

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

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**Paper Title: Microbial Genetics**

**Unit 3: Mutations**

**Module Name: Complementation Test**

**Module No: 23**

**Name of the Presenter: Ms. Dviti Dayanand Mapari**

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## **Notes**

### **Complementation Test**

Complementation test allows us to determine whether two mutations, both of which produce a similar phenotype are in the same gene i.e. whether they are alleles or represent mutations in separate genes, whose proteins are involved in the same function.

A complementation test (sometimes called a “cis-trans” test) developed by American geneticist Edward B. Lewis. In genetics, complementation occurs when two strains of an organism with different homozygous recessive mutations that produce the same phenotype produce offspring with the wild-type phenotype when mated or crossed.

Complementation will occur only if the mutations are in the different genes. In a diploid organism the complementation test of allelism (allelism test) is performed by intercrossing homozygous recessive mutants two at a time and observing whether or not the progeny have a wild type phenotype. If the two recessive mutations are in the separate genes and are not alleles of one another, then following the cross, all F1 progeny are heterozygous for both genes. Complementation is said to occur. Because each mutation is in a separate gene and each F1 progeny is heterozygous at both loci, the normal products of both genes are produced. If the two mutations affect the same gene and are alleles of one another. Complementation does not occur. Because the two mutations affect the same gene, the F1 (1<sup>st</sup> Generation) is homozygous for the two mutant alleles. No normal product of the gene is produced. Complementation analysis for allelism, is often called the cis-trans test. Cis (along one side of one another) refers to the case where the two mutations are on the same homolog. Trans (opposite one another) refers to the case where mutations are on separate homolog. The Trans configuration is critical in determining whether the two mutations are alleles of the same genes or not.

Example of a complementation test: Two strains of flies are white eyed because of two different autosomal recessive mutations which interrupt different steps in a single pigment-producing metabolic pathway. Flies from Strain 1 have complementary mutations to flies

from Strain 2 because when they are crossed the offspring are able to complete the full metabolic pathway and thus have red eyes.