

## **Quadrant II – Transcript and Related Material**

**Programme: Bachelor of Science (Third Year)**

**Subject: Microbiology**

**Paper Code: MIC 107**

**Paper Title: Microbial Genetics**

**Unit: 2: Gene Transfer Mechanisms**

**Module Name: Transduction: Generalized Transduction**

**Module No: 12**

**Name of the Presenter: Sunita Borkar, Ph.D.**

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### **Notes:**

Generalized transduction is the transfer of any part of a bacterial or archaeal genome that occurs during the lytic cycle of virulent and some temperate phages. During the assembly stage, when the viral chromosomes are packaged into protein capsids, random fragments of the partially degraded bacterial chromosome also may be packaged by mistake. Because the capsid can contain only a limited quantity of DNA, the viral DNA is left behind. The quantity of bacterial DNA carried depends primarily on the size of the capsid. The P22 phage of *Salmonella enterica* serovar *typhimurium* usually carries about 1% of the bacterial genome; the P1 phage of *E. coli* and a variety of gram-negative bacteria carries about 2.0 to 2.5% of the genome. The resulting virus particle often injects the DNA into another bacterial cell but cannot initiate a lytic cycle. This phage is known as a defective / abnormal / generalized transducing particle or phage and is simply a carrier of genetic information from the original bacterium to another cell. The DNA remains double stranded during transfer, and both strands are integrated into the recipient's genome. Recombinant bacterium thus formed has a genotype that is different from recipient bacteria. Change in genotype changes the phenotype of the organism.

Generalized transduction was discovered in 1952 by Joshua Lederberg and Norton Zinder during an attempt to show that conjugation, discovered several years earlier in *E. coli*, could occur in other bacterial species. Lederberg and Zinder were repeating the earlier

experiments with *Salmonella enterica* serovar *typhimurium*. They found that incubation of a mixture of two multiple auxotrophic strains yielded prototrophs at the level of about one in  $10^5$ . When these investigators performed the U-tube experiment with *Salmonella*, they still recovered prototrophs. The filter in the U tube had pores that were small enough to block the movement of bacteria between the two sides but allowed phage P22 to pass. Lederberg and Zinder had intended to confirm that conjugation was present in another bacterial species but instead discovered a completely new mechanism of bacterial gene transfer.

**Steps involved in generalized transduction:**

- ✓ **Phage infects the donor bacterial cell**
  - ✓ **Host DNA is hydrolysed into pieces, and phage DNA and proteins are made**
  - ✓ **Phages assemble; occasionally a phage carries a piece of the host cell chromosome (Defective/Abnormal Phage)**
  - ✓ **The donor cell lyses and releases phage particles containing bacterial DNA**
  - ✓ **Transducing phage injects its DNA into a new recipient cell**
  - ✓ **Transduced DNA is recombined into the chromosome of the recipient cell producing a recombinant cell**
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