Nucleic Acid :

The nucleic acid first isolated by Friedrich Miescher (1868) from nuclei of pus cells (dead body white blood cells) and was named nuclein. The term nucleic acid was given after knowing its acidic property.

There are two types of nucleic acid found in nature —

A. DNA (Deoxyribonucleic acid)

B. RNA (Ribonucleic acid)

Historical Perspective :

Miescher isolated nuclei from the white blood cells present in the pus recovered from surgical bandages. By treating nuclei with alkali, he was able to obtain an extract which contained an unusual substance which he called 'nuclein'. Later Miescher separated this substance from Salmon sperm. He found this substance was formed of unusually large acidic molecules, rich in phosphorus. He also

isolated from sperm nuclei a class of basic proteins called 'Protamines'. These are small 'pro-teins' in phosphorus. These are small protein containing large amount of basic amino acid like lysine and arginine. Initially, protein was perceived to be hereditary material and composing the genes. Nucleic acid was believed to be a simple polymer, consisting of a single tetranucleotide sequence (ATCG) repeated over and over again. Nucleic acid was thought to be for genes made of Protein. This view prevailed till Frederick Griffith (1928) and Avery, Macleod and McCarty provide evidence that DNA is the hereditary material.

Griffith's Experiment:

In 1928, Frederick Griffith conducted one of the first experiments to show that cells possessed genetic material. Griffith's experiment involved the use of two strains of Pneumococcus / Streptococcus - a deadly virulent strain (S) or a non-virulent strain (R).

→ When Griffith infected mice with the non-virulent bacteria (strain R), the mice survived.

→ When Griffith infected mice with the virulent bacteria (strain S), the mice died.

→ When Griffith infected mice with heat killed virulent bacteria had been killed.

→ When Griffith infected mice with a mix of heat killed ~~structure~~ strain S and living strain R, the mice were found to have died.

From this Griffith's concluded that the living R cells had somehow been transformed into virulent S cells. This indicated that there was some form of transferable genetic material present within cells (DNA).

Living S strain (virulent) → Result → Mouse dies has S-strain

Living R-strain (Non-virulent) → Mouse lives No S-strain

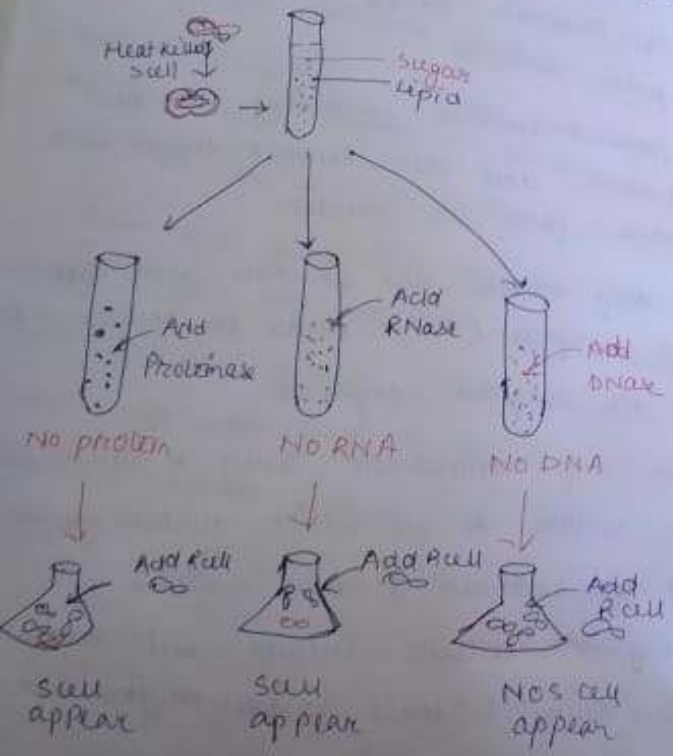
Dead S-strain (heated) → Mouse lives No living S-strain

Mix Living R strain Dead S strain → Mouse dies has living S-strain

Conclusion: A chemical substance from one cell is genetically transforming another cell

component that was being transferred between cells.

Despite this finding, the scientific community was to accept the role of DNA as a genetic material.



Remove lipids and sugars from a soup of heat killed S cells. Proteins, RNA and DNA remain.

↓

Treat solutions with Enzyme to destroy protein, RNA and DNA

↓

Add to culture containing living R cells

Observe for transformation by testing for presence of virulent S cells.

Conclusion: Transformation requires DNA, H
A is genetic material of cell.

Avery - MacLeod - McCarty Experiment :

Oswald Avery and colleagues expanded upon the findings of Frederick Griffith to demonstrate that DNA is genetic material.

→ They prepared cultures containing the heat killed S strain and then removed lipids and carbohydrates from the solution.

→ Next they treated the solution with different digestive enzymes (DNase, RNase or protease) to destroy the targeted compounds.

→ Finally, they introduced living R strain ce to the culture to see which culture could develop transformed S strain bacteria.

Only in the culture treated with DNase the S strain bacteria to fail to grow (ie DNA = no transformation)