

2017

The Small, Feminine Scientist: Novelty, Narrative, and Authority in the Accounts of Women in Science

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The Small Feminine Scientist: Novelty, Narrative, and Authority in Accounts of Women in Science

An Honors Thesis presented by
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to the Department of English
in partial fulfillment of the requirements for
Honors in the Major Field

Connecticut College
New London, Connecticut
May 2017

Acknowledgements

This work and all of its unshapely beginnings would not have been possible without the counsel of Professor Lina Wilder, who has seen this writing through its many forms and fragmented ideas and helped turn it into something I am proud of. Professor Wilder has been my advisor, but she has also been my mentor who encouraged me to push my writing from the very beginning. I am lucky to have worked with her.

Chapter Two would not be where it is without the staff at the Linda Lear Center for Special Collections and Archives. Rose Oliveira, Becky Parmer, and Ben Panciera humored me when I geeked out over the Carson collection and trusted me with numerous archival documents, and for that I am thankful. I also would like to thank Dr. Linda Lear for donating such fantastic and invaluable resources to Connecticut College.

This thesis was in good hands with my readers, Professors Anne Bernhard and Steven Shoemaker. Professor Bernhard has helped shape my future in the sciences because of her guidance as my Biology advisor, and for reminding me that science and writing go together more than an English major would ever admit. Professor Shoemaker helped me focus my writing and reading skills in class and through my position at the Roth Writing Center and for that I am thankful.

My family and friends have listened to me talk incessantly about this project for well over a year and I thank them for their patience and willingness to complain and analyze with me. Thank you for sticking with me and for consistently being a source of encouragement and warmth. This thesis is for them.

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Introduction

In 2014, the total percentage of women who earned doctoral degrees in all academic fields was 50.1%, which is encouraging, a step in the direction of equality in the workplace (NSF). Yet, when this is compared with all science and engineering fields combined, the numbers are a bit less heartening. In the same year, only 41.6% of all science and engineering PhDs were women (NSF), which is more than in previous years (in 2004, only 38.8% of women earned PhDs in STEM fields), but there is still a gap. This gap increases in specific STEM fields and when both race and gender are considered. Out of 38,939 doctoral degrees awarded in science and engineering fields in 2014, white individuals received 42.4%, while all minorities combined, both male and female, earned 57.6%. These numbers do more than take up space on the NSF website, they act within STEM fields, shifting an environment that has historically rejected women and especially women minorities.

Representations of those working in scientific fields influence the way in which cultural patterns emerge in the sciences. The way in which scientists and the sciences as a field are portrayed in literature (including memoir and nonfiction essay) and film influence how the public perceives who works in science. These representations also set a social and cultural norm for who is allowed to maintain certain roles within the scientific community. For example, because white men have historically been shown in higher scientific positions compared to women, when one pictures a scientist in their mind, what they imagine is typically a white man, most likely with scraggly hair. These perceptions are important to note because they establish a way of thinking about women in science as a novelty. Because women are underrepresented in the sciences and are not historically the protagonists of narratives about science, they become objects of interest in environments that are typically dominated by men.

Both film and literature have historically portrayed women scientists in a way that questions their role in the scientific community. Frequently, representations of women in science in literature and film are simply inaccurate, which skews their involvement even more. *The Double Helix*, James Watson's memoir about the journey of discovering the structure of DNA is seen as a classic and, if taken at face value for scientific history, gives its readers a story about how the structure of DNA was discovered which exhibits deep bias. His discovery would have been incomplete if it were not for Rosalind Franklin, an X-ray crystallographer whose photographs and work with DNA fragments allowed Watson and his colleague Francis Crick to see the genetic material in a new way. Watson's publication of *The Double Helix* creates an image of Franklin that draws the reader's attention to her identity as a woman before her calling as a scientist. What is problematic about this is that the primary focus of Watson's narrative recollection of Franklin is how her gender not only inhibited her success in science, but the successes of others. The fact that one of the chemists working in the Cavendish Laboratory at King's College London was a woman overshadowed her talents and the work she accomplished there. Watson's narrative reinforces the idea that women in science, especially those working in a laboratory setting, are out of the ordinary. His descriptions of Franklin suggest a curiosity about gender and how it played out in a scientific setting and an inherent discriminatory viewpoint. Watson appears to consider women as objects displaced in the wrong field instead of scientists on their own merit. This view that separates being a woman and being a scientist is forced upon readers of *The Double Helix* as they read a story about the academic success of two white male scientists. It reinforces an image of an ideal scientist, which, in Watson's view, Franklin most certainly was not.

