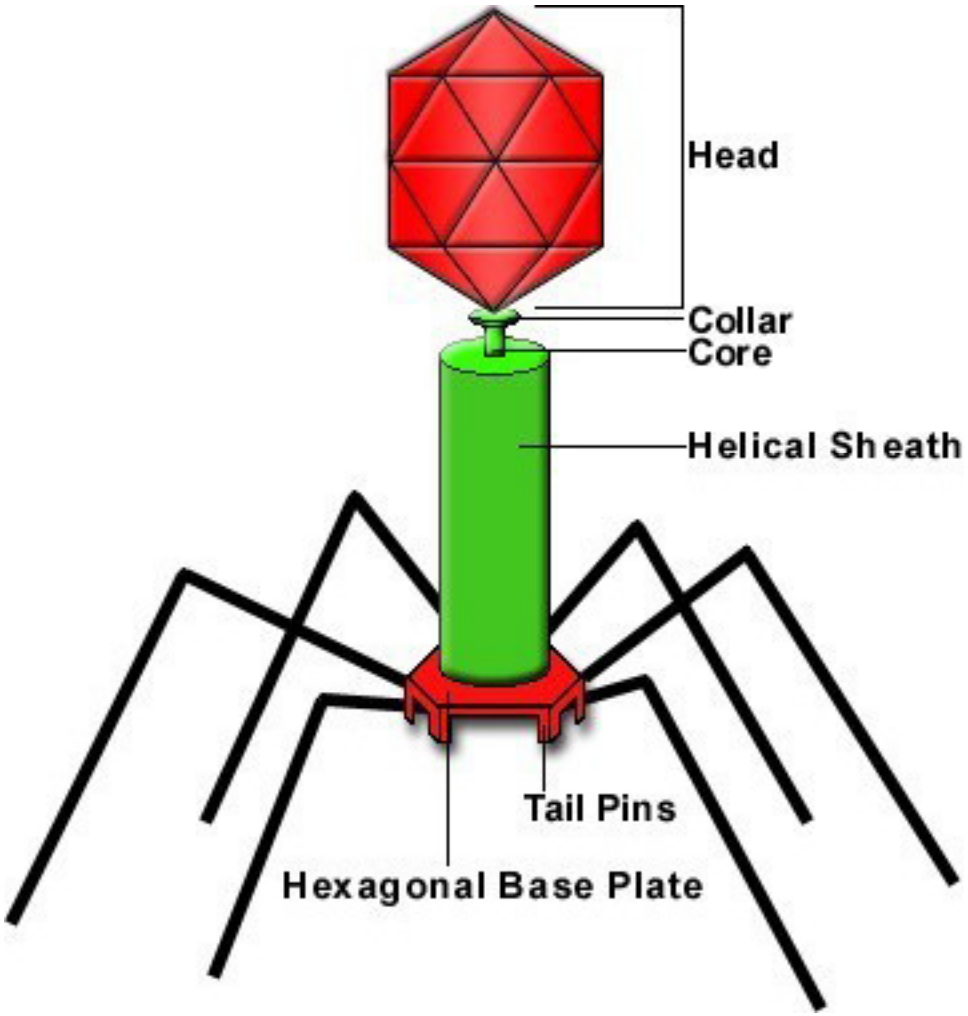
- **NUCLEOID:**NUCLEIC ACID [DNA OR RNA] IS CALLED NUCLEOID.



BACTERIOPHAGE

- VIRUSES WHICH ATTACK BACTERIAL CELLS ARE BACTERIOPHAGES

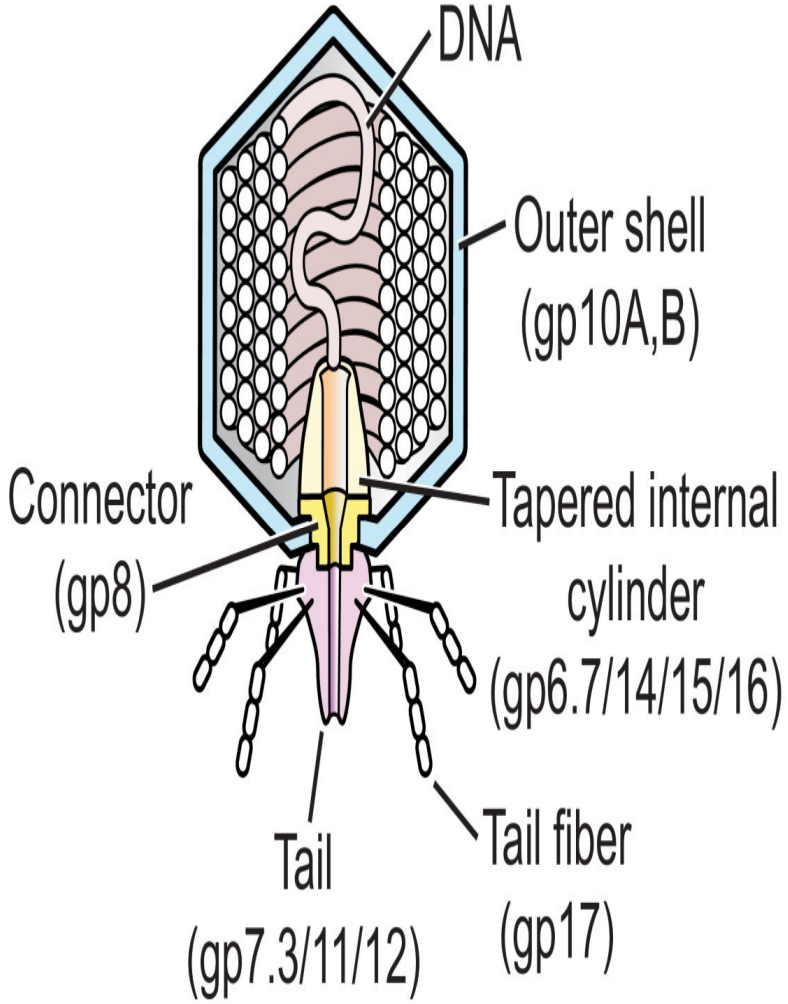
- **STRUCTURE OF BACTERIOPHAGE**
- TADPOLE LIKE VIRUS CONSISTING OF A HEAD AND A TAIL.



