

# The Secret Of Photo 51 Worksheet

WRITING MISTAKES 1  
ADVANCED LEVEL EOI REUS 2008/09

- Because of **this**, I want to learn to pilot a plane, because I'd like to fly around the world with my own plane.
- I need a lot of money to pay **for** the degree, **which** costs thousands of euros.
- ... now there are a lot of pilots, so **even though/although/despite the fact that** you **may** have finished the degree, you will find it difficult to find a job.
- Half the adults in Spain **are** overweight/**suffer from** obesity.
- ... and a **more and more sedentary way of life**.
- since I **finished** my career as an athlete ...
- It would be a **daunting/enormous/exciting/huge challenge** to me.
- Nowadays, I am **training really/extremely/rather** hard; I go to the gym, ...
- ... about **writing techniques my favourite novelists used**.
- As I am aware that **achieving** an overnight success **in the literary world** is **incredibly/extremely/rather** difficult, ...
- **While** I keep waiting for success to be at my reach, I will continue to be patient and work hard.
- **However/Nevertheless**, becoming a star wasn't easy.
- I **even** made my family listen to me **whenever I could/at certain times**.
- At the beginning this does not have to be a secret ambition, but ...
- Although it could be possible that I **passed** one or two of those exams, ...
- **Despite the difficulty**, these days I feel thrilled ...
- ... difficult **paths to follow/cross/run/ride** by bicycle.
- ... you need to **rest to recover** and get stronger for **the** next season.
- Please, let me know **about** your decision as soon as possible ...
- ... climbing these mountains is **every/any** mountaineer's dream.
- Extreme ascents are as famous for dimbers who died trying to conquer **their** summit as for those who ...
- I would love to **experience** contrasting **ways of life**.
- I would **spend** some time ...
- I could understand life around me **more easily**.
- They say that **everything can be achieved** with effort and perseverance, but no one **refers to/centres on/focuses on** work contacts,...
- I think **lucky people really exist/luck really exists**, but I usually **add the following phrase** ...
- **It took me by surprise/It came as a surprise** when I realized that I wasn't going to ...
- That is what **I think has influenced** my decision to ...

THE SECRET OF PHOTO 51 WORKSHEET SERVES AS AN INTRIGUING ENTRY POINT INTO THE WORLD OF MOLECULAR BIOLOGY AND THE DISCOVERY OF THE DNA DOUBLE HELIX STRUCTURE. THIS WORKSHEET IS OFTEN ASSOCIATED WITH THE FAMOUS X-RAY DIFFRACTION IMAGE TAKEN BY ROSALIND FRANKLIN IN 1952, KNOWN AS PHOTO 51. THE PHOTO PLAYED A PIVOTAL ROLE IN UNDERSTANDING THE MOLECULAR STRUCTURE OF DNA AND SUBSEQUENTLY REVOLUTIONIZED THE FIELD OF GENETICS. IN THIS ARTICLE, WE WILL EXPLORE THE SIGNIFICANCE OF PHOTO 51, THE CONTEXT SURROUNDING ITS CREATION, ITS IMPACT ON THE SCIENTIFIC COMMUNITY, AND THE EDUCATIONAL VALUE OFFERED BY THE SECRET OF PHOTO 51 WORKSHEET.

## THE CREATION OF PHOTO 51

# ROSALIND FRANKLIN AND HER CONTRIBUTIONS

ROSALIND FRANKLIN WAS A PIONEERING SCIENTIST WHOSE WORK IN X-RAY CRYSTALLOGRAPHY LAID THE GROUNDWORK FOR UNDERSTANDING THE STRUCTURE OF DNA. BORN IN 1920 IN LONDON, SHE EARNED HER PH.D. IN PHYSICAL CHEMISTRY FROM CAMBRIDGE UNIVERSITY. FRANKLIN SPECIALIZED IN THE STUDY OF CARBON AND COAL BEFORE TURNING HER ATTENTION TO DNA IN THE EARLY 1950S.

1. X-RAY CRYSTALLOGRAPHY: FRANKLIN'S EXPERTISE IN X-RAY DIFFRACTION WAS CRITICAL IN CAPTURING THE IMAGE KNOWN AS PHOTO 51. THIS TECHNIQUE INVOLVES DIRECTING X-RAYS AT A CRYSTALLIZED SAMPLE, WHICH SCATTERS THE RAYS TO CREATE A PATTERN THAT REVEALS STRUCTURAL INFORMATION.
2. PHOTO 51: THE RESULTING IMAGE FROM FRANKLIN'S WORK WAS A CLEAR DEPICTION OF DNA'S HELICAL STRUCTURE, CHARACTERIZED BY A DISTINCTIVE "X" SHAPE, INDICATING THE MOLECULE'S HELICAL NATURE.
3. RESEARCH ENVIRONMENT: FRANKLIN WORKED IN A MALE-DOMINATED ENVIRONMENT AT KING'S COLLEGE LONDON, WHERE SHE FACED NUMEROUS CHALLENGES, INCLUDING LIMITED RECOGNITION FOR HER CONTRIBUTIONS AT THE TIME.