The disbelief that women could also be scientists continues with the narratives surrounding Rachel Carson that were developed mainly by scientists in the pesticide industry who used gender discrimination as a vehicle for pushing their notions about what real scientific research should look like. Rachel Carson had scientific training, but again, at the forefront of the criticisms to her work, were remarks about how compared to her small stature, she was making potent claims about chemicals that (according to industry scientists) she knew little about. These scientists were essentially trying to prove her science faulty based on the supposed fact that women were not capable, or characteristic, of the real science conducted by men who didn't wear "soft pink nail polish" (Durgin). Not only was she an atypical scientist in the eyes of the chemical industry that fought her theories and instructions in her most noted book, *Silent Spring*, but her gender performance and the characteristics she was born with gave critics the chance to argue a capitalistic agenda with gender discrimination as an excuse. Although Carson was able to take complex information about the use of chemical pesticides and their influence in ecological processes and write about it in a way that made science more accessible to the public, the backlash her book received labeled her popularizations untrustworthy or just nonsensical. Carson's work was deemed science fiction and her activism with the publication of *Silent Spring* was described as stirring up a "fuss," a choice of words that not only works to push her research from the larger scientific discussion, but uses language that is inherently gendered to do so.

Gender continues to be the main focus of narratives of women in STEM positions today. Although most of these narratives aim to highlight the contributions that these women made to the STEM fields, it is important to note that their gender is still seen as something which must be noted before discussing anything about science. *Hidden Figures*, the book by Margot Lee Shetterly about three women who worked at NASA, which was adapted into a film, is an

example of how accurate reporting of a life in STEM can lead to improved representations of women in science. Shetterly incorporates extensive details about the work of Mary Jackson, Dorothy Vaughan, and Katherine Johnson (her former Sunday school teacher). When this story is turned into a film, however, the narrative shifts. What becomes important is emphasizing Katherine Johnson's role as an outsider (an African American female mathematician in an environment mostly made up of white men) over her role as a professional trying to be seen as a typical NASA employee who did her job. Johnson becomes the central "hidden figure," and some of the character's experiences in the movie are exaggerations of Johnson's own career or are taken from other NASA employees. Johnson's own experiences as a mathematician in the segregated south of Hampton, Virginia, according to the film's producers, were not sufficient on their own. By displacing the stories of others into Johnson's narrative, the film not only defines her as the representative of all African American women mathematicians at the time, but it invalidates the experiences Johnson actually faced. In this way, the narrative that is created for Johnson uses her position as a novelty at NASA to report inaccurate information, turning it into a story about a woman in STEM that shifts our perspective as viewers.

However, it is important to add that the film does serve a purpose. Apart from its inaccuracies in representation, the film serves as a reminder that these women and their stories should have been a part of the narrative history of STEM long before 2016, and before its central character turned 98. It generates discussion about the representations of minorities in science and is a reminder that although Johnson, Jackson, and Vaughan experienced discrimination in the workplace because of their race and gender in 1953, the same situations are still circulating throughout STEM fields today.

The way in which the narratives of women in science are told relates directly to how the sciences are perceived, especially in regard to who is involved and at what capacity. The narrative techniques we employ to remember women scientists are oftentimes not fully representative of them or exaggerate their accomplishments, which in its own way takes value from what was actually done. The way in which we document science should be inclusive to every story, but with a long history of discrimination both of gender and race, this is difficult to accomplish completely. Most of the narratives surrounding women in STEM create passive positions for the women they describe. Instead of being critical to scientific advancement, women scientists instead are seen as obstacles in the way of actual research. They are a scientific impediment rather than the agents of scientific advancement. These narratives question the presence of women in fields traditionally dominated by white men and reduce intellectual breakthroughs to untrustworthy science. What was written in the past to document scientific discovery, as narrative science has set a basis for the way in which scientists are represented and documented today.

Overview

In this work, the narratives of the experiences of three women in science are explored to demonstrate how scientific social norms are created. The first chapter evaluates the gendered tactics behind James Watson's *The Double Helix* that are used to form an image of Rosalind Franklin that diminishes her authority and role in the discovery of the structure of DNA. Watson used his authority as a trusted voice in the scientific community to write a work of nonfiction that attacked science from a solely gendered perspective. In describing his experiences in science and the people that shaped them, Watson is able to make excuses for what he sees as Franklin's

incapacity to conduct research in a way that agrees with him, by employing aspects of her gender as the cause. He blames her “belligerent moods” for the uneasy environment in the laboratory at King’s College and reduces her opinions and scientific inquiries to “complaints” all within the first paragraph of introducing her. Franklin is not seen as a scientist on her own merit, but rather a tool there to be used for the advancement of the science conducted by men. Watson writes that if she could “keep her emotions under control, there would be a good chance that she could really help” one of the male scientists in her lab (18). Instead of allowing Franklin to have agency as a scientist on her own, Watson creates a space for her to exist only as an instrument to the potential scientific success of others. This chapter investigates the ways in which making gendered attacks on women in science invalidates their accomplishments, and, in this case, subverts the importance of research that was critical to a revolutionary discovery.

The next chapter extends gender discrimination among narratives of women in science to incorporate capitalism in the responses to Rachel Carson’s *Silent Spring*. The chemical pesticide industry, including companies like Monsanto, went on the attack after Carson published the work, which advised the public as to what was being implemented into the environment and how ecosystems were changing as a result, because they saw it as a threat to production. What is different about the narratives created to downplay Carson’s research is that in addition to making arguments about the credibility of her work, the chemical industry was motivated by capital interest and ensuring the security of their products. They make these arguments by putting an unnecessary emphasis on how Carson’s physical characteristics limit her capacity to be seen as a characteristic scientist, namely one that is white and male. Carson is made out to be an unusual specimen, picked apart to analyze the motives behind her involvement in the field of science (almost comparable to the creatures she wrote about in her second book *The Sea Around Us*).