- HEAD HAS OUTER COAT OF PROTEIN ENCLOSING SINGLE MOLECULE OF DNA WHICH IS DOUBLE HELIX & COILED.

- TAIL IS NARROW & HAS TAIL SHEATH

- TAIL FIBRES ARE ALSO PRESENT.



- **GENE EXPRESSION:** VIRAL GENOME CARRIES GENETIC INFORMATION FOR FORMATION OF NEW VIRUSES BUT HAS NO MACHINARY TO DO SO.

- VIRUS MUST INFECT LIVING CELLS & USE THEIR CELLULAR MACHINARY FOR SYNTHESIZING NEW VIRUSES.

- EXPRESSION OF VIRAL GENES IS REGULATED IN TWO WAYS:

- **LYTIC CYCLE**
- **LYSOGENIC CYCLE**

THREE STAGES OF BACTERIOPHAGES HAVE BEEN IDENTIFIED:

EXTRACELLULAR VIRIONS: COMPLETE VIRUS PARTICLE PRIOR TO INFECTION

VEGETATIVE PHAGE: FREE HAVING AUTONOMOUS REPLICATION

PROPHAGE:BECOME INSERTED WITH BACTERIAL DNA & IS REPLICATED ALONG WITH IT.

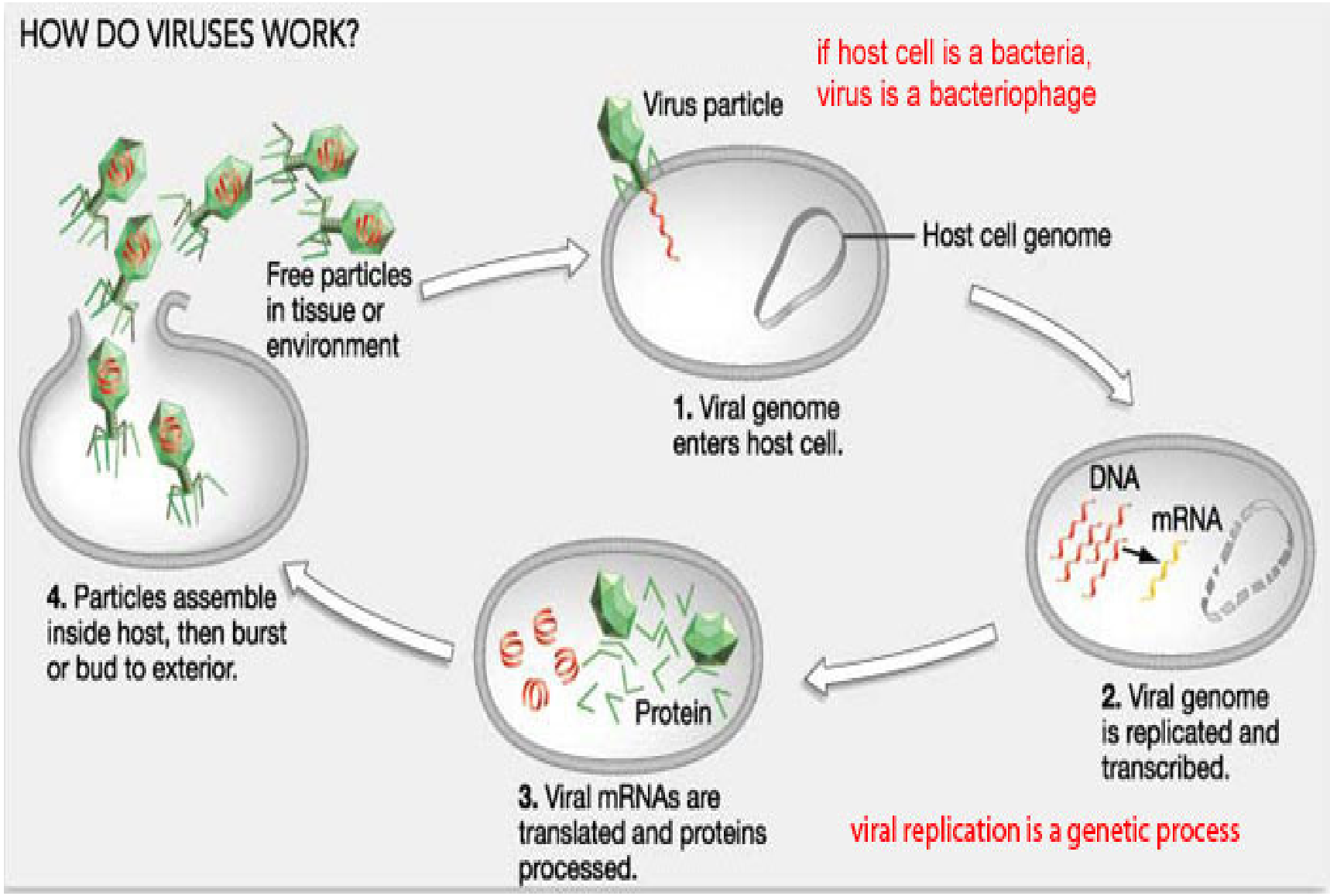
LYTIC CYCLE

- **PROCESS**:
- **ADSORPTION**: ATTACHMENT OF VIRUS PARTICLE TO SPECIFIC HOST BACTERIAL CELL AT RECEPTOR SITE.

- **PENETRATION:** INJECTION OF NUCLEIC ACID OF VIRION INTO HOST CELL

- CELL WALL HYDROLYZED BY LYSOZYME ENZYME PRESENT AT TIP OF TAIL.

