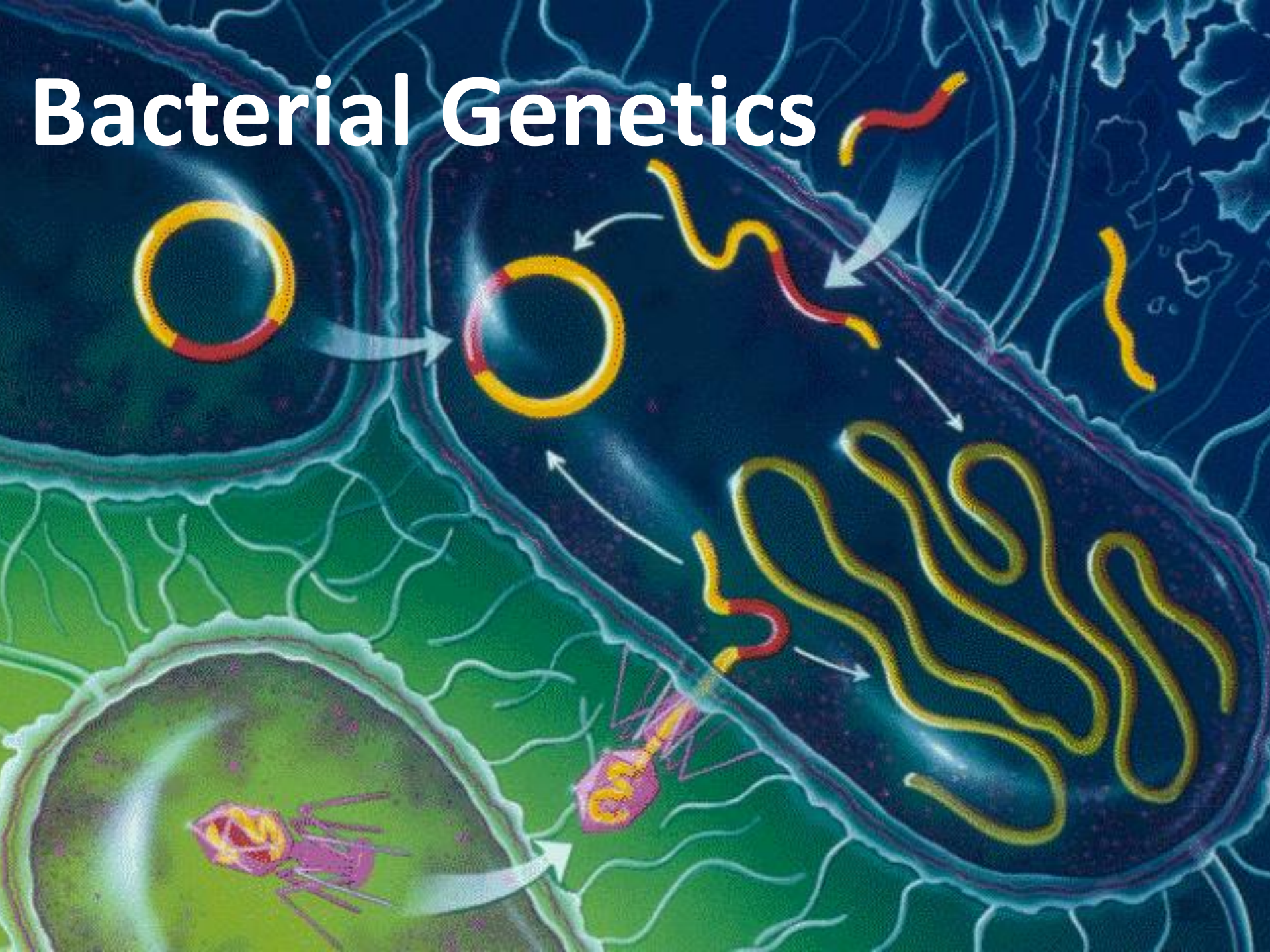


Bacterial Genetics



Understanding Genetics

- We resemble and differ because of Genetic configurations
- They breed true from Generation to Generation
But vary in small proportions in progeny.
- Bacteria too obey the laws of Genetics

