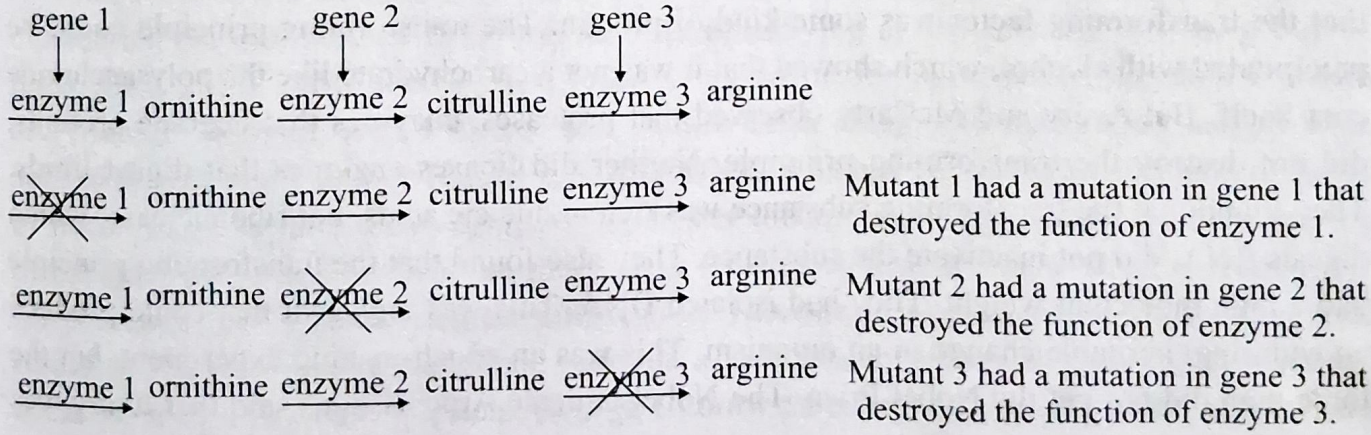
3.3 ONE GENE ONE ENZYME HYPOTHESIS (1941)

Sir Archibald Edward Garrod, was an eminent English physician recognised for his groundbreaking contributions to the study of inborn errors of metabolism. Among his notable achievements was the discovery and elucidation of alkaptonuria, including its mode of inheritance. In 1941, **Beadle and Tatum** expanded upon Garrod's earlier work by using the fungus *Neurospora crassa* as a model organism to investigate the relationship between genes and metabolic pathways. *Neurospora* is particularly well suited for genetic studies because, it can be grown quickly on simple culture medium and it spends most of its life cycle in the haploid condition so any recessive mutations will show up in its phenotype. They hypothesized that individual mutations in genes could disrupt specific steps in biochemical pathways. By exposing *Neurospora* spores to X-rays, they induced mutations, some of which resulted in auxotrophic strains unable to grow on minimal medium but capable of growing on complete medium supplemented with specific nutrients. This implied that each mutation blocked a particular step in a pathway and could be circumvented by supplying the missing nutrient. Through these experiments, Beadle and Tatum linked nutritional mutants to specific biochemical pathways, demonstrating the connection between genes and enzymes and laying the groundwork for the **"one gene, one enzyme"** hypothesis, which proposed that each gene encodes a protein with a distinct function in a metabolic pathway. This pioneering work earned them a Nobel Prize in 1958 and established a link between our understanding of genetics and biochemistry.