- PROTEIN COAT OUTSIDE HOST CELL WALL ARE GHOSTS


HOW DO VIRUSES WORK?
if host cell is a bacteria,
virus is a bacteriophage
Virus particle
Host cell genome
Free particles
in tissue or
environment
1. Viral genome
enters host cell.
DNA
mRNA
2. Viral genome
is replicated and
transcribed.
Protein
3. Viral mRNAs are
translated and proteins
processed.
4. Particles assemble
inside host, then burst
or bud to exterior.
viral replication is a genetic process

- **ECLIPSE STAGE**: VIRAL DNA OCCURS INSIDE HOST CELL.
- SUPPRESSION OF ALL CELLULAR ACTIVITY IN HOST CELL

- SYNTHESIS OF NEW ENZYMES BY PHAGE DNA UTILIZING AMINO ACID POOL OF HOST CELL.

- ENZYME USED TO DESTRUCT DNA OF HOST. FRESH DNA SYNTHESIZE VIRAL PROTEINS& LYSOZYMES .

- **MATURATION:** ASSEMBLY OF COMPONENTS INTO COMPLETE VIRIONS.HEAD & TAIL ASSEMBLED FIRST & THEN ASSEMBLE TO FORM NEW PHAGE PARTICLES.

- **LYSIS &RELEASE OF NEW VIRIONS:** CELLWALL BURSTS & RELEASES VIRIONS & TERMED AS LYSIS. NO. OF VIRIONS PRODUCED PER CELL IS SPECIFIC & TERMED AS **BURST SIZE**.

LYSOGENIC CYCLE

- SHOWN BY LAMBDA PHAGE.

- HAS HEXAGONAL HEAD WHICH CONTAINS DOUBLE STRANDED CIRCULAR DNA & CYLINDERICAL HOLLOW TAIL WHICH LACK TAIL FIBRES.

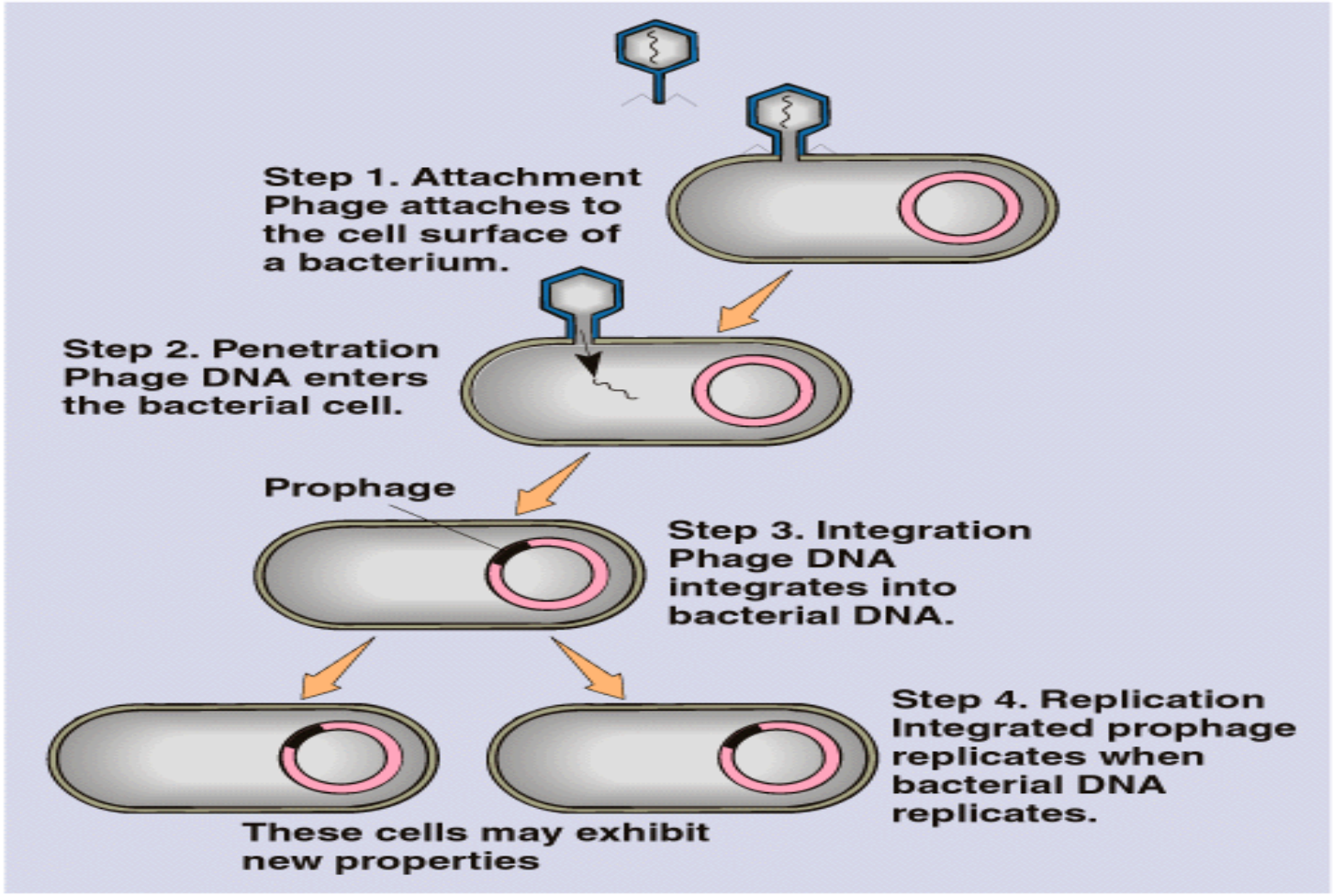
- DNA GETS ATTACHED TO BACTERIAL DNA, BECOME S INACTIVE &IS **PROVIRUS** OR **PROPHAGE**.

- PHAGE DNA BECOMES INACTIVE DUE TO REPRESSOR PROTEIN BY PHAGE DNA WHICH CAUSES REPRESSION OF VIRAL GENES.

