FACULTY OF ENGINEERING &TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY

Transduction

Transduction is a mechanism of DNA uptake by bacteria in which donor DNA, consisting of fragments of bacterial chromosome, is intoduced into the recepient's cells via a bacterial virus (bacteriophage) vector. During this process, new genetic information may be acquired by the host cell.

Types of transduction

There are two types of transduction: generalized and specialized. In generalized transduction, the bacteriophages can pick up any portion of the host's genome. In contrast, with specialized transduction, the bacteriophages pick up only specific portions of the host's DNA.

Generalized transduction

❖During generalized transduction virtually any bacterial gene can be transferred.

❖The genetic transfer is mediated by virulent or lytic bacteriophage. Lytic bacteriophages are bacterial viruses that upon the infection of a host bacterial cell destroys the DNA of the host and ultimately lyse the cell, releasing numerous viral progeny.

❖ Upon infection of a host cell by a lytic bacteriophage, viral enzyme degrade the host's DNA into fragments.

❖ Viral DNA is not degraded because some of the bases into the bacteriophage genome are modified so that they are not recognized by viral enzymes.

❖The viral DNA is then replicated and viral proteins are synthesized.

❖The newly replicated DNA is packaged into the coat proteins, and then infectious viral particles are assembled. When the viruses are fully assembled, viral enzymes degrade the cell's envelopes, lysing the cell and releasing the viral progeny.

❖Infrequently, however, some of that host's DNA is packaged into the virus along with an incomplete viral genome.

❖When this happens, a generalized transducing phage is formed, which, although capable of initiating an infection, is unable to replicate itself or lyse the host cell.

❖Some phage genes must be given up to accommodate the bacterial genes within the confines of the virus head.

❖These defective transducing phages serves as vehicle for transfer of the host DNA (incorporated during viral assembly) from one cell to another.

❖ Because the packaging of host DNA into the viral particle is a random event, any given bacterial gene has an equal chance of being packaged and transferred to a recepient cell.

❖Upon infection of a bacterial host cell by the transducing phage, the transducing DNA is introduced into the host's cytoplasm and becomes incorporated into the bacterial genome by homologous recombination.

❖The infected cell is not destroyed because the transducing phage is defective in that it doesnot a full complement of genes.

