CLASSIFICATION OF VIRUSES

What is the procedure ?

- Family often the highest classification. Ends in -viridae.
- Many families have subfamilies. Ends in -virinae.
- Bacterial viruses referred to as bacteriophage or phage (with a few exceptions).

Example

Herpes*viridae*

Alphaherpes*virinae*

Varicello *virus*

Bovine Herpes virus 1 (BHV1)

Parameters of classification

A. Virion properties
   - Virion size
   - Virion shape
   - Presence of envelope
   - Symmetry and structure of capsomer

B. Genome properties
   - Type of nucleic acid (DNA or RNA)
   - # of strand (single or double)
   - Linear or circular
   - Polarity (+ or -)
   - # of segments

C. Properties of proteins

- # of proteins
- Size of proteins
- Functional properties
- Amino acid sequence

D. Replication properties

- Replication strategy
- Characteristics of transcription

E. Physical Properties

- pH stability
- Thermal stability
- Cation (Mg^{+2}, Mn^{+2}) stability
- Stability to solvent and detergents

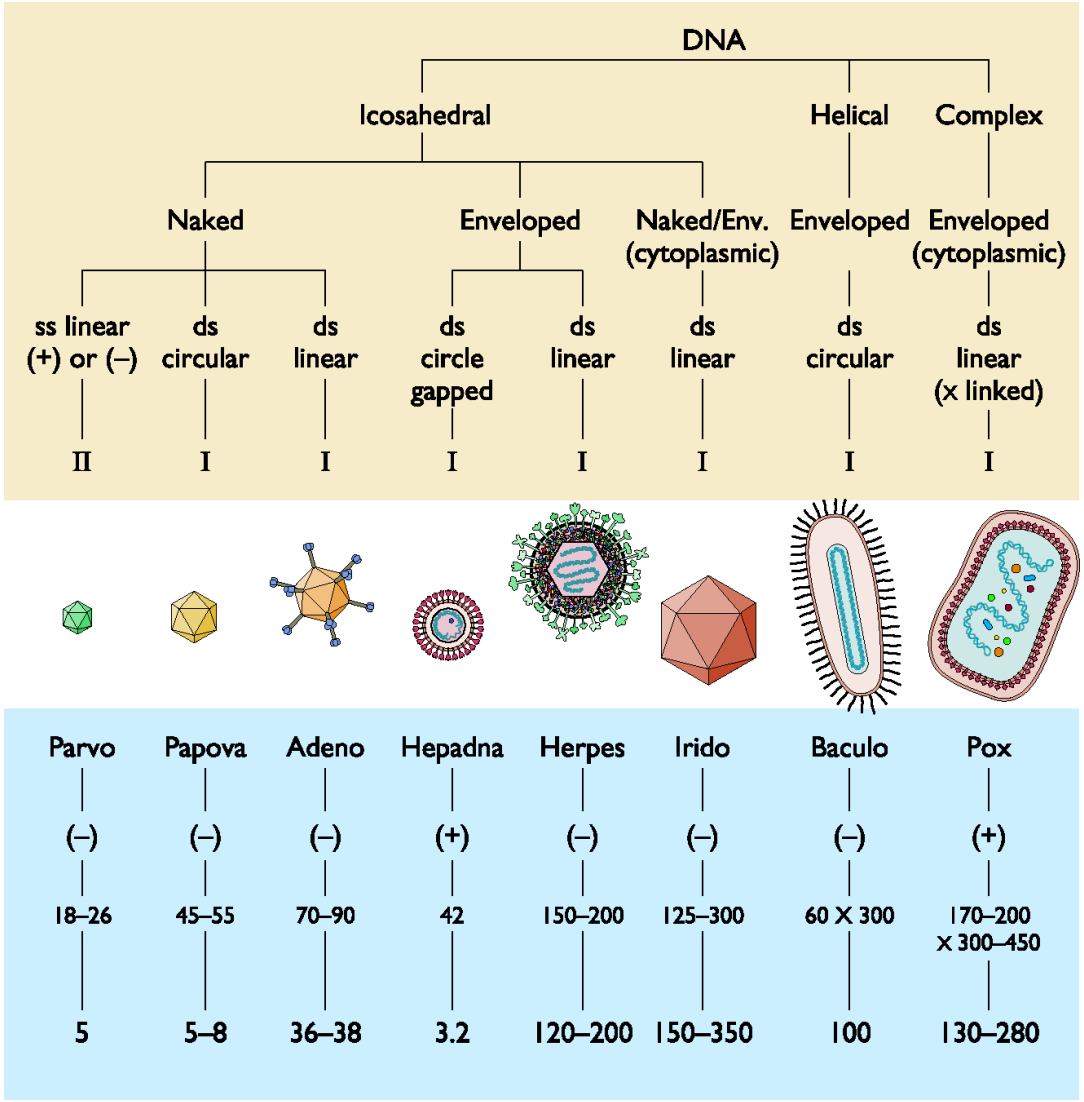
F. Biological properties

- Serologic relations
- Host spectrum (natural and experimental)
- Tissue tropism, pathology and histopathology
- Transmission mode
- Vector based relations
- Geographical distribution

You should know!!!

- Virus families carrying DNA
  - Adenoviridae
  - Hepadnaviridae
  - Herpesviridae
  - Parvoviridae
  - Papovaviridae
  - Poxviridae