- PROPHAGE REPLICATES ALONG WITH BACTERIAL DNA & DISTRIBUTED TO DAUGHTER CELLS.

- OCCASIONALLY PROPHAGE MAY GET DISSOCIATED FROM BACTERIAL DNA & BECOMES ACTIVE TO CARRY LYTIC CYCLE.

Solomon: Biology, 5/e
Figure 23.3



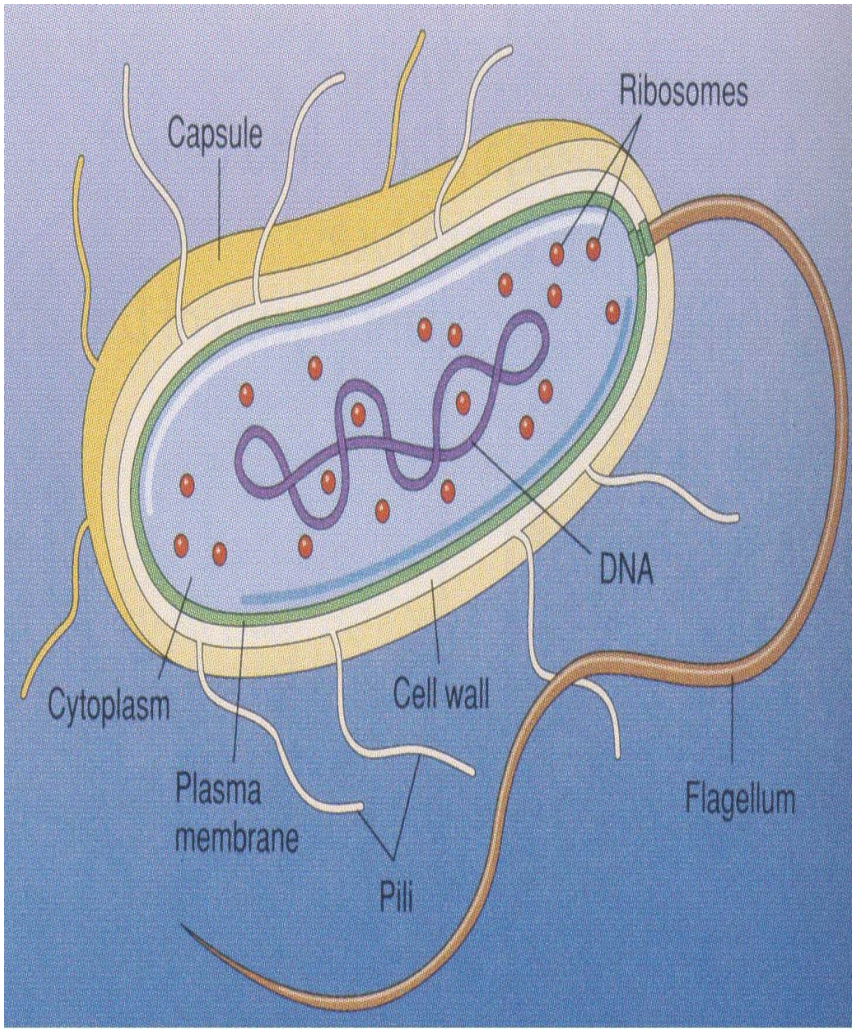
- ACTIVE PHAGE DNA IS CALLED VEGEPHAGE OR TEMPERATE PHAGE.

- CARRIES ON ALL EVENTS OF LYTIC CYCLE FORMING MORE PHAGES DUE TO LYSIS OF HOST CELL.

- BACTERIUM CONTAINING PROPHAGE HAS POTENTIALITY TO GET LYSED BY ACTIVITY OF VIRAL DNA.