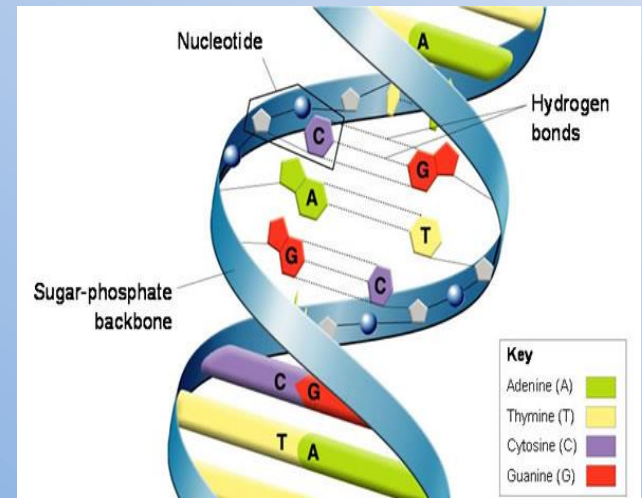
THE BACTERIAL GENOME

- A. The chromosome
- B. Pathogenicity islands
- C. Plasmids

THE BACTERIAL GENOME

A. The chromosome

- DNA (Deoxyribonucleic Acid)
- DNA is composed of:
 - Adenine – Thymine A – T
 - Guanine – Cytosine G – C
- Proportion differ for each species
- DNA replicates first unwinding at one end to form a fork
- Each strand of fork acting as template for the synthesis of complementary strand



THE BACTERIAL GENOME

A. The chromosome

Genetic code:

- Is a unit consists of sequence of three Bases
- Code is triplet A-T- C
- A code can make single Amino acid
- More than one code present for making similar sequence of Amino acid
- AGA make Arginine
- AGC, CGU, CGG, also code for similar Amino acid
- Some Codons UAA don't code for any Amino acid (Nonsense codon)

THE BACTERIAL GENOME

A. The chromosome

Gene:

- is a sequence of DNA carrying codons specifying for particular polypeptide
- DNA contains many Genes (A combinations of hundreds and thousands of Nucleotides)
- Constitutive genes
- Inducible genes

Bacterial Chromosome:

- Contains a Double stranded molecules of DNA arranged in circular form
- Bacterial DNA contains about 4,000 genes

