Prof ANIL KUMAR zoology
B.Sc HONS Part-III Paper-VI
Topic: Give an account of Cyto Plasmic Inheritance.

Prof Anil Kumar
Associate Professor (zoology)
R.R.S College MOKAMA

Q. 12. Give an account of Cytoplasmic inheritance.

Ans. Most of the phenotypic characters are controlled by genes present in the chromosomes. But some characters are expressed by factors present in the Cytoplasm. These factors lying in the Cytoplasm are called plasmogenes. The transmission of characters controlled by plasmogenes is called Cytoplasmic inheritance. This was first described by Correns in 1908.

Characteristics of Cytoplasmic inheritance–

1. Plasmagenes are situated outside the chromosomes.
2. Plasmagenes are also self-replicating.
3. Plasmagenes are transmitted by means of Cytoplasm only.
4. Plasmagenes are also capable of mutation.
5. The offspring receive Cytoplasm only from female gamete and not from male gamete. As a result the Cytoplasmic inheritance is said to be a maternal inheritance.
6. The results of reciprocal crosses are not the same.

Examples–1. Kappa particles in paramecium.

2. Shell coiling in snail.
3. Plastid inheritance in mirabilis.
4. Inheritance of pigments in ephestia.

Kappa particles in Paramecium–Sonneborn found that there are two strains of Paramecium. They are killer and sensitive. Killer strain produces a toxic substance called paramecin that kills the other type. The production of paramecin in Killer type is controlled by certain Cytoplasmic particles known as Kappa particles. The sensitive strains lack these particles. The Kappa particles pass from one generation to the next generation in the process of cell division. The multiplication of kappa particles is controlled by a dominant nuclear gene K and the sensitives have the recessive allele K. Thus kappa is dependent for its continued existence on the genetic consitution. The gene K can only maintain the kappa particles and cannot initiate its production.

When killers KK conjugate with non-killers KK, the exconjugants are KK. But the development of a particular type depends upon the duration of Cytoplasmic exchange. In normal case of conjugation the nuclear material alone is exchanged and there is no exchange of Cytoplasmic material. In such cases, each conjugant gives rise to the organisms of its own type. i.e., Killer exconjugant produces killers and non-killer produces non-killers.

Sometimes the conjugation period is prolonged and the Cytoplasmic bridge between the two conjugants is larger. In such cases, in addition to the nuclear material, the Cytoplasmic materials are also exchanged. During this Cytoplasmic exchange the kappa particles present in the Cytoplasm of the

killer type enter the non-killer type and convert it into a killer type. So all the offspring produced by the exconjugants are killer type. This shows that a paramecium becomes a killer when it receives kappa particles and it becomes a sensitive when it does not receive kappa particles.

It is possible to convert a killer type into a non-killer type. At high temperature the killer type paramicia divide rapidly. But the kappa particles of the Cytoplasm fail to divide rapidly and their number in the offspring are highly reduced. In some offspring they are completely absent and these offspring develop as non-killers even though they carry the nuclear gene K. This indicates that the gene K produces more kappa particles only in the presence of some kappa particles. It has been shown that kappa particles can thrive in the Cytoplasm without the gene K, but under this condition, cells cannot reproduce more kappa particles.