

# Search for Genetic Material

## SEARCH FOR GENETIC MATERIAL

Even though the discovery of nuclein by Meischer and the proposition for principles of inheritance by Mendel were almost at the same time, but that the DNA acts as a genetic material took long to be discovered and proven. Previous discoveries by Gregor Mendel, Walter Sutton, Thomas Hunt Morgan and numerous other scientists had narrowed the search for genetic material to the chromosomes located in the nucleus of most cells. But what molecule acts actually as the genetic material, was still elusive.

### Transforming Principle

In 1928, Frederick Griffith, in a series of experiments with *Streptococcus pneumoniae* (bacterium responsible for pneumonia), found a miraculous transformation in the bacteria. During the course of his experiment, a living organism (bacteria) had changed in physical form.

When *Streptococcus pneumoniae* (pneumococcus) bacteria are grown on a culture plate, some produce smooth shiny colonies (S) while others produce rough colonies (R). This is because the S strain bacteria have a mucous (polysaccharide) coat, while R strain does not.

Mice infected with the S strain (virulent) die from pneumonia infection but mice infected with the R strain do not develop pneumonia.

S strain → inject into mice → mice die

R strain → inject into mice → mice live

Griffith was able to kill bacteria by heating them. He observed that heat-killed S strain bacteria injected into mice did not kill them. When he injected a mixture of heat-killed S and live R bacteria, the mice died. Moreover, he recovered living S bacteria from the dead mice.

Conclusion: R strain bacteria had somehow been transformed by the heat-killed S strain bacteria.

S strain (heat killed) → inject into mice → mice live

S strain (heat killed)

+ R strain (live) → inject into mice → mice die

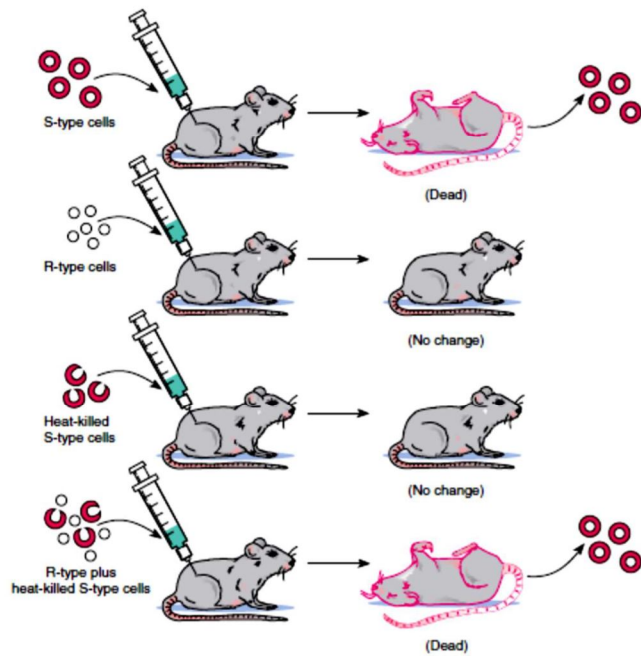
Some 'transforming principle', transferred from the heat-killed S strain, had enabled the R strain to synthesise a smooth polysaccharide coat and become virulent.

Biochemical Characterisation of Transforming Principle  
Oswald Avery, Colin MacLeod and Maclyn McCarty (1933-44) worked to determine the biochemical nature of 'transforming principle' in Griffith's experiment.

They purified biochemicals (proteins, DNA, RNA, etc.) from

the heat-killed S cells to see which ones could transform live R cells into S cells. They discovered that DNA alone from S bacteria caused the transformation of R bacteria to S bacteria.

They discovered that protein-digesting enzymes (proteases) and RNA-digesting enzymes (RNases) did not affect transformation, so the



Griffith Experiment

transforming substance was neither a protein nor RNA. Digestion with DNase did inhibit transformation that suggests DNA as transforming principle.

Conclusion: DNA is the hereditary material.