THE BACTERIAL GENOME

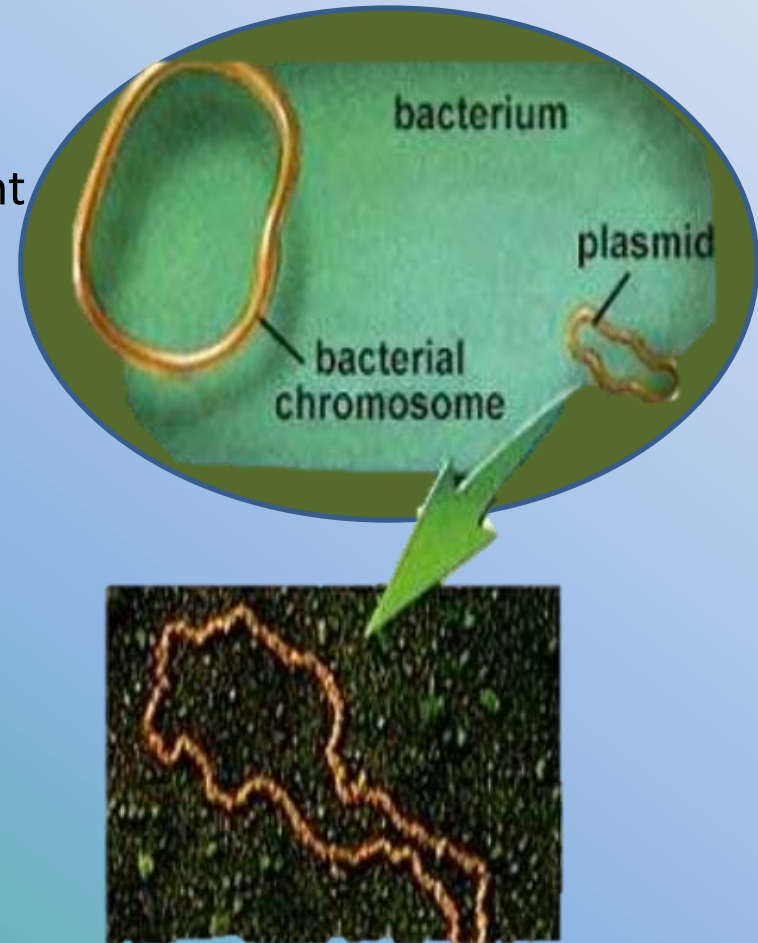
B. Pathogenicity islands

- Are a distinct class of genomic islands acquired by microorganisms through horizontal gene transfer
- Differ from the rest of the chromosome in G+C content
- PAIs are discrete genetic units flanked by direct repeats, insertion sequences or tRNA genes
- Encode virulence factors

THE BACTERIAL GENOME

C. Plasmids

- ✓ Plasmids are circular DNA molecules present in the cytoplasm of the Bacteria
- ✓ Capable of Autonomous replication
- ✓ Can transfer genes from one cell to other



THE BACTERIAL GENOME

C. Plasmids

1. Resistance to Antibiotics
2. Bacteriocins production
3. Enterotoxin production
4. Enhanced pathogenicity
5. Reduced Sensitivity to mutagens
6. Degrade complex organic molecules

