e-ISSN:2319-9849
p-ISSN:2322-00

Research and Reviews: Journal of Chemistry

Chemical Structure of DNA

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Review Article

Received date: 26/06/2016
Accepted date: 30/06/2016
Published date: 25/07/2016

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Keywords: DNA replication, DNA Transcription, DNA Translation,Nucleiotides.

ABSTRACT

DNA (Deoxyribonucleic acid) is also known as the basic unit of nucleus which is present inside the cell. DNA is a molecule which makes each and every individual unique. It contains the information that how an organism needs to develop, live and reproduce. DNA is the medium by which genetic material is passed down from parents to their offspring so basically DNA is the hereditary material in almost all the organisms. Every cell in our body has the same DNA. Deoxyribonucleic acid as the name suggests its structure it is made up of deoxyribose sugar. DNA molecule is consisting of two polynucleotide chains contains four different types of nucleotide subunit these chains of DNA is known as DNA strands. Between the nucleotide hydrogen bond holds the structure in each type of nucleotide subunit only base differs from each other.

INTRODUCTION

The structure of DNA [1-4] was first discovered by James Watson and Francis Crick in 1953. They determine that DNA is a double helix structure the two DNA strands [5,6] are spirally attached to each other and on the base of the nucleotide hydrogen bond [7] is the bond which holds the structure of the DNA. In the DNA nucleotides contains the deoxyribose sugar attached with a phosphate group [8-11] and one of the bases. DNA is called hereditary material because DNA is much more stable then RNA. DNA is semiconservative [12-14] in nature.

STRUCTURE OF NUCLEOTIDE

Nitrogenous Bases: Adenine, Guanine, Thymine, Cytosine.

Deoxyribose Sugar [15,16] (absence of the oxygen at the second carbon).

Phosphate Group.

Nucleotides are joined with each other by covalent bonds which form in between the sugar of the first nucleotide and the phosphate of the next nucleotide and the whole formation is known as sugar phosphate backbone. The polynucleotides are bound together by the double stranded hydrogen bond the two strands of DNA are anti-parallel

they run in opposite directions to each other. During cell division [17,18], the two strands of DNA split into two single strands and then the two single strands used as a template [19-22] In order to form a new complimentary strand which will repeat the same process during cell division [23,24].

Bond formation between nitrogenous bases:

Nitrogenous bases [25,26] are of two types: Purines: Adenine, Guanine.

Pyrimidine: Cytosine, Thymine, Uracil.

Purine shares double hydrogen bond [27] whereas pyrimidine shares triple hydrogen bond.

Erwin Chargaff's Rule: Chargaff explained that A=T and C=G, means the amount of the adenine is equals to thymine and the amount of cytosine is same as the amount of the guanine.

Watson and Crick Model of DNA: Watson and Crick got Nobel Prize for the discovery of the structure of the DNA the main feature that he described about DNA are:

- DNA molecule is made up of double stranded polynucleotide strands [28-30] which are spirally twist around each other it form right-handed coiled structure.
- Both the strands will be antiparallel [31,32] means they will run opposite to each other so that 3′ end of one chain will face the 5′ end of the other strand.
- Two strands will remain attached with the help of the hydrogen bond [33] between the two bases.
- Adenine and Thymine will pair with each other with double hydrogen bond, guanine and cytosine will pair with each other with triple hydrogen bond.
- DNA helix will have one minor groove and one major groove.
- Diameter of DNA is 20 A. the bases are separated by 0.34nm. The complete turn length of the helix is 3.4nm. 10bp per turn will be there.

DNA Basics (Eukaryotes Vs Prokaryotes):

- Very small fraction of DNA is active in eukaryotes [34-38].
- Only a single loop of DNA is present in the nucleoid of prokaryotes [39].
- Prokaryotes DNA are much simpler then eukaryotic DNA.
- DNA is stored in the nucleus of the cell in eukaryotic cell.
- DNA present in the eukaryotes has the histone protein but in prokaryotes histone proteins [40-44] are absent.
- Eukaryotes DNA are tightly organized, whereas the prokaryotes DNA are single loop of chromosomal DNA.

BASIC TERMS

DNA Replication: DNA molecule will produce two identical DNA. DNA is semi conservative [45] in nature.

DNA Translation: Transformation of mrna or cellular RNA to protein. Three main phases will be there in translation Initiation, Elongation and Termination [46,47].

DNA Transcription: Transformation of DNA to mrna. Rna polymerase is the enzyme which play key role in this process. It may include the processes like polyadenylation, capping, and splicing [48].

CONCLUSION

DNA is the basic genetic material for all the eukaryotes and prokaryotes. In eukaryotes it is much more complicated than in the eukaryotes. It is a double helix structure. The two strands of DNA is antiparallel to each other they will run in the opposite direction and also they are complementary to each other. DNA is semiconservative in nature which means during replication when the two DNA strand will replicate they will produce the new double stranded DNA with each the strand. DNA is called the basic hereditary unit because it is more stable then RNA because in RNA oxygen is present at the second carbon which makes it unstable.

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