

Chemical basis of cytoplasmic inheritance :-

Cytoplasmic inheritance is due to the presence of organelles (free or organelle DNA) in number of cytoplasmic organelles have their own DNA of chloroplast, mitochondria. Both these organelles viz bacteria have also free cytoplasmic DNA. But in many cases cytoplasmic & organelle DNA is quite different from that of nuclear one. They have their own replicating ability though their pool of building blocks are quite different from that of the nuclear DNA. They have their own pattern of synthesizing machinery and with a quite different set up viz ribosomes are slightly smaller than the nuclear cytoplasmic one. It has also been found that some of the organelle transfer RNA molecules are unique and different from those of the cytoplasm. These facts indicate that plastids and mitochondria are partially autonomous. So the inheritance of characters controlled by the genomes of organelles is usually difficult to study because most of the organisms have more than one organelle per cell and each organelle contains several DNA molecules.

Cytoplasmic inheritance

Quite diff from nuclear DNA

Indicates their autonomous nature

arised as prokaryotic cells & became symbiotic to eucaryotic cell

Organelles which are responsible for chromosomal inheritance are supposed to have arisen from prokaryotic type organism as nuclear became symbiotic with eucaryotic cells. This fact can be supported by the following :-

1. Symboisis is of common occurrence
2. Organelle DNA and RNA is different from nuclear DNA and its transcript
3. Organelle DNA appears to be physically circular like the DNA of many bacteria and viruses
4. Organelle ribosomes are more like prokaryotic ribosome (70S) than like eucaryotic ones (80S)

Page - 701
Ex - 105

- ✓ B There is a double membrane separating the organelles from the rest of the cytoplasm and there is a (physical) continuity between the organelles and cytoplasmic membrane.

Although these points argue strongly in favour of parasitic nature of cytoplasmic organelles, it is difficult to derive the organelles from symbiotic bacteria, because the DNA of the organelles from different organisms is widely different. This will necessitate numerous independent symbiotic events which is statistically unlikely. Moreover, in many cases some of the organelle DNA is similar in base sequence and density to the nuclear DNA indicating its origin and location from the nucleus. Some of the vital proteins (like cytochromes & of mitochondria) are synthesized in the cytoplasm under nuclear control and are then transferred to the organelles, suggesting that organelles simply represent semi-autonomous components of eucaryotic cells.

IMPORTANCE -

- ✓ 1 It prevents total loss of organelles due to a single mutation in nuclear genes.
- ✓ 2 It provides a reservoir of cytoplasmic mutations which could become useful under strange environmental conditions.
- ✓ 3 It is useful in maize breeding. (cytoplasmic)

CONCLUSION -

Scientists have stood hard to answer the question why should be two separate genetic systems yet the bulk of inheritance depends upon chromosomal genes? perhaps extra chromosomal genes were the only part of heredity in primitive organism during the early