DNA viruses

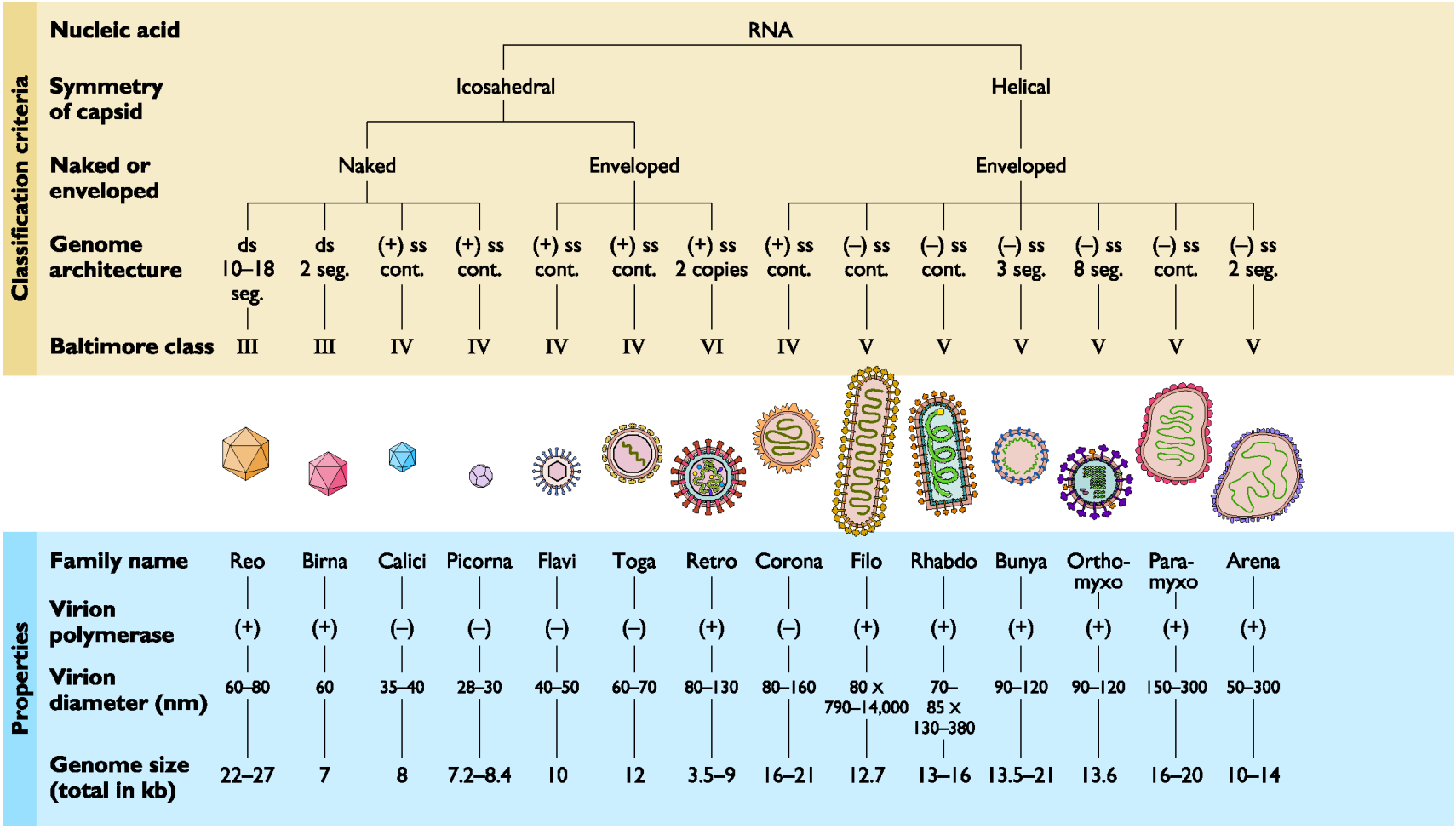


From Principles of Virology Flint et al ASM Press

You should know !!!

- Virus families carrying RNA
  - Arenaviridae
  - Bunyaviridae
  - Caliciviridae
  - Coronaviridae
  - Flaviviridae
  - Filoviridae
  - Orthomyxoviridae
  - Paramyxoviridae
  - Picornaviridae
  - Rhabdoviridae
  - Reoviridae
  - Retroviridae

RNA viruses



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VİRUS GENETICS

MUTATION

- Irreversible changes in virus genome called as mutation.
- Mutations are;
  - The most important strategy for keeping themselves alive (and infectious of course) in the nature
  - Occurs more often in RNA viruses in comparison to DNA viruses.

Types of Mutation

- Spontaneous Mutation → happens itself under natural conditions

- Induced Mutation → happens by manipulations for certain kind of purposes (vaccines, weapons)

- In addition, two kind of mutation have been described based on mechanism of occurence and final effect;
    - Point mutations
    - Frame shift mutations

Point Mutations

- This was characterized by single nucleotide change in the genome and relevant amino acide.

5′- **ATG GGC GAG TCC CGA AAA TGG CAC CCG CTA** -3′
Met Gly Glu Ser Arg Lys Trp His Pro Leu

5′- **ATG GGC GA<u>C</u> TCC CGA AAA TGG CAC CCG CTA** -3′
Met Gly **Asp** Ser Arg Lys Trp His Pro Leu