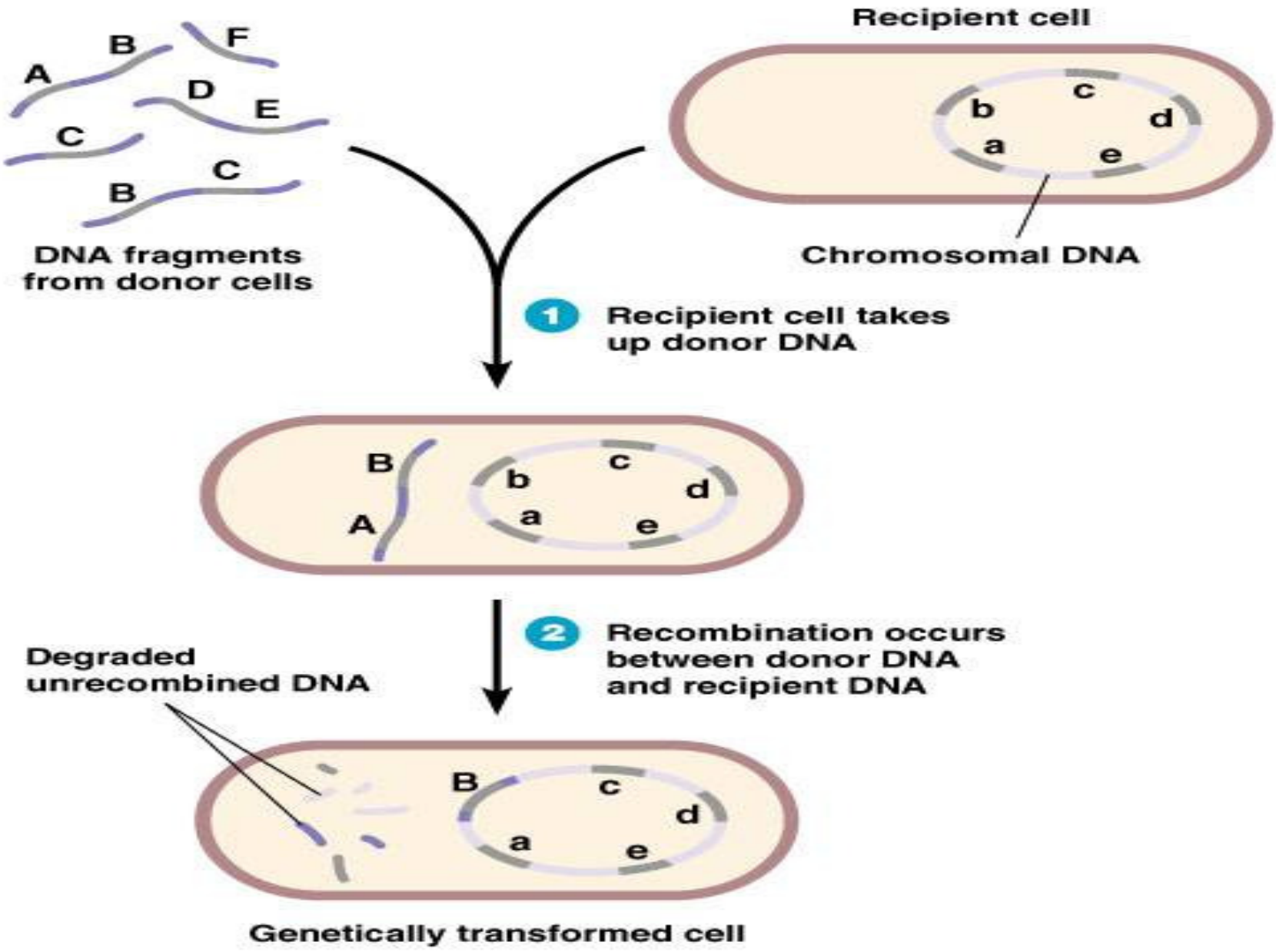
GENE EXPRESSION IN PROKARYOTES

- BACTERIAL CHROMOSOME:
- NUCLEOID SIMILAR TO SINGLE EUKARYOTIC CHM.
- IT IS CIRCULAR REPRESENTED BY SINGLE DOUBLE STRANDED DNA MOLECULE NOT BOUNDED BY NUCLEAR MEMBRANE.
- NUCLEOID ATTACHED TO MESOSOME REPLICATES & PASSED TO DAUGHTER CELLS.

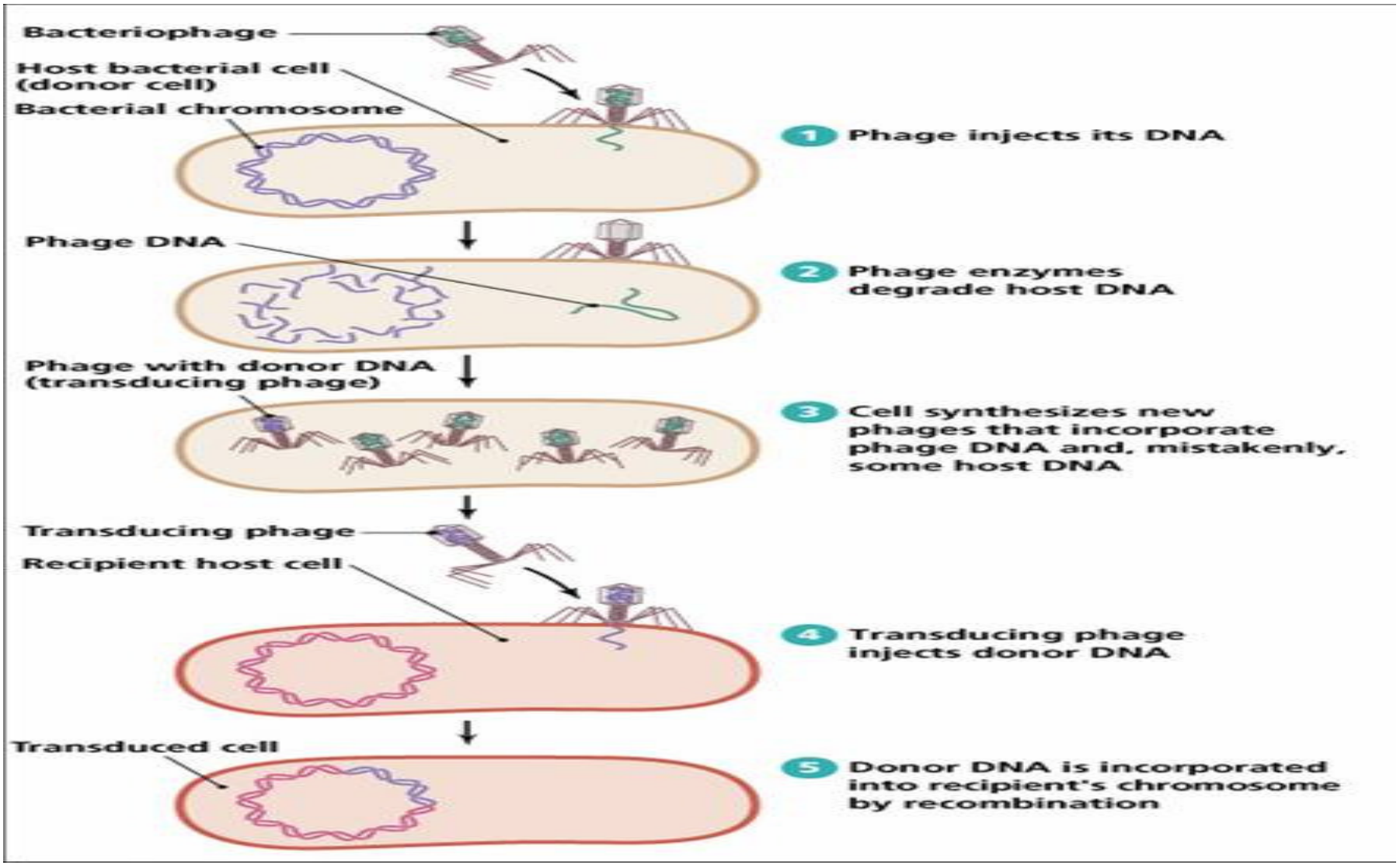


- **GENE RECOMBINATION IN BACTERIA:** SHOWS GENETIC RECOMBINATION IN ONE OF THREE WAYS:

- **TRANSFORMATION:**PHENOMENA BY WHICH DNA ISOLATED FROM ONE TYPE OF CELL,WHEN INTRODUCED INTO ANOTHER TYPE IS ABLE TO BESTOW SOME OF PROPERTIES INTO THE LATTER



- **TRANSDUCTION**
- Transfer Of Genetic Material From One Bacterium To Another Through Bacteriophage.

