The Torch
Vol. 2 (8)

The story of DNAÃ¢â‚¬â„¢s electrostatic force

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DNA is a negatively charged molecule, which is because of the presence of a phosphate backbone. The presence of bonds created between phosphorus and oxygen atoms exhibits a negative charge to the entire DNA strand. As a result of this, attraction or repulsion takes place with other molecules. DNA consists of four bases, namely adenine, thymine, guanine and cytosine. Adenine pairs with thymine forming two hydrogen bonds between them and guanine pairs with cytosine forming 3 hydrogen bonds between them. When DNA is placed in an electric field, many molecules interact with it owing to its negative charge. Positive molecules get attracted and negative molecules get repelled. For example, when DNA interacts with copper ions, these copper ions combine with the DNA and attack the nucleotides of the DNA causing damage to the structure of the DNA. Another example is DNA’s interaction with nitrogen ions, which are negatively charged. When DNA interacts with nitrogen ions, they get repelled resulting in the disruption of the DNA. The negative charge on DNA is extremely important not only in the interaction of DNA with various proteins during the transcription of genetic information but also in the packing of genetic material in the nucleus. Histones, the proteins play an important role in the regulation and compaction of DNA within the nucleus of the cell. These histones possess alkali features and positive charges, which neutralise the negative charges of DNA. Hence, the electrostatic force despite holding the DNA molecule together provides structure and strength to it. Studies pertaining to the electrostatics of DNA have imparted many benefits to modern molecular biology.

Keywords: DNA, Electrostatic force, Negative charge, Phosphate, Bonds, Interaction, Transcription

Citation:
Vedaant Bhandary. The story of DNAÃ¢â‚¬â„¢s electrostatic force. The Torch. 2021. 2(8). Available from:
https://www.styvalley.com/pub/magazines/torch/read/the-story-of-dna-electrostatic-force.