Nucleotide Changes

- Transition mutations

  Pirimidin – Pirimidin Purin – Purin

  T → C C → T A → G G → A

- Crossed mutations

  Pirimidin – Purin

  T → A T → G C → A C → G

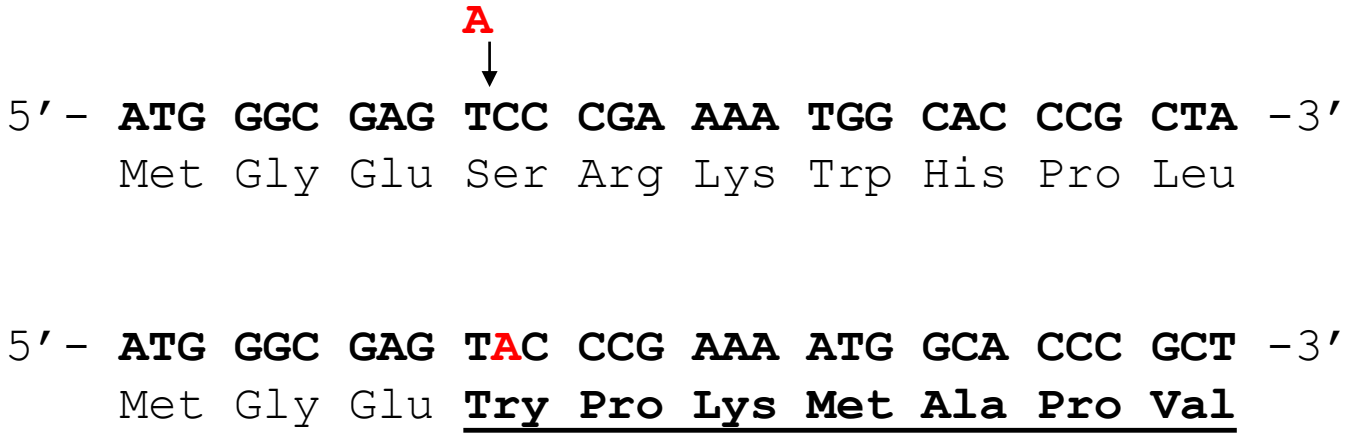
  Purin – Pirimidin

  A → T A → C G → T G → C

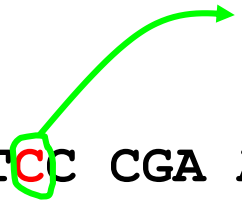
Frame Shift Mutations

- Occures either insertion or deletion of a nucleotide in to the frame so that all sequence after the point of effect (insertion or deletion) of gene would change dramatically affecting relevant amino acide sequence.

1. Nucleotide insertion



2. Nucleotide deletion



5′- **ATG GGC GAG TCC CGA AAA TGG CAC CCG CTA** -3′

Met Gly Glu Ser Arg Lys Trp His Pro Leu

5′- **ATG GGC GAG TCC GAA AAT GGC ACC CGC TAT** -3′

Met Gly Glu **Ser Glu Asn Gly Thr Ala Try**

MUTAGENS

1. Chemical Mutagens
   - A. *Base analogs*
     - 5-bromourasil (Urasil)
     - 2-aminopurin (Adenin)
   - B. *Agents changing nucleic acide*
     - Nitreus acide (HNO_2) } A → H
     - Hydroxylamine (NH_2OH) } C → U
   - C. *Alkylizing agents*
     - Nitrosoguanidin
     - Etilmetan sülfonat
     - Metilmetan sülfonat
   - D. *Acylizing agents*
   - E. *Interchalating agents*

2. Physical Mutagens
   - A. *Heat and pH*
   - B. *Rays*
     - Ionized (X and gamma)
     - Non-ionized (UV)

Genetical Relations Between Viruses

- Intermolecular recombination

Partial of total gene exchanges between viruses co-infecting same cell. Mostly seen in herpesviruses

