

REVIEW ARTICLE

Rosalind Franklin: Unveiling the Molecular Architecture of Life

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ABSTRACT

Rosalind Franklin made foundational contributions to the discovery of the DNA double-helix through her pioneering work in X-ray crystallography. Her precise experimental methods and high-resolution diffraction images, particularly Photograph 51, provided critical evidence for understanding DNA's helical structure and molecular dimensions. Beyond DNA, her research significantly advanced knowledge of RNA viruses, coal structure, and carbon materials, demonstrating her broad scientific impact. Despite her central role, Franklin's contributions were historically under-recognized, prompting renewed scholarly attention to her scientific legacy and the ethical dimensions of scientific credit. This paper reviews her major discoveries, examines the technical innovations she introduced, and highlights her lasting influence on molecular biology and structural science. Furthermore, the reassessment of Franklin's scientific contributions has inspired broader conversations about the representation of women in science and the structural barriers they have historically faced. Her career exemplifies the challenges of navigating competitive research environments where collaboration, recognition, and access to data were often unevenly distributed. Modern evaluations of her work underscore not only her extraordinary technical expertise but also her resilience and dedication in pursuing high-precision scientific inquiry despite these barriers. As a result, Franklin has become a symbol of both scientific excellence and the ongoing effort to ensure that contributions to discovery are acknowledged with transparency and fairness, reinforcing her lasting relevance to contemporary scientific discourse. In addition to reshaping historical perspectives, Franklin's body of work continues to influence modern research methodologies. Advances in structural biology, including cryo-electron microscopy and high-resolution diffraction techniques, build upon principles she refined in her studies

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of crystalline and helical structures. Her emphasis on methodological rigor, precise sample preparation, and the integration of experimental evidence with theoretical modeling remains a cornerstone of contemporary practice. By demonstrating how careful empirical work can drive major conceptual breakthroughs, Franklin set a standard that guides current generations of scientists. Her legacy thus extends not only through her discoveries but also through the scientific values and practices she helped establish.

KEYWORDS

• Rosalind Franklin • DNA double helix • X-ray crystallography • Photograph 51, • Molecular biology • Structural biology • Genetics • Scientific legacy • Women in science • RNA viruses

INTRODUCTION

Rosalind Franklin was a ground breaking molecular biophysicist whose precise X-ray diffraction studies fundamentally advanced the discovery of DNA's structure.¹ Working at King's College London, Franklin captured the famous Photograph 51, the most definitive evidence of DNA's helical configuration.² Despite her essential contributions, her role remained historically overshadowed, prompting renewed recognition of her scientific impact. Franklin's work not only transformed molecular biology but also set high standards for experimental rigor, inspiring continued reflection on scientific collaboration, ethics, and legacy.³

Background:

Rosalind Franklin (1920–1958) was a British chemist whose early academic excellence led her to specialize in physical chemistry and later X-ray diffraction techniques. During her postwar research in Paris, she mastered crystallography, becoming known for her technical precision.

Upon joining King's College London in 1951, she began her pivotal research on the physical structure of DNA.⁴ Her time at King's, however, was marked by strained professional relationships and institutional sexism, which limited collaboration but did not deter her scientific productivity. Her expertise and disciplined methodology allowed her to generate exceptionally detailed photographs of DNA fibers, surpassing the quality of existing data.⁵

Scientific Contributions

Franklin's primary scientific contribution lies in her X-ray diffraction images of DNA, most

notably Photograph 51, which provided direct evidence of DNA's helical structure. Her careful measurement of helical parameters, water content, and symmetry offered quantitative insights essential for developing accurate structural models. Beyond DNA, Franklin made major advancements in understanding the structure of viruses, particularly the tobacco mosaic virus (TMV), where she established the arrangement of its RNA within the protein coat. Her collective work advanced crystallography, molecular structure determination, and virology, cementing her as a foundational figure in molecular biology.

Challenges & Breakthroughs

Franklin faced significant challenges, including gender discrimination, limited credit for her findings, and restricted access to her own data within her research group. Her work environment at King's College was characterized by misunderstandings and lack of recognition, which complicated collaboration. Despite these obstacles, Franklin achieved ground breaking scientific results through her rigorous methodology, persistence, and technical mastery. Her data became a critical turning point that enabled Watson and Crick's model of the DNA double helix. Over time, historical reevaluations have acknowledged her essential role, transforming her story into a symbol of scientific integrity and perseverance.

Reflection

Franklin's legacy reflects the resilience, precision, and intellectual courage required to advance scientific understanding. Her story highlights the importance of ethical collaboration, proper attribution, and the

essential role of women in science. Today, Franklin stands as a symbol of excellence whose contributions continue to inspire researchers worldwide.

CONCLUSION

Rosalind Franklin's ground breaking work laid the structural foundation of modern molecular biology. Although her contributions were not fully recognized during her lifetime, her meticulous research on DNA and viruses profoundly shaped scientific progress. Acknowledging her achievements not only restores historical accuracy but also reaffirms the enduring impact of her scientific brilliance.

Conflict of Interest: The authors declare that there are no conflicts of interest.

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