BACTERIOPHAGE

1. Temperate phage

2. Virulent phage

- Lysogenic bacterium
- Lysogenic conversion

Gene transfer

1. Conjugation

2. Transduction

A. Generalized transduction

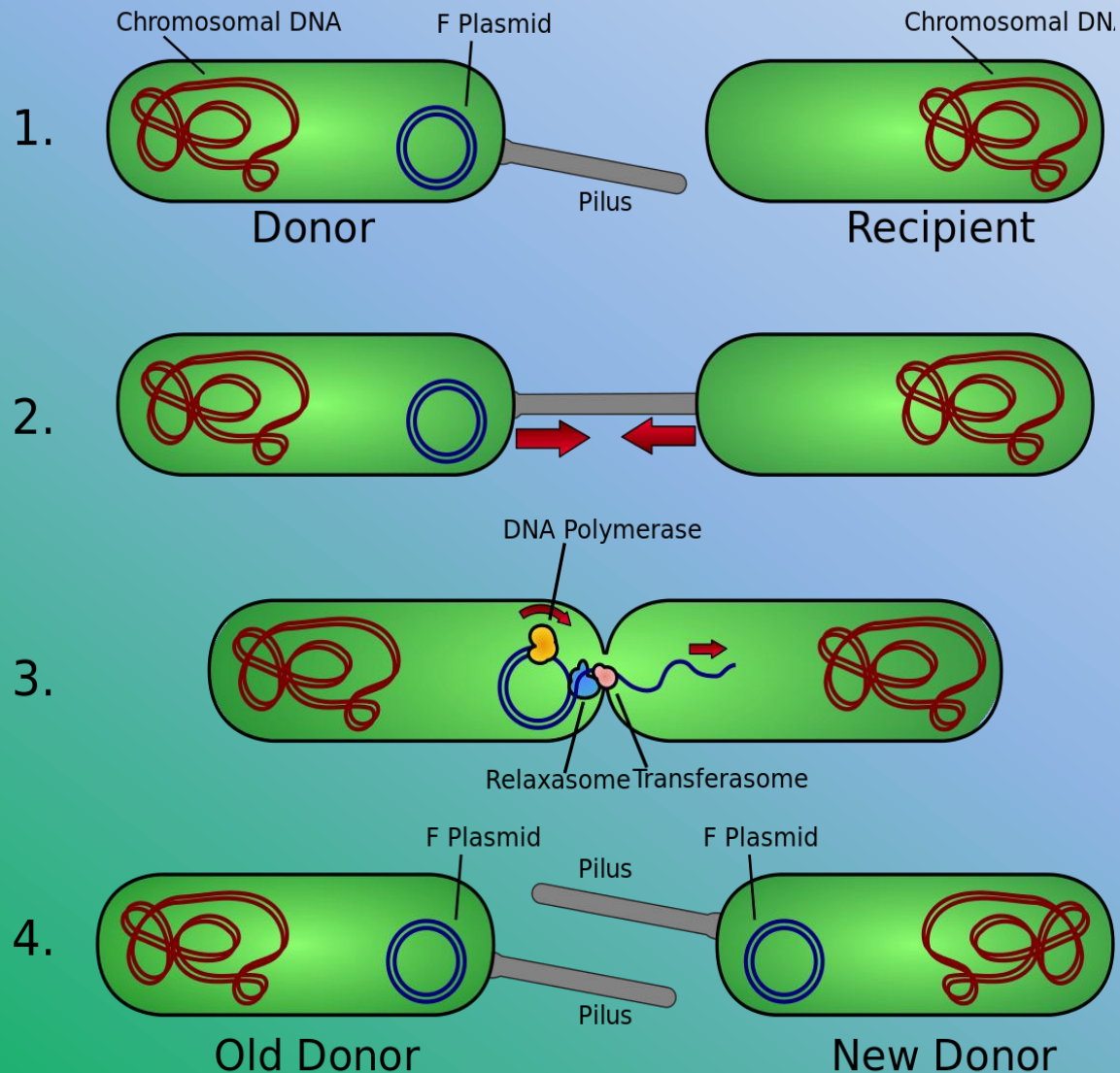
B. Specialized transduction

3. Transformation



Gene transfer

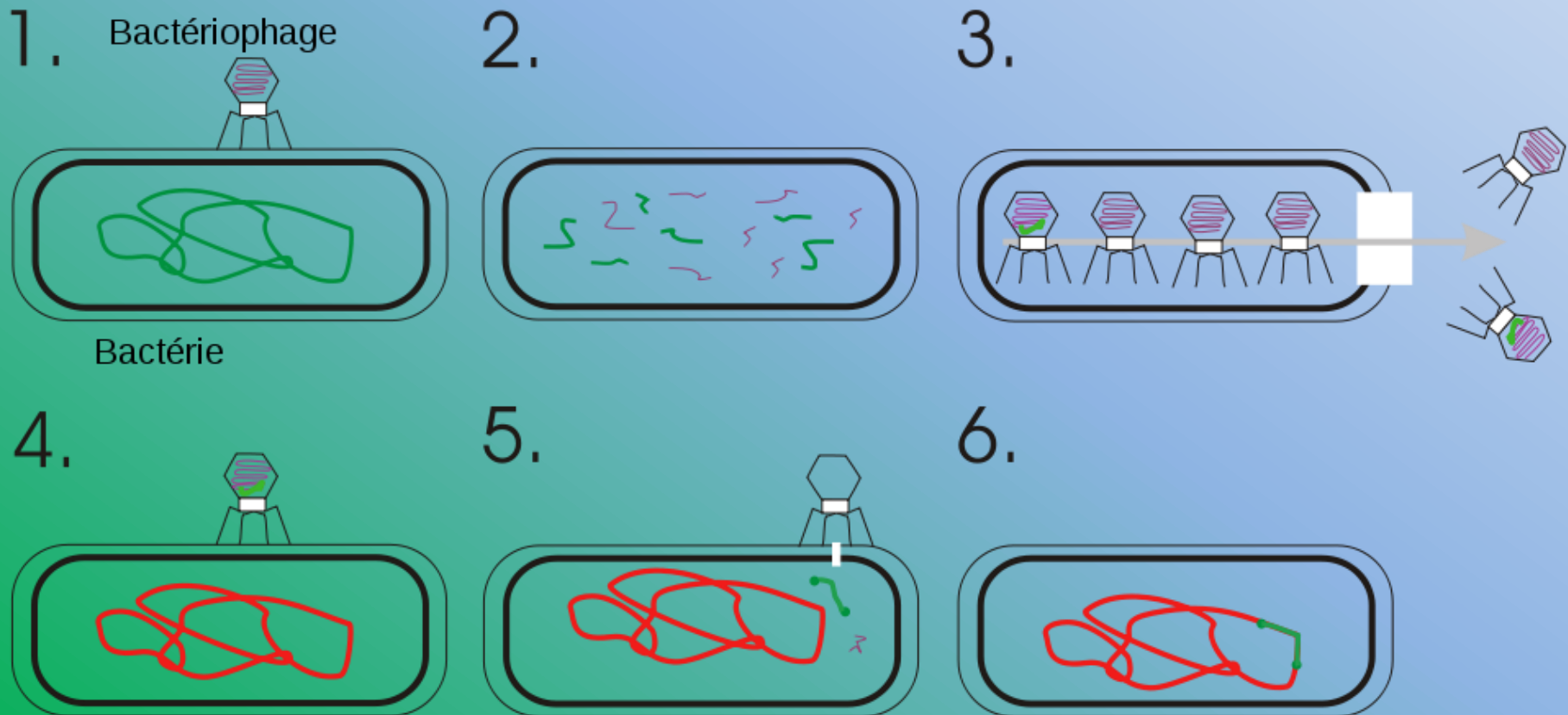
1. Conjugation



Gene transfer

2. Transduction

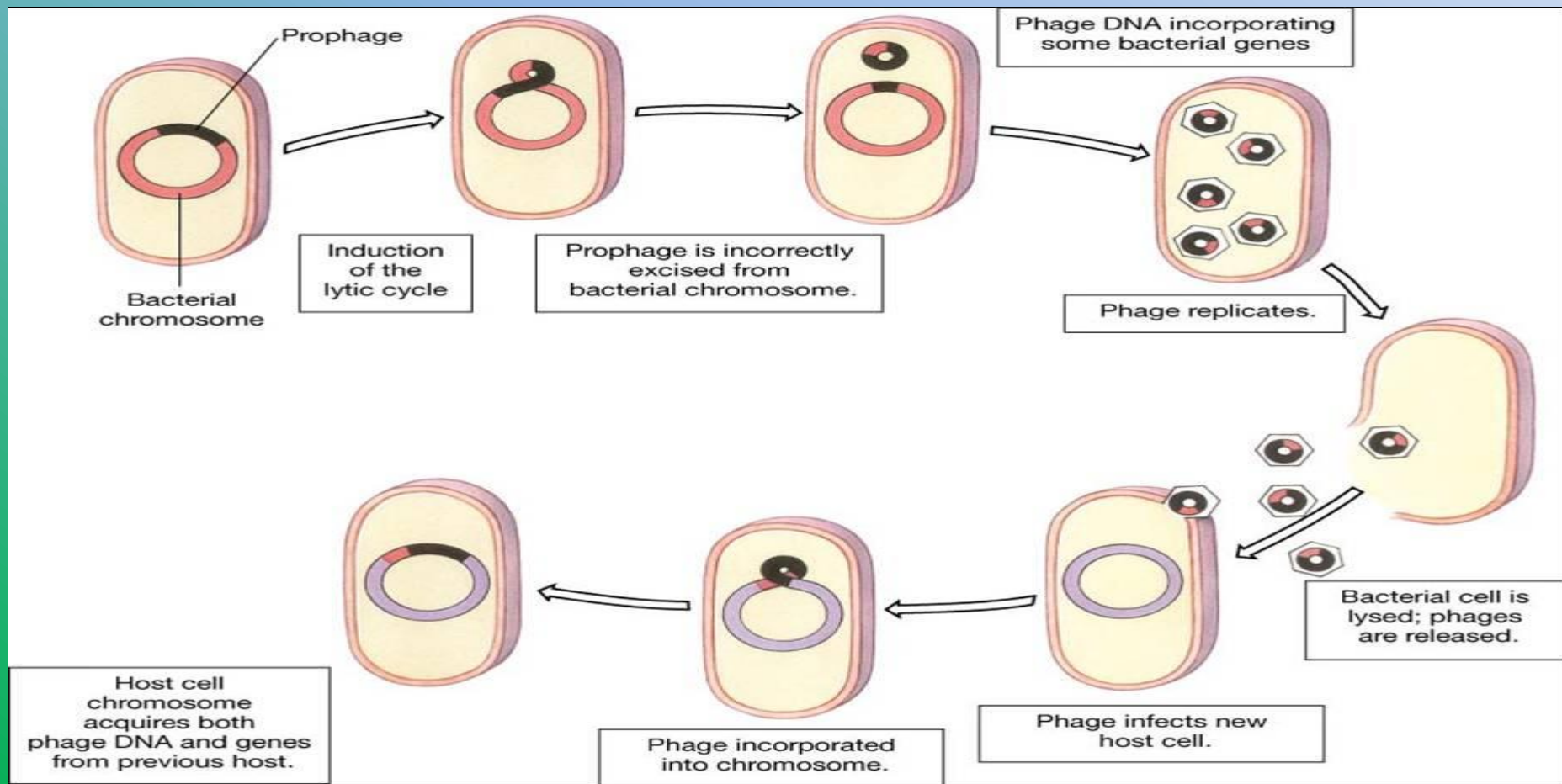
A. Generalized transduction



Gene transfer

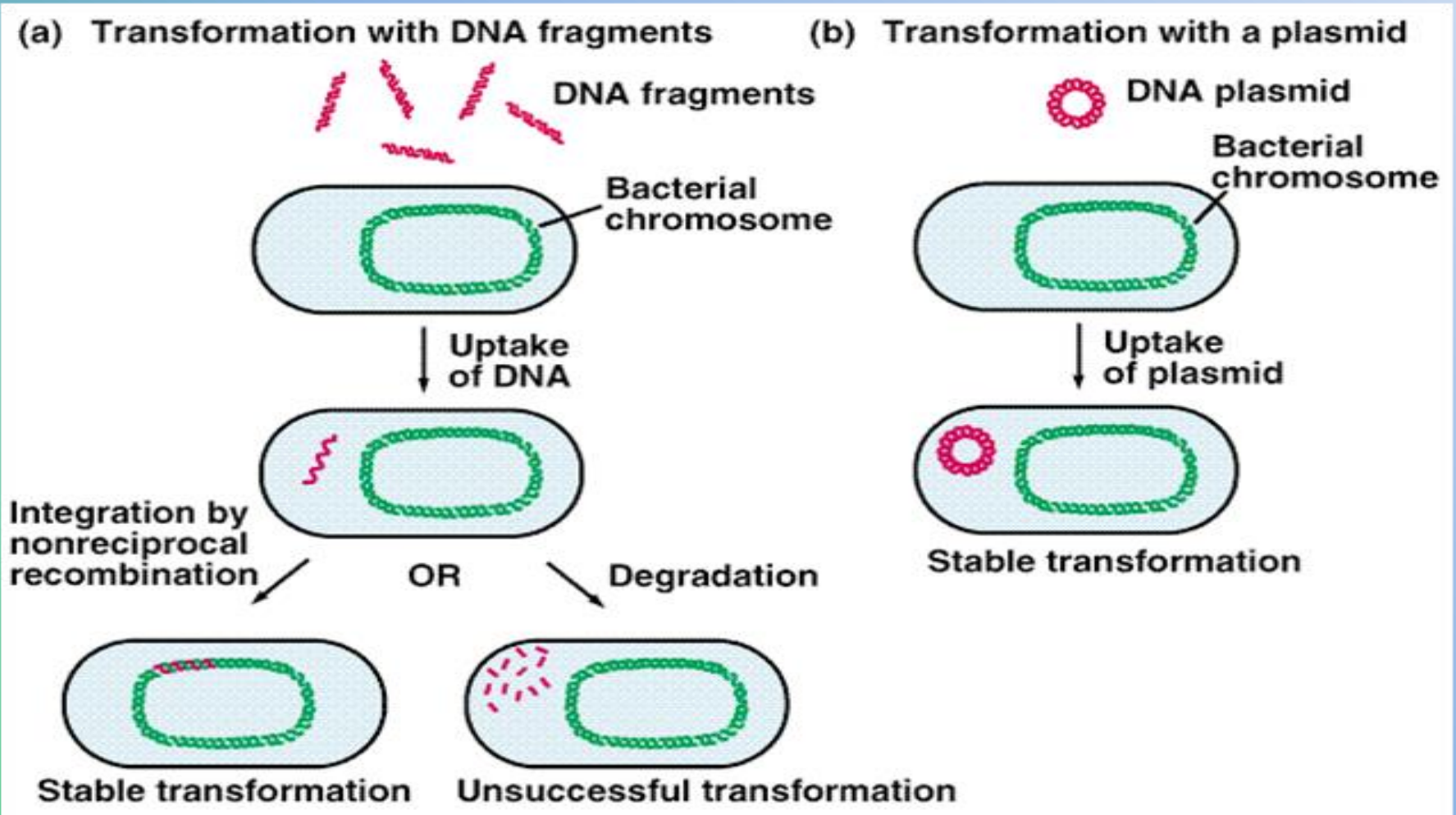
2. Transduction

B. Specialized transduction



