

Nucleic Acid

1.1 INTRODUCTION

The genetic material DNA was discovered between 1869-1944 in the white blood cell of nuclei. Friedrich Miescher (1869) found a Phosphorous rich material which he named as “nuclein”. During 1919-1939, another scientist identified that nucleotides such as nitrogenous bases, sugar and phosphate are the fundamental parts of DNA.

In 1928, Fredrick Griffith performed his famous experiment on Transformation and concluded that the genetic material which is transferring from one organism to other is called as ‘Transforming factor’ or ‘Transforming principle’. Till 1928, there was a big confusion that this transforming principle’s component could be a macromolecule that might be either carbohydrate, lipid or nucleic acid but Griffith was not sure. Through his experiments, he was sure that something was transferred from one organism to other and changed the property of the organism. But he has no clarity on this whether DNA could be a genetic material or protein or carbohydrate.

After his demise, Griffith’s student Avery, Macleod and McCarty performed their experiment using Griffith experiment’s result as a base. In 1944, they expanded the finding of Griffith’s experiment. They used different digestive enzymes like lipase, Glucosidases, Proteases, RNAase and DNAase for their experiment to identify that DNA is the ‘transforming principle’.

In 1949, Erwin Chargaff found that the amount of Purines is equal to amount of Pyrimidines. In 1950s, Rosalind Franklin and Maurice Wilkins used X-ray crystallography to take pictures of DNA fibers which helped them understand the structure of the molecule. To establish that DNA serves as the genetic material, the Hershey-Chase experiment was carried out in 1953, using radioactive T2-bacteriophage. After the experiment they observed that the phage DNA labelled with P32 would transfer the radioactivity in the host cell and concluded that the DNA is the genetic material.

Based on data from Franklin and Wilkins X-ray crystallography pictures helped Watson and Crick to understand the structure of double-helical molecule. Watson and Crick gave model in 1953, suggesting that DNA consist of two anti-parallel strands held together by complementary base-pairing. The four nitrogenous bases held together by hydrogen bonds. This model explained how DNA could replicate itself and transmit genetic information from generation to generation. So, the Watson and Crick model is still a key idea in the study of molecular biology. Detailed experiments to determine the heredity nature of DNA are described in Chapter 3 of next unit.