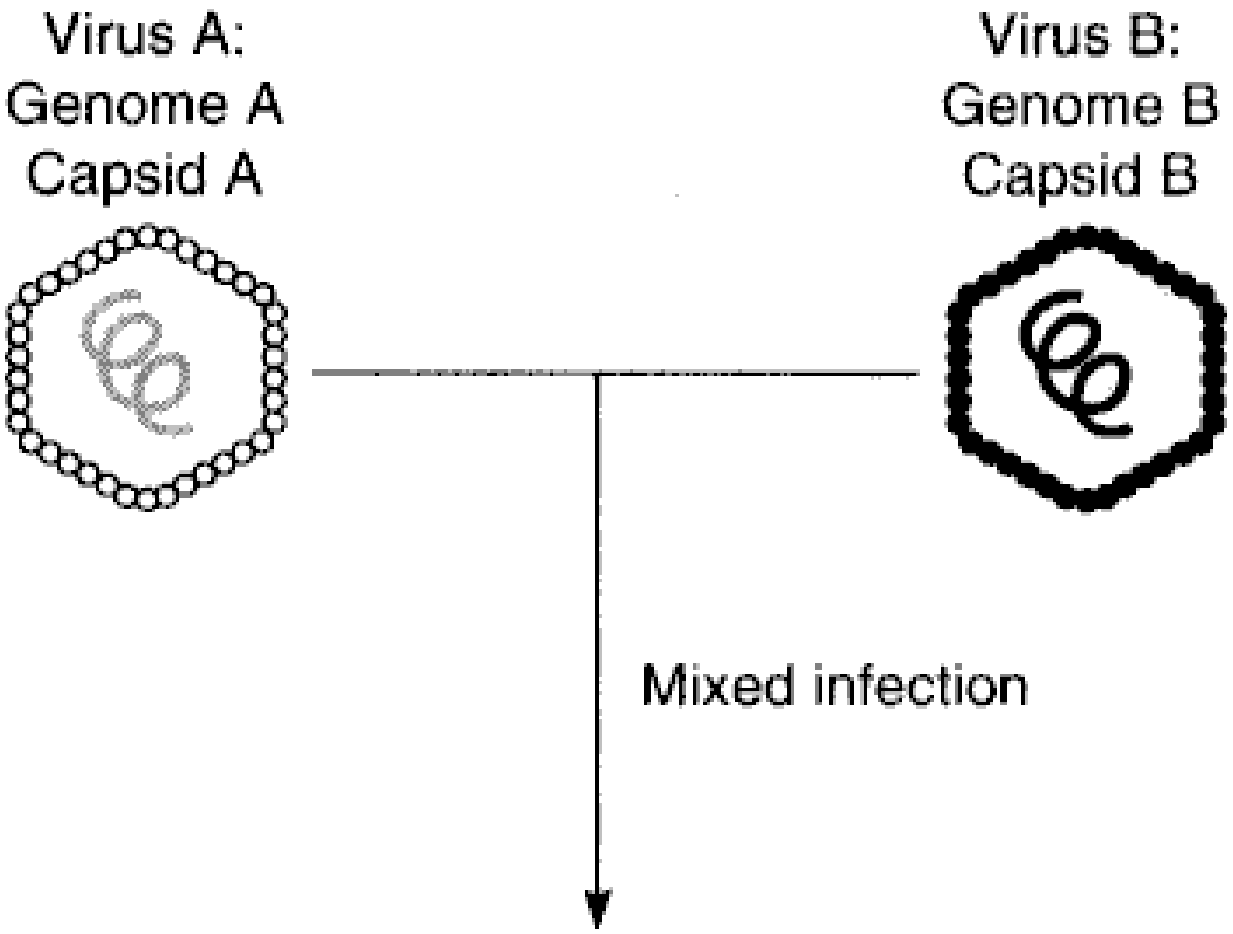
- Genetic reassortment

Seen in segmented RNA viruses. The mechanism is segment exchange between genetically close related viruses. For example, Influenzaviruses