## THE ROLE OF JAMES WATSON AND FRANCIS CRICK

WHILE FRANKLIN'S FINDINGS WERE GROUNDBREAKING, IT WAS THE COLLABORATION OF JAMES WATSON AND FRANCIS CRICK THAT PROPELLED THE UNDERSTANDING OF DNA FURTHER. IN 1953, THEY PUBLISHED THEIR FAMOUS DOUBLE-HELIX MODEL OF DNA, LARGELY BASED ON FRANKLIN'S PHOTO 51.

- ACCESS TO PHOTO 51: WATSON AND CRICK ACCESSED PHOTO 51 WITHOUT FRANKLIN'S PERMISSION, WHICH HAS LED TO ONGOING DEBATES ABOUT ETHICS IN SCIENTIFIC RESEARCH AND THE RECOGNITION OF CONTRIBUTIONS FROM FEMALE SCIENTISTS.
- PUBLICATION OF FINDINGS: WATSON AND CRICK'S MODEL WAS PUBLISHED IN THE JOURNAL NATURE, ALONG WITH A PAPER BY FRANKLIN AND HER COLLEAGUE MAURICE WILKINS THAT FURTHER DETAILED THE STRUCTURE OF DNA.

## THE SCIENTIFIC IMPACT OF PHOTO 51

### UNDERSTANDING DNA STRUCTURE

THE UNVEILING OF THE DOUBLE HELIX STRUCTURE WAS MONUMENTAL FOR SEVERAL REASONS:

1. GENETIC CODE: THE DOUBLE HELIX MODEL PROVIDED INSIGHTS INTO HOW GENETIC INFORMATION IS STORED AND TRANSMITTED IN LIVING ORGANISMS. THIS UNDERSTANDING LAID THE FOUNDATION FOR MODERN GENETICS, INCLUDING AREAS SUCH AS GENETIC ENGINEERING AND BIOTECHNOLOGY.
2. RESEARCH AND MEDICINE: THE DISCOVERY HAS HAD PROFOUND IMPLICATIONS IN VARIOUS FIELDS, INCLUDING MEDICINE, FORENSICS, AND ANTHROPOLOGY, AS IT ALLOWS FOR THE ANALYSIS OF GENETIC MATERIAL.
3. NOBEL PRIZE: IN 1962, WATSON, CRICK, AND WILKINS WERE AWARDED THE NOBEL PRIZE IN PHYSIOLOGY OR MEDICINE FOR THEIR DISCOVERIES CONCERNING THE MOLECULAR STRUCTURE OF NUCLEIC ACIDS.

### ETHICAL CONSIDERATIONS

THE STORY OF PHOTO 51 ALSO RAISES IMPORTANT ETHICAL QUESTIONS REGARDING SCIENTIFIC COLLABORATION AND CREDIT:

- RECOGNITION OF CONTRIBUTIONS: THE LACK OF ACKNOWLEDGMENT FOR FRANKLIN'S WORK HIGHLIGHTS THE GENDER BIASES

PREVALENT IN THE SCIENTIFIC COMMUNITY AT THE TIME. MANY ARGUE THAT HER CONTRIBUTIONS WERE OVERSHADOWED BY HER MALE COUNTERPARTS.

- REVISITING SCIENTIFIC HISTORY: TODAY, HISTORIANS AND SCIENTISTS ARE ACTIVELY WORKING TO REWRITE THE NARRATIVE SURROUNDING THE DISCOVERY OF DNA TO INCLUDE FRANKLIN'S PIVOTAL ROLE, EMPHASIZING THE IMPORTANCE OF RECOGNIZING ALL CONTRIBUTORS IN SCIENTIFIC ADVANCEMENTS.

## THE SECRET OF PHOTO 51 WORKSHEET: AN EDUCATIONAL RESOURCE

THE SECRET OF PHOTO 51 WORKSHEET SERVES AS AN EXCELLENT EDUCATIONAL TOOL FOR STUDENTS AND EDUCATORS ALIKE. IT HELPS TO CONTEXTUALIZE THE SCIENTIFIC CONCEPTS SURROUNDING DNA WHILE PROVIDING INSIGHTS INTO THE HISTORY OF MOLECULAR BIOLOGY. HERE ARE SOME KEY COMPONENTS OF THE WORKSHEET:

### OBJECTIVES OF THE WORKSHEET

THE WORKSHEET AIMS TO ACHIEVE SEVERAL EDUCATIONAL GOALS:

