RAMA UNIVERSITY

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FACULTY OF AGRICULTURAL SCIENCES

AND ALLIED INDUSTRIES

REPLICATION of DNA

DNA has two important functions as the carrier of genetic information.

i. When DNA directs the synthesis of DNA itself, or in otherwords when DNA replicates, such a function in auto catalytic.
ii. When DNA directs the synthesis of chemical molecules other than itself, such as synthesis of RNA, protein etc.

The double helical model of DNA provides a template system for self replication. Because of the specificity of base pairing, A with T and G with C, the sequences of bases along one chain automatically determine the base sequence along the other. Hence each chain of the double helix can serve as template for the synthesis of the other.

Three theories were proposed for DNA replication. They are (1) semi conservative theory (2) conservative theory (3) dispersive theory

Semi conservative theory

According to this theory both the complementary strands in a DNA molecule separate and each strand functions as a template or mould to prepare its replica.

Conservative theory

The strands are not supposed to separate from each other, but a new double helix appears within the old double helical stands.

Dispersive theory

Each of the strands of the double helix breaks into pieces and these pieces duplicate. The broken and duplicated pieces are reconstructed into two double helices consisting of strands containing both old and new pieces.

Mostly, DNA replication occurs by the semi-conservative method.

Some of the nucleic acid enzymes play an important role in DNA replication; they are;

i. Nucleases- that catalyze the break down of particular bonds leading to fragmentation of nucleic acids. They may be exo-nucleases that attack nucleic acid at its terminal nucleotide only or endonuceleases that react only with those bonds that occur within the interior of the nucleotide chain to cut into pieces.
ii. Ligases – that join broken ends of two DNA chains
iii. Restriction enzymes that produces breaks only within the sequences.
iv. Polymerases that are involved in the synthesis of nucleic acids.

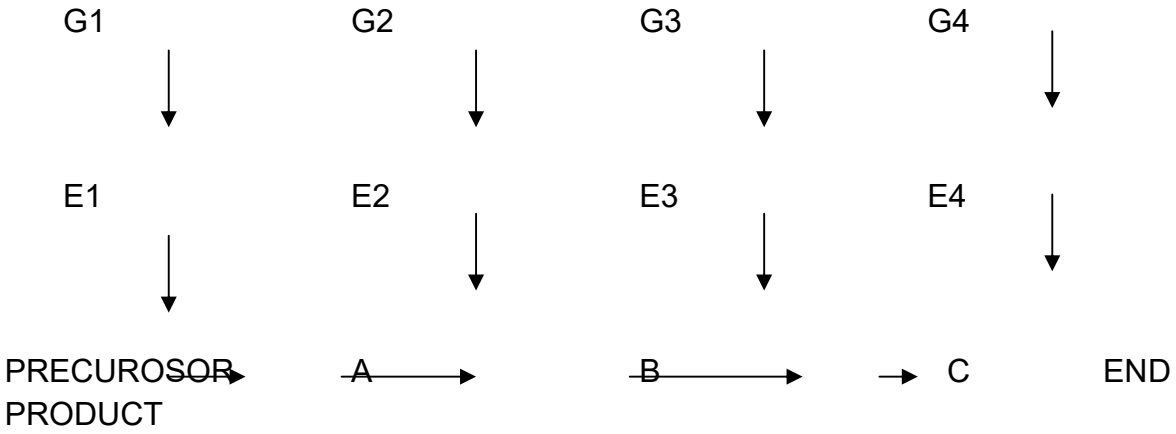
The spread of DNA replication was studied in Vivo and invitro by Kornberg et al., (1967). The speed was 500 to 1000 nucleotides per minute invitro and as high as 100,000 nucleotides per minute in vivo.

Replication of RNA

The genetic RNA of viruses in self-replicating. Its model of replication is called ‘RNA dependent RNA synthesis”. RNA polymerase enzyme mediates in the replication mechanism keeping the parent RNA as the template and synthesizing a complementary RNA chain.

ONE GENE – ONE ENZYME HYPOTHESIS

When we consider the phenotype of an organism, we should understand that, it is the result or end product of many complicated actions and interactions within and between genes. Phenogenesis in the mechanism by which the phenotype of an organism is produced under the control of DNA in a given environment, which includes not only external factors such as temperature intensity and quality of light, but also internal factors such as enzymes and hormones, but also internal factors such as enzymes and hormones. The phenotype is the result of various embryological and biochemical activities involving enzymatic proteins. Enzymes catalyse in separating or uniting different cellular molecules. A precursor is transformed into an end product through the production of many intermediate products each aided by an enzyme produced by a gene and this constitutes the 'biosynthetic pathway'.



DNA itself does not have enzymatic character and does not directly involve in the biosynthetic pathway. The immediate gene product is a kind of RNA called in RNA, which controls the amino acids, to form enzymes at the surface of cytoplasmic ribosomes. Thus DNA transcribes m RNA which translater protein that ultimately produces a phenotypic trait.

Beadle and Tatum (1941) found that U-V mutants produced defeact in enzyme on loss of specific enzyme. This concept is known as 'One gene-one enzyme hypothesis".

PROTEINS AND ENZYMES

Enzymes are proteins, that composed of sub units called polypeptides, which can be further broken into Aminoacids. The aminoacids are united by peptide linkage. Though there are 35 different aminoacids in biological systems most of the biological proteins contain only 20 amino acids.

IMPORTANT QUESTIONS:

1. Explain replication process in detail.
2. Explain replication fork with its importance.
3. What is okazaki fragment? Briefly explain one gene one enzyme hypothesis.
4. Differentiate between lagging and leading strand.
5. Briefly explain the factors affecting replication
6. Describe semi conservative mode of DNA replication
7. What is the importance of replication?