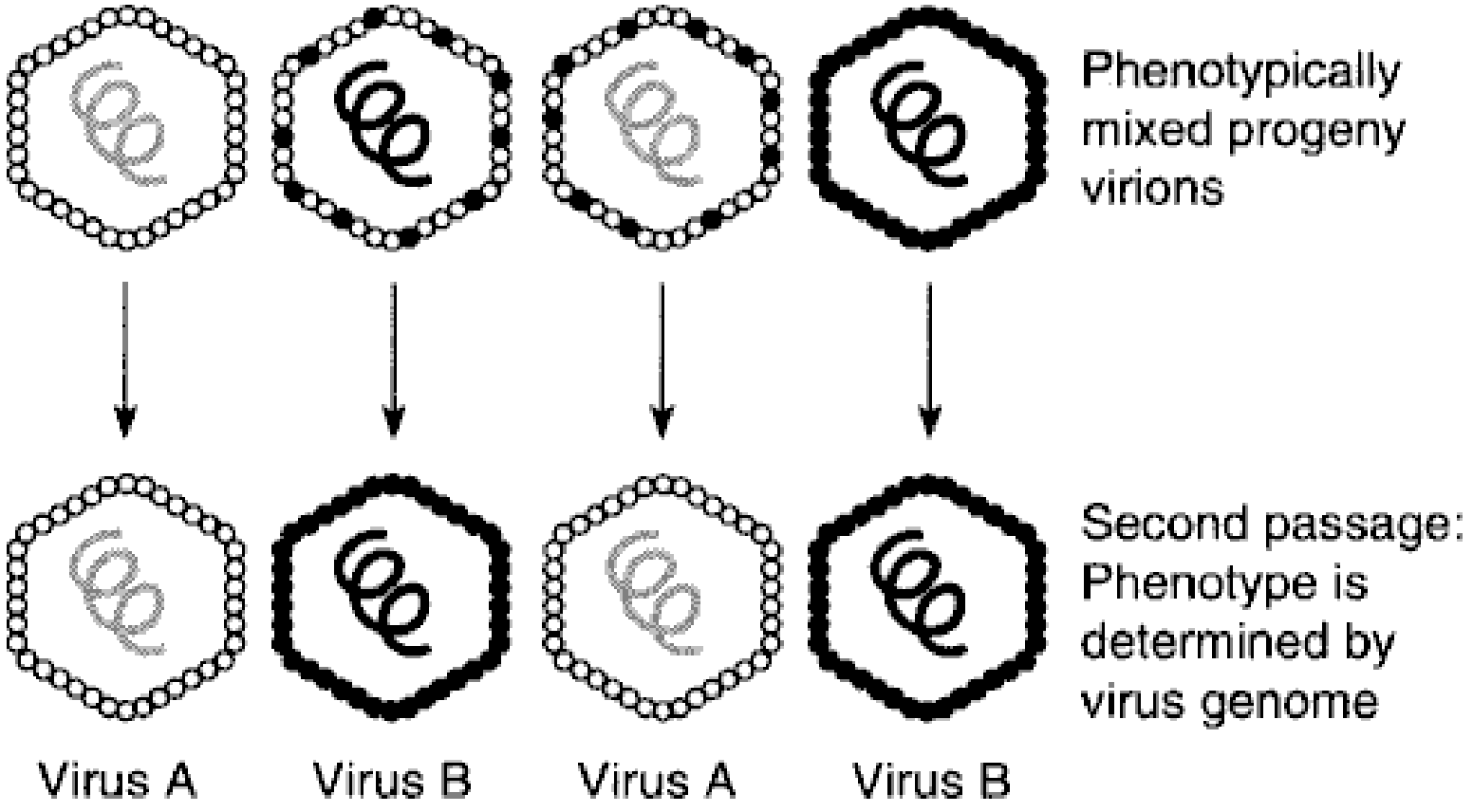
- Complementation

Exchange of structural protein subunits of viruses in order to complete the missing parts.

