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Marilia Lavinia Lekka

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DNA: The Blueprint of Life and Its Journey to Discovery

Marilia Lavinia Lekka

Abstract
This paper outlines the discovery of DNA as the carrier of genetic information, the foundational experiments that proved it, and the impact of this knowledge on modern science. It highlights key figures in the discovery—especially Rosalind Franklin—and discusses both the biological structure of DNA and its applications in medicine, genetics, and beyond.

Keywords: DNA, genetic material, Rosalind Franklin, double helix, bacterial transformation

1. Introduction

DNA (deoxyribonucleic acid) is the molecule that carries the genetic instructions essential to life. Its structure and function have not only deepened our understanding of biology but have also led to transformative applications in fields such as medicine, forensic science, and biotechnology. The journey to this discovery involved multiple scientists, some of whom were long overlooked.

2. What is DNA?

DNA is composed of nucleotides, each containing three components: a phosphate group, a deoxyribose sugar, and one of four nitrogenous bases—adenine (A), thymine (T), cytosine (C), or guanine (G). These form two strands in a double-helix structure, where A pairs with T and C pairs with G.

3. Experiments That Proved DNA is Genetic Material

3.1 Griffith's Experiment (1928)

Frederick Griffith demonstrated the "transforming principle" using two strains of *Streptococcus pneumoniae*. A non-virulent strain became virulent when exposed to heat-killed virulent bacteria, suggesting a heritable factor was transferred.

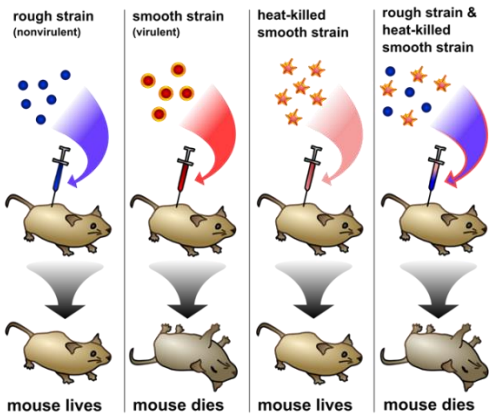

Figure 1: Diagram that illustrates the Griffith's experiment, showing that a harmless bacterial strain became deadly when mixed with heat-killed virulent bacteria—evidence of a "transforming principle."

3.2 Avery, MacLeod, and McCarty (1944)

They built on Griffith's work and isolated DNA as the molecule responsible for transformation. By eliminating proteins and RNA from their samples, they proved that only DNA caused the genetic change.

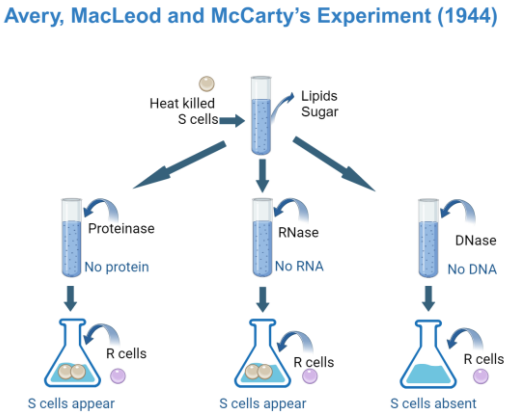

Figure 2: Visual summary of the Avery, MacLeod and McCarty experiment, where enzymes were used to eliminate proteins and RNA—demonstrating that DNA alone caused bacterial transformation**.**

3.3 Hershey–Chase Experiment (1952)

This experiment further confirmed DNA's role. They used bacteriophages to demonstrate that DNA, not protein, was injected into bacterial cells during viral infection.

4. Rosalind Franklin and the Double Helix

Rosalind Franklin used X-ray diffraction to analyze DNA structure. Her famous "Photograph 51" revealed the double-helix shape and key structural dimensions. Without her consent, her data was shared with Watson and Crick, who then modeled the DNA structure. Despite her pivotal role, Franklin was not credited alongside them in the initial publications.

5. Applications of DNA

Understanding DNA has enabled advancements such as:

- Genetic testing and diagnosis
- Development of vaccines and treatments
- Forensic identification
- Ancestry tracking
- Agricultural improvements through biotechnology

6. Conclusion

DNA is the foundation of life and a centerpiece of modern biology. Experiments by Griffith, Avery, and Franklin laid the groundwork for one of science's most significant breakthroughs. Rosalind Franklin's story also serves as a reminder of the importance of ethical collaboration and recognition in research. The study of DNA continues to shape innovation and deepen our understanding of life itself.

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