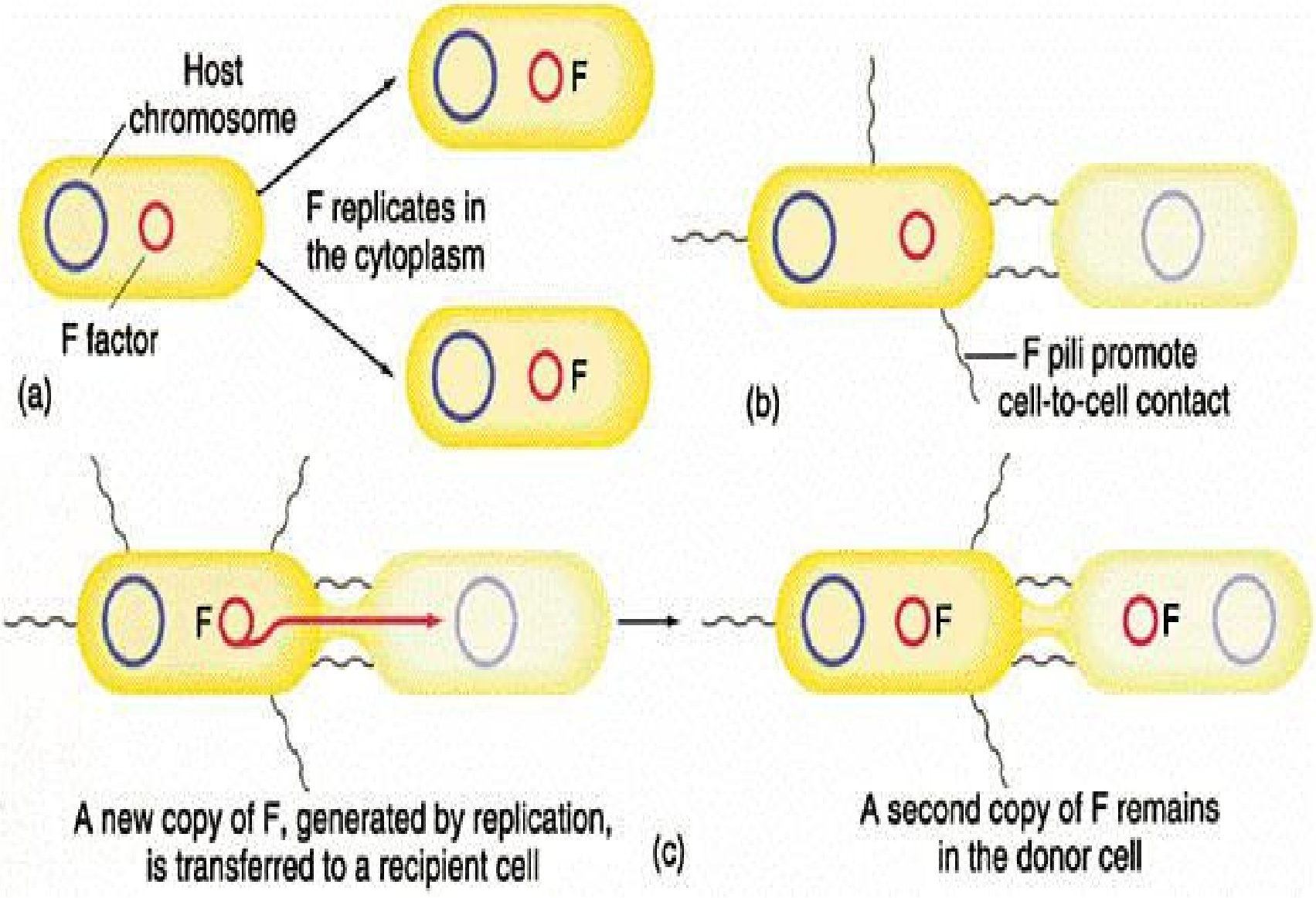


- **CONJUGATION**
- UNIDIRECTIONAL TRANSFER OF DNA FROM ONE CELL TO ANOTHER THROUGH A CYTOPLASMIC BRIDGE CALLED CONJUGATION TUBE

- EQUIVALENT TO SEXUAL MATING IN EUKARYOTES.

- TWO BACTERIAL HAPLOID CELLS COME CLOSE TO EACH OTHER.

- GENE EXCHANGE OCCURS BY TWO METHODS:


Host chromosome
F
F replicates in the cytoplasm
F factor
F
(a)
(b)
F pili promote cell-to-cell contact
F
A new copy of F, generated by replication, is transferred to a recipient cell
(c)
F
F
A second copy of F remains in the donor cell