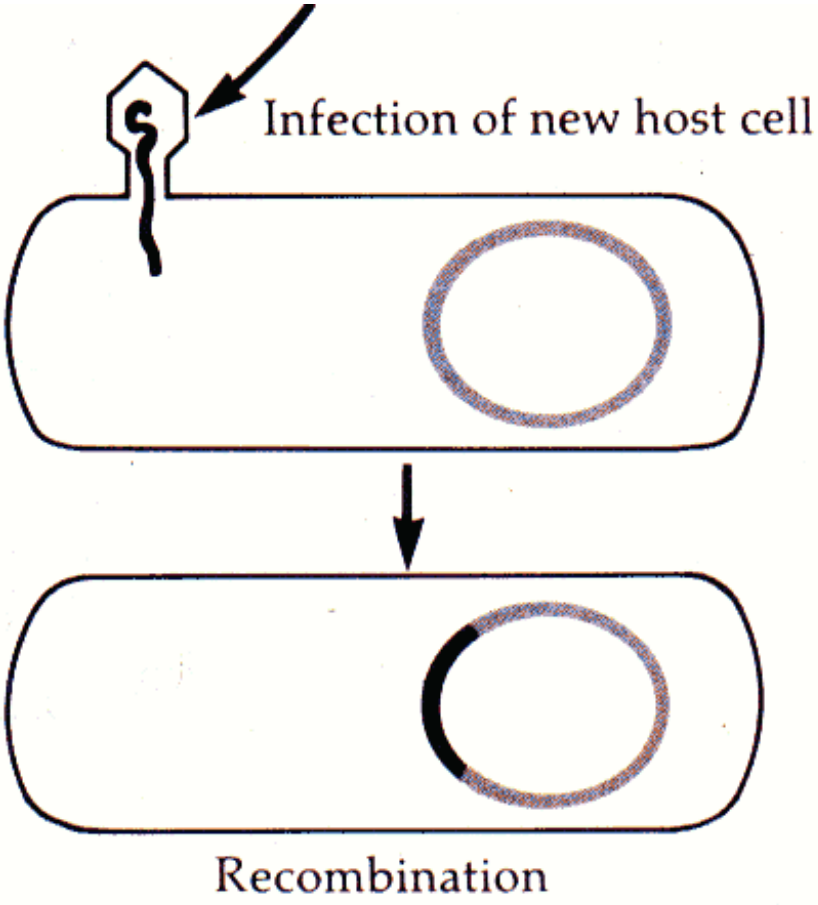
PHENOTYPIC MIXING



PHENOTYPIC MIXING



NON-SPECIFIC (GENERAL) TRANSDUCTION



Genetic Reassortment