- UNDERSTANDING X-RAY CRYSTALLOGRAPHY: STUDENTS LEARN ABOUT THE PRINCIPLES OF X-RAY DIFFRACTION AND HOW IT IS USED TO STUDY MOLECULAR STRUCTURES.
- EXPLORING THE HISTORY OF DNA RESEARCH: THE WORKSHEET OFFERS A DETAILED OVERVIEW OF THE KEY FIGURES INVOLVED IN THE DISCOVERY OF DNA'S STRUCTURE, INCLUDING ROSALIND FRANKLIN, JAMES WATSON, AND FRANCIS CRICK.
- ENCOURAGING CRITICAL THINKING: BY PRESENTING ETHICAL CONSIDERATIONS AND THE IMPLICATIONS OF SCIENTIFIC DISCOVERY, THE WORKSHEET ENCOURAGES STUDENTS TO THINK CRITICALLY ABOUT THE SCIENTIFIC PROCESS AND THE IMPORTANCE OF COLLABORATION.

### COMPONENTS OF THE WORKSHEET

AN EFFECTIVE WORKSHEET ON PHOTO 51 MAY INCLUDE THE FOLLOWING SECTIONS:

1. BACKGROUND INFORMATION: A BRIEF OVERVIEW OF THE HISTORY OF DNA RESEARCH, INCLUDING KEY DATES AND FIGURES.
2. KEY CONCEPTS: DEFINITIONS AND EXPLANATIONS OF CRITICAL TERMS SUCH AS DNA, DOUBLE HELIX, AND X-RAY CRYSTALLOGRAPHY.
3. DISCUSSION QUESTIONS: OPEN-ENDED QUESTIONS THAT PROMPT STUDENTS TO THINK ABOUT THE IMPLICATIONS OF THE DISCOVERY AND THE ETHICAL DIMENSIONS OF SCIENTIFIC RESEARCH.
4. ACTIVITIES: ENGAGING ACTIVITIES COULD INCLUDE DRAWING THE DOUBLE HELIX STRUCTURE, MODELING DNA USING EVERYDAY MATERIALS, OR CONDUCTING A SIMPLE X-RAY DIFFRACTION EXPERIMENT IF RESOURCES ALLOW.
5. ASSESSMENT: QUIZZES OR SHORT ANSWER QUESTIONS TO ASSESS STUDENTS' UNDERSTANDING OF THE MATERIAL COVERED IN THE WORKSHEET.

### USING THE WORKSHEET IN THE CLASSROOM

WHEN IMPLEMENTING THE SECRET OF PHOTO 51 WORKSHEET IN THE CLASSROOM, EDUCATORS CAN CONSIDER THE FOLLOWING STRATEGIES:

- GROUP WORK: ENCOURAGE COLLABORATIVE LEARNING BY HAVING STUDENTS WORK IN SMALL GROUPS TO DISCUSS THE

HISTORICAL CONTEXT AND SCIENTIFIC SIGNIFICANCE OF PHOTO 51.

- MULTIMEDIA RESOURCES: INCORPORATE VIDEOS AND DOCUMENTARIES THAT HIGHLIGHT ROSALIND FRANKLIN'S CONTRIBUTIONS AND THE STORY BEHIND THE DISCOVERY OF DNA.

- GUEST SPEAKERS: IF POSSIBLE, INVITE A GENETICIST OR A HISTORIAN OF SCIENCE TO DISCUSS THE IMPACT OF DNA RESEARCH AND THE IMPORTANCE OF ETHICAL PRACTICES IN SCIENCE.

## CONCLUSION

THE SECRET OF PHOTO 51 WORKSHEET IS MORE THAN JUST AN EDUCATIONAL TOOL; IT REPRESENTS A SIGNIFICANT CHAPTER IN THE HISTORY OF MOLECULAR BIOLOGY AND GENETICS. ROSALIND FRANKLIN'S CONTRIBUTIONS, OFTEN OVERLOOKED, REMIND US OF THE IMPORTANCE OF RECOGNIZING DIVERSE VOICES IN SCIENCE. BY USING THE WORKSHEET, EDUCATORS CAN INSPIRE THE NEXT GENERATION OF SCIENTISTS TO APPRECIATE THE INTRICACIES OF DNA AND THE COLLABORATIVE NATURE OF SCIENTIFIC DISCOVERY. THROUGH UNDERSTANDING THE PAST, WE CAN BETTER NAVIGATE THE FUTURE OF GENETIC RESEARCH AND ITS ETHICAL IMPLICATIONS.

## FREQUENTLY ASKED QUESTIONS

### WHAT IS PHOTO 51 AND WHY IS IT SIGNIFICANT?

PHOTO 51 IS AN X-RAY DIFFRACTION IMAGE OF DNA TAKEN BY ROSALIND FRANKLIN IN 1952. IT PROVIDED CRITICAL EVIDENCE OF THE HELICAL STRUCTURE OF DNA, WHICH HELPED JAMES WATSON AND FRANCIS CRICK DEVELOP THEIR DOUBLE HELIX MODEL.