TABLE 3.1 *Experiment setup and outcome of Beadle and Tatum experiment.*

Beadle and Tatum Experiments				
Bread Mold	**Minimal Medium (MM)**	**MM + Ornithine**	**MM + Citrulline**	**MM + Arginine**
Wild type	grew	grew	grew	grew
Mutant 1	did not grow	grew	grew	grew
Mutant 2	did not grow	did not grow	grew	grew
Mutant 3	did not grow	did not grow	did not grow	grew



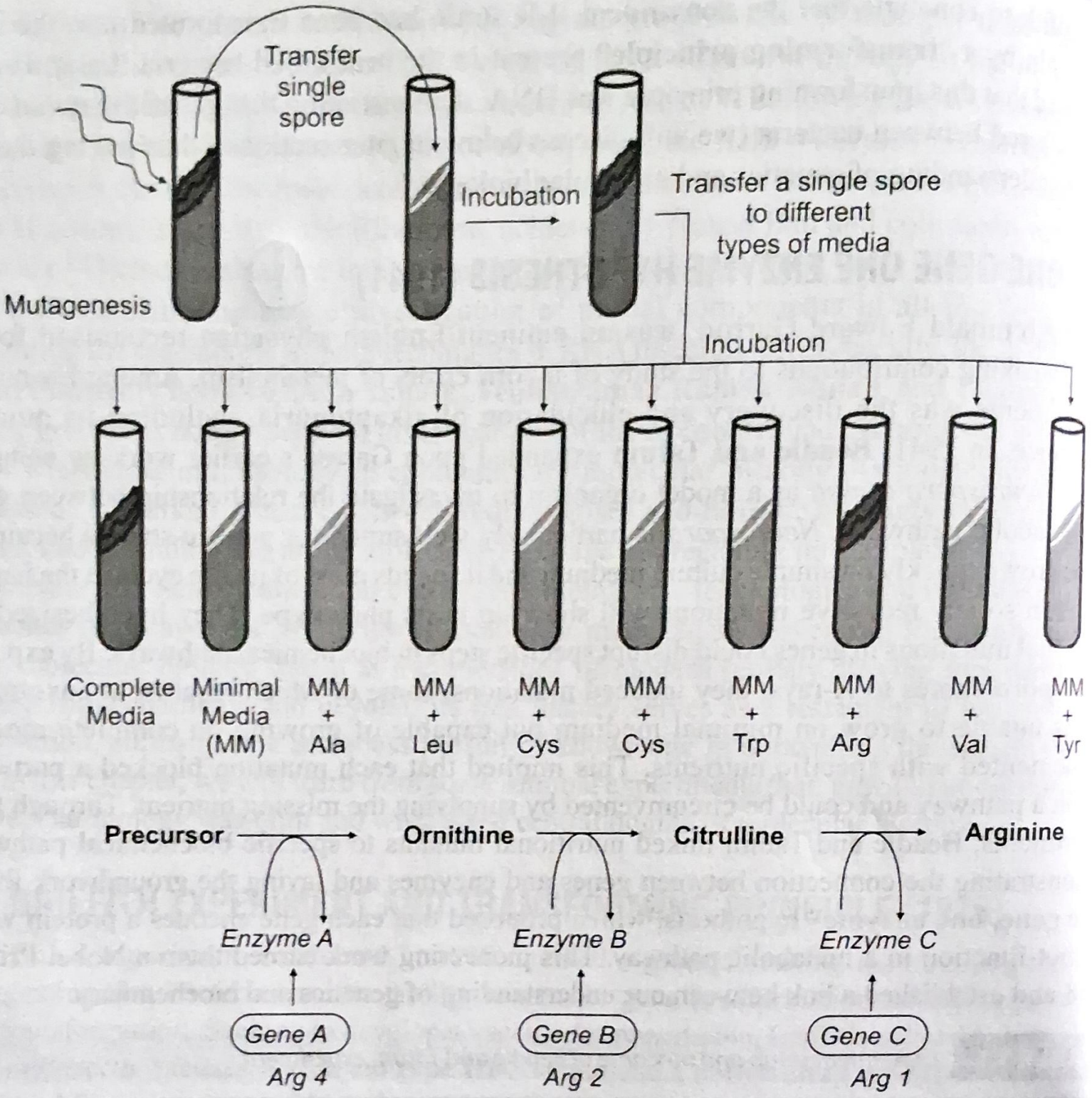


Fig. 3.2. *Experiment of Beedle and Tatum and their one-gene-one enzyme hypothesis.*