STERILE MALE METHOD

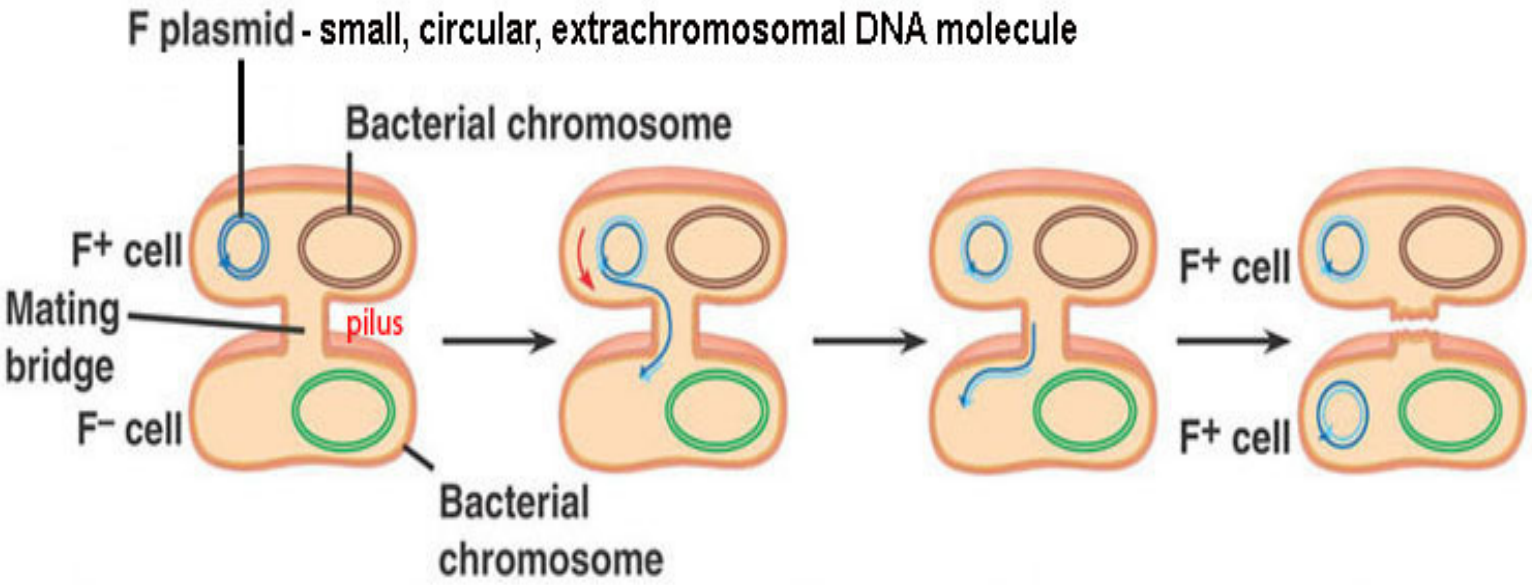
- PLASMID HAVING FERTILITY FACTOR UNDERGOES REPLICATION.
- COPY OF IT TRANSFERRED TO RECIPIENT CELL THROUGH CONJUGATION TUBE
- RECIPIENT CELL CHANGES INTO DONOR CELL
- F FACTOR CARRIES GENES FOR PRODUCING PILI & TRANSFER OF DNA