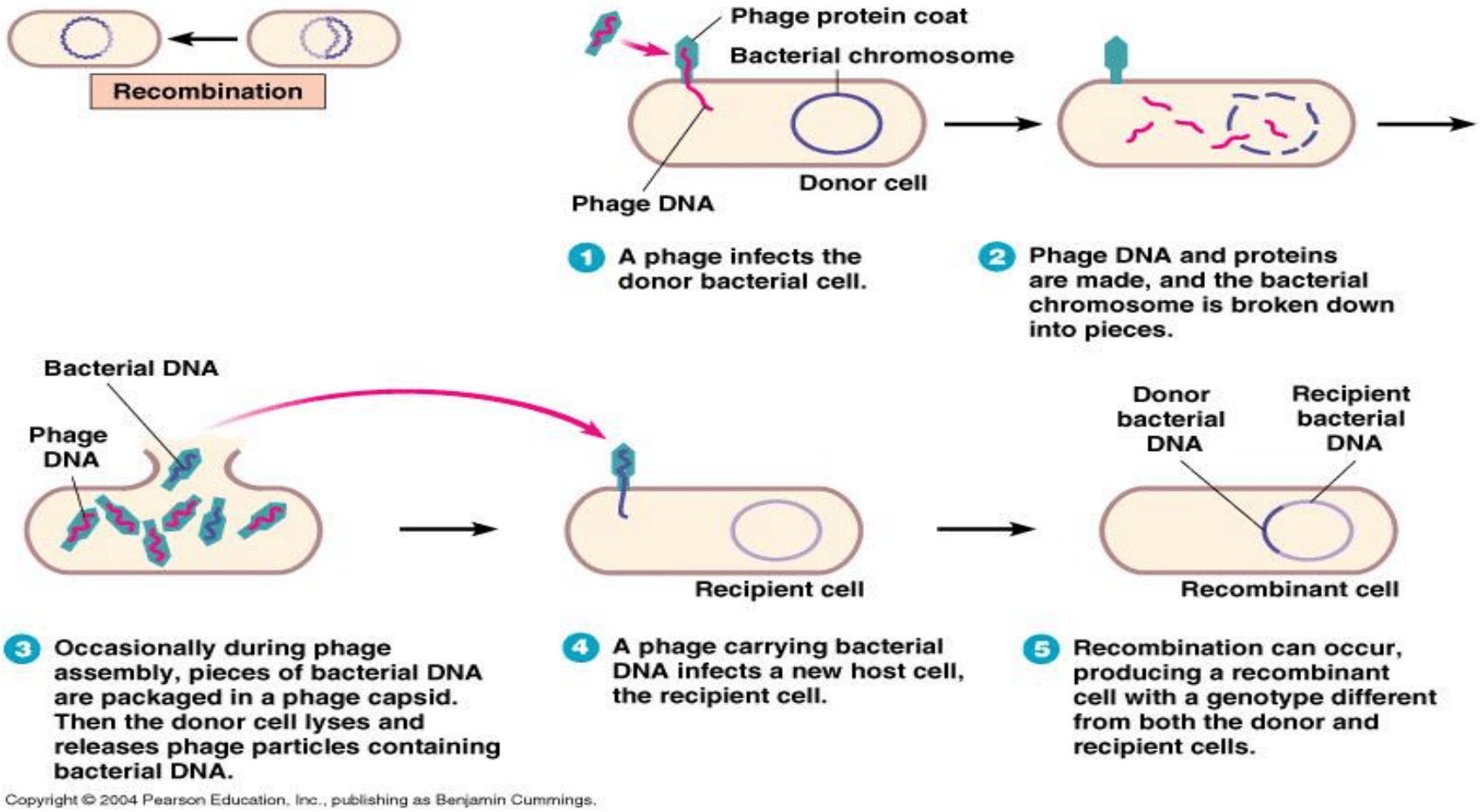

Figure : Schematic of generalized transduction

Specialized transduction

Specialized or restricted transduction is a process whereby a lysogenic bacteriophage serve to transfer a specific gene at a high frequency. When lysogenic bacteriophages infect host cells, their DNA is incorporated into the host's genome by site-specific recombination. Specialized transduction is carried only by temperate bacteriophage (ability to adapt lysogenic lifecycles) which undergoes lysogenic cycle in donor cell.

- At first temperate bacteriophage enter into donor bacteria and then its genome gets integrated with host cell's DNA at certain location and remains dormant and pass generation to generation into daughter cell during cell division. The bacteriophage which follows lysogenic cycle is known as temperate phage.

- When such lysogenic cell is exposed to certain stimulus such as some chemicals or UV lights, it causes induction of virus genome from host cell genome and begins lytic cycle.

- On induction from donor DNA, this phage genome sometimes carries a part of bacterial DNA with it. The bacterial DNA lies on sides of integrated phage DNA are only carried during induction.

- When such bacteriophage carries a part of donor bacterial DNA infects a new bacteria, it can transfer that donor DNA fragments into new recipient cell. So, in this specialized transduction only those restricted gene which are situated on the side of integrated viral genome have a chance to enter into recipient cell.

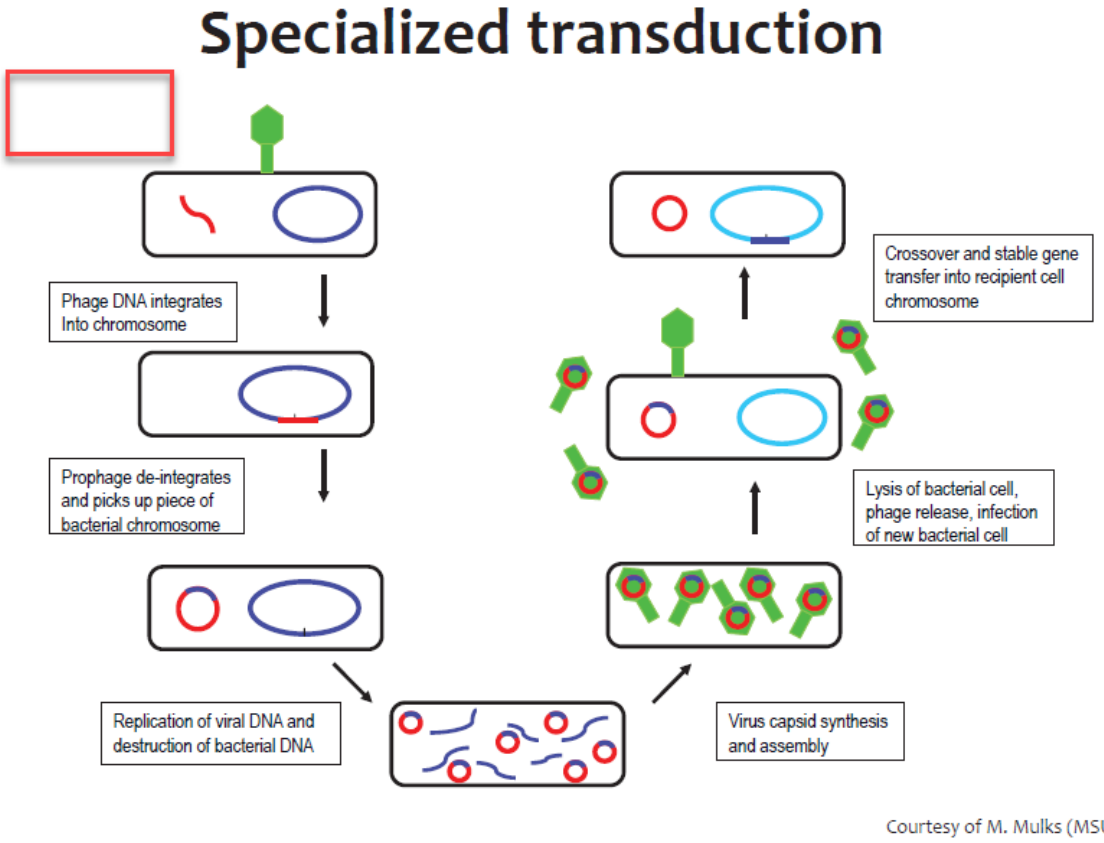

Figure : Schematic of specialized transduction