Gene transfer

3. Transformation



GENETIC VARIATION

- A. Mutation
- B. Mobile genetic elements
- C. Mechanisms of acquired antibiotic resistance

GENETIC VARIATION

A. Mutation

- Bacteria Multiply by asexual binary fission
- Altered Nucleotide sequence in expresses new or altered characteristics
- Selective value to the organism
- Evolutionary value
- Acquires Antibiotic resistance grows in body without inhibition
- Become a prominent organism
- Phenotypic variation occurs when genes changes in response to the environment but reversible

GENETIC VARIATION

A. Mutation

- Mutation is a Random, Undirected, Heritable variation
- Caused by alteration in the Nucleotide sequence at some point of DNA which can occur due to Addition Deletion Substitution of one or more bases

GENETIC VARIATION

Chromosomal Mutations:



DELETION



DUPLICATION



INVERSION



TRANSLOCATION

GENETIC VARIATION

B. Mobile genetic elements

Transposons (jumping genes)

- Replicative
 - Non-replicative
-
- ✓ The genetic variability bacterial populations
 - ✓ The spread of antibiotic resistance genes

GENETIC VARIATION

C. Mechanisms of acquired antibiotic resistance

1. Decreased uptake of antibiotic
2. Antibiotic efflux
3. Alteration of the target site for antibiotic
4. Acquisition of the ability to destroy or modify the antibiotic
5. Acquisition of a new target

PCR & Genetic engineering

- **Molecular Genetics**
 - Analysis and manipulation of DNA using Biochemical and Microbiological technique
- **Genetic Engineering**
 - Recombinant DNA techniques changed the ideals of Medicine
 - Genetic Engineering await many surprises?