- FERTILE MALE METHOD :
  AT TIMES F FACTOR INTEGRATES WITH BACTERIAL CHROMOSOME

- INTEGRATED PLASMID CALLED EPISOME

- DONOR CELL HAVING FERTILITY FACTOR INTEGRATED IS Hfr

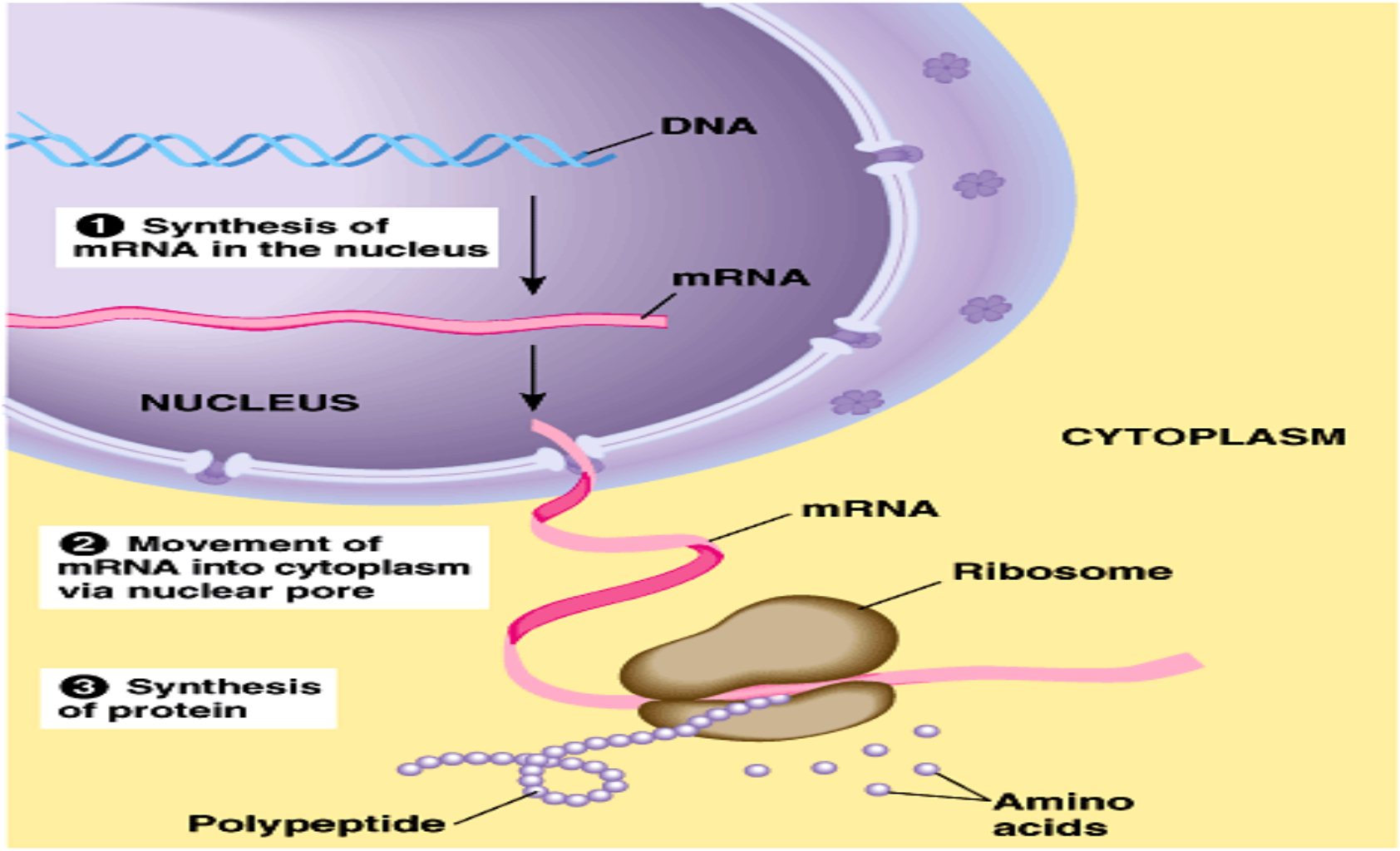
- BACTERIAL CHM .REPLICATES & COPY OF IT PASSES INTO RECIPIENT CELL



(a) Conjugation and transfer of an F plasmid from an F+ donor to an F− recipient

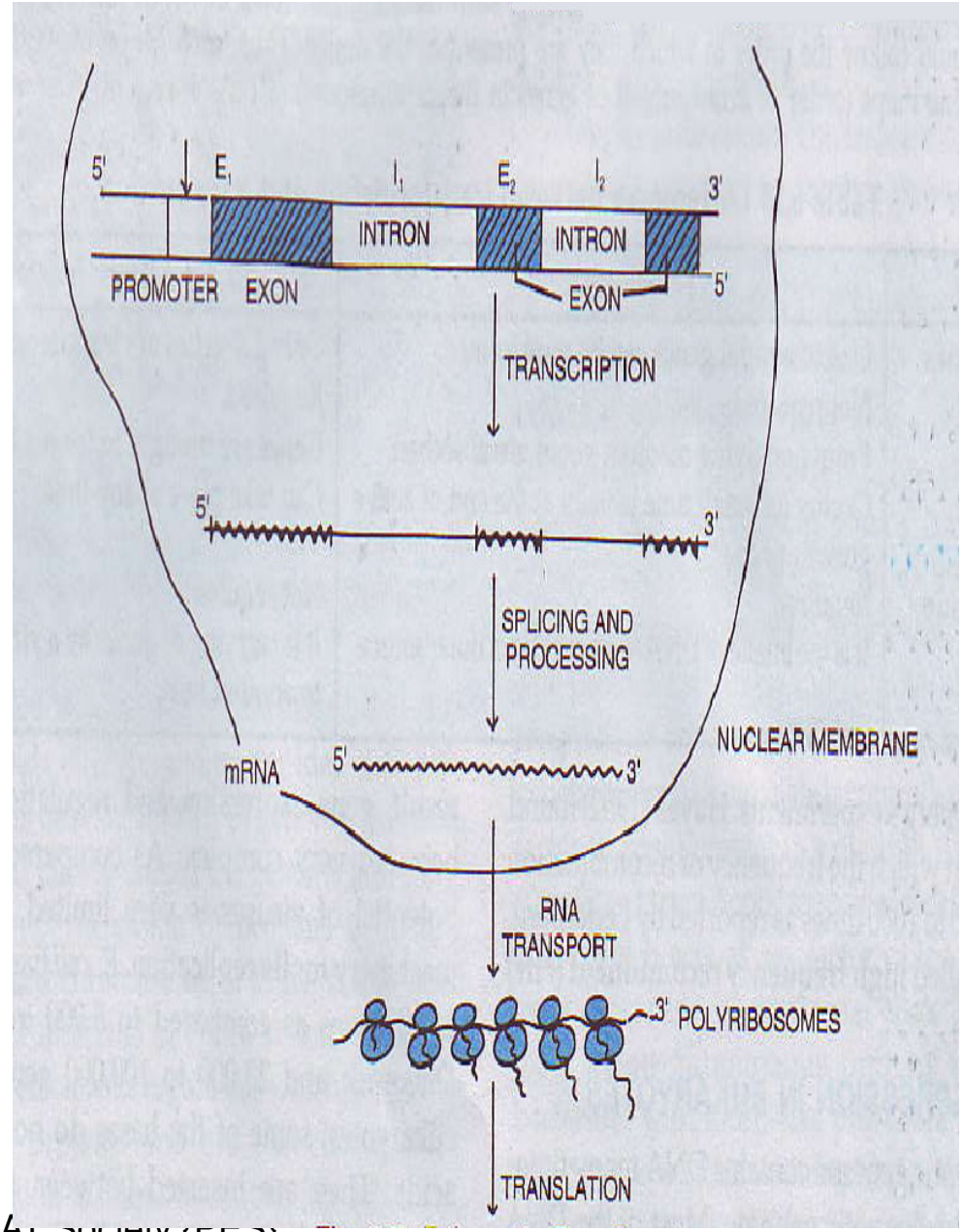
(b) R-plasmid carries genes for antibiotic resistance

GENE EXPRESSION IN EUKARYOTES



- EUKARYOTIC GENOME CONTAINS DNA MANY TIMES AS COMPARED TO PROKARYOTIC GENOME.
- MOST OF DNA NON FUNCTIONAL & TERMED AS EXCESS DNA OR REPETITIVE DNA
- GENOME IN EUKARYOTES CONTROLS & DIVISION OF CELLS, DIFFERENTIATION & SPECIALISATION IN EUKARYOTES, SOME OF BASES DONOT CODE FOR AMINO ACIDS.
- THEY ARE INSERTED BETWEEN THE BASES WHICH NORMALLY CODE FOR AMINO ACIDS

- CODING SEGMENTS ARE EXONS & NON CODING INSERTS ARE INTRONS.
- INFORMATION IS IN SPLIT PIECES.
- UNWANTED mRNA REGIONS ARE REMOVED & FUNCTIONAL REGIONS ARE JOINED & PROCESS TERMED AS SPLICING.




.THANKS
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