### WHO WERE THE KEY FIGURES INVOLVED IN THE DISCOVERY OF THE DNA STRUCTURE RELATED TO PHOTO 51?

THE KEY FIGURES INCLUDE ROSALIND FRANKLIN, WHO CAPTURED PHOTO 51, AND JAMES WATSON AND FRANCIS CRICK, WHO USED THE IMAGE, ALONG WITH OTHER DATA, TO PROPOSE THE DOUBLE HELIX MODEL OF DNA.

### WHAT DOES THE 'WORKSHEET' ASPECT OF THE SECRET OF PHOTO 51 REFER TO?

THE 'WORKSHEET' ASPECT TYPICALLY REFERS TO EDUCATIONAL RESOURCES OR ACTIVITIES DESIGNED TO HELP STUDENTS UNDERSTAND THE SIGNIFICANCE OF PHOTO 51 AND THE ROLE IT PLAYED IN THE DISCOVERY OF DNA'S STRUCTURE.

### HOW DID ROSALIND FRANKLIN'S WORK CONTRIBUTE TO THE UNDERSTANDING OF DNA?

ROSALIND FRANKLIN'S X-RAY CRYSTALLOGRAPHY TECHNIQUES ALLOWED FOR THE VISUALIZATION OF DNA'S STRUCTURE, PARTICULARLY THROUGH PHOTO 51, WHICH REVEALED THE HELICAL SHAPE THAT WAS ESSENTIAL FOR UNDERSTANDING GENETIC INFORMATION STORAGE.

### WHAT ETHICAL CONSIDERATIONS ARISE FROM THE USE OF PHOTO 51 IN SCIENTIFIC DISCOVERY?

ETHICAL CONSIDERATIONS INCLUDE THE LACK OF PROPER CREDIT GIVEN TO ROSALIND FRANKLIN FOR HER CONTRIBUTIONS, AS WATSON AND CRICK USED HER DATA WITHOUT HER CONSENT, RAISING QUESTIONS ABOUT AUTHORSHIP AND RECOGNITION IN SCIENCE.

### WHAT LESSONS CAN BE LEARNED FROM THE STORY OF PHOTO 51 IN TERMS OF COLLABORATION IN SCIENCE?

THE STORY OF PHOTO 51 HIGHLIGHTS THE IMPORTANCE OF COLLABORATION, ACKNOWLEDGMENT, AND ETHICAL PRACTICES IN

SCIENTIFIC RESEARCH, EMPHASIZING THAT CONTRIBUTIONS FROM ALL SCIENTISTS SHOULD BE RECOGNIZED AND VALUED.

## WHAT TOOLS OR METHODS WERE USED TO CAPTURE PHOTO 51?

PHOTO 51 WAS CAPTURED USING X-RAY CRYSTALLOGRAPHY, A TECHNIQUE THAT INVOLVES DIRECTING X-RAYS AT A CRYSTALLIZED SAMPLE OF DNA AND ANALYZING THE DIFFRACTION PATTERN PRODUCED.

## IN WHAT WAYS HAS PHOTO 51 IMPACTED MODERN GENETICS AND BIOTECHNOLOGY?

PHOTO 51 LAID THE GROUNDWORK FOR MODERN GENETICS BY PROVIDING A FUNDAMENTAL UNDERSTANDING OF DNA'S STRUCTURE, WHICH HAS INFLUENCED FIELDS SUCH AS MOLECULAR BIOLOGY, GENETIC ENGINEERING, AND BIOTECHNOLOGY.

## HOW HAS THE NARRATIVE SURROUNDING PHOTO 51 CHANGED OVER TIME?

THE NARRATIVE SURROUNDING PHOTO 51 HAS EVOLVED TO INCREASINGLY ACKNOWLEDGE ROSALIND FRANKLIN'S CRITICAL CONTRIBUTIONS, SHIFTING FROM A FOCUS PRIMARILY ON WATSON AND CRICK TO A MORE BALANCED VIEW OF COLLABORATIVE EFFORTS IN THE DISCOVERY OF DNA.

## WHAT INTERACTIVE ACTIVITIES MIGHT BE INCLUDED IN A WORKSHEET ABOUT PHOTO 51?

INTERACTIVE ACTIVITIES COULD INCLUDE ANALYZING THE DIFFRACTION PATTERN OF PHOTO 51, DISCUSSING THE IMPLICATIONS OF THE FINDINGS, CREATING A TIMELINE OF THE DNA DISCOVERY, OR ROLE-PLAYING THE CONTRIBUTIONS OF DIFFERENT SCIENTISTS INVOLVED.

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