Her science is put into question on the basis that she was an atypical version of the people making “real” contributions to the field.

The final chapter explores the intersectionality of discrimination against women in the sciences by looking at Margot Lee Shetterly’s *Hidden Figures* as well as its film adaptation. Shetterly’s book works to dismantle the narratives that have previously kept women of color out of the history of science. The chapter compares the narrative techniques in the book and the film adaptation. The film, released in December of 2016, works well in providing a visual to the stories that helped make NASA what it is today, but at the same time, reinforces a few problematic sequences that remove the agency from Katherine Johnson and displace it onto fictional characters. In addition to exploring *Hidden Figures*, this chapter looks at modern representations of women in science. By incorporating ideas from Dr. Chanda Prescod-Weinstein, an astrophysicist who writes about what it means to be a minority in science, working to change the perception of the “typical” scientist, reminding us that discrimination in science did not end in the 1950s.

The purpose of this work is to challenge the ways in which previous narratives of women in science have been documented. To question the use of gendered language and blatant discrimination that were kept as records of women who did extraordinary things to progress their respective fields. Rosalind Franklin, Rachel Carson, and Katherine Johnson are only three of many women in STEM who have experienced discrimination because of the conflict society posed between their personal identities and their identities as scientists and mathematicians. By challenging this need to be either a woman or a scientist, not both, creates a space to interpret and appreciate the lives and accomplishments of these women more fully and more accurately.

Challenging discrimination that is disguised as narrative is the first step in shaping a future for science that is more inclusive to all.

Chapter One: Hot Anger and Further Evidence of a “Feminist” Chemist

Three research articles discussing the structure of DNA were published in *Nature* magazine on April 25, 1953, but only one was labeled as “further evidence.” Rosalind Franklin, Raymond Gosling, James Watson, Francis Crick, and Maurice Wilkins all worked on determining the shape of the DNA molecule, yet the way in which their work is presented in a well-regarded journal is different. What is important to note, however, is not just that the research is separated (this was done for obvious reasons: there were separate research projects occurring), but it is how the research is separated in such ways that indicate the favoring of one perspective over the rest.

archive

A Structure for Deoxyribose Nucleic Acid

Watson J.D. and Crick F.H.C.
Nature **171**, 737-738 (1953)

April 25, 1953: James Watson and Francis Crick’s classic paper that first describes the double helical structure of DNA. With some understatement they note that the structure “suggests a possible copying mechanism for the genetic material”.


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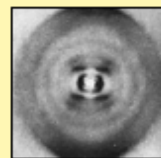


Molecular Structure of Deoxyribose Nucleic Acids

Wilkins M.H.F., A.R. Stokes A.R. & Wilson, H.R.
Nature **171**, 738-740 (1953)

April 25, 1953: From the same issue, Wilkins, Stokes and Wilson analyse the X-Ray crystallography evidence, and suggest evidence that the structure exists in biological systems.


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Molecular Configuration in Sodium Thymonucleate

Franklin R. and Gosling R.G.
Nature **171**, 740-741 (1953)

April 25, 1953: Rosalind Franklin and Ray Gosling provide further evidence of the helical nature of nucleic acids, and conclude that the phosphate backbone lies on the outside of the structure.

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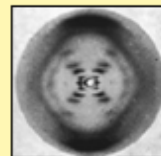


Figure 1. Image from archived issues of *Nature* that lists the publications of Franklin, Gosling, Watson, and Crick. Franklin and Gosling’s work is cited as “further evidence,” where Watson and Crick’s work is listed as a “classic paper.”

We are much indebted to Dr. Jerry Donohue for constant advice and criticism, especially on interatomic distances. We have also been stimulated by a knowledge of the general nature of the unpublished experimental results and ideas of Dr. M. H. F. Wilkins, Dr. R. E. Franklin and their co-workers at King's College, London. One of us (J. D. W.) has been aided by a fellowship from the National Foundation for Infantile Paralysis.

J. D. WATSON
F. H. C. CRICK

Medical Research Council Unit for the
Study of the Molecular Structure of
Biological Systems,
Cavendish Laboratory, Cambridge.
April 2.

We are grateful to Prof. J. T. Randall for his interest and to Drs. F. H. C. Crick, A. R. Stokes and M. H. F. Wilkins for discussion. One of us (R. E. F.) acknowledges the award of a Turner and Newall Fellowship.

ROSALIND E. FRANKLIN*
R. G. GOSLING

Wheatstone Physics Laboratory,
King's College, London.
April 2.

Figure 2. Acknowledgements at the end of the 1953 *Nature* publications by Franklin and Gosling and Watson and Crick. Watson and Crick mention being “stimulated” by the knowledge of *unpublished* experimental results from Wilkins and Franklin. Here they are astute to call “Rosy” Dr. R.E. Franklin.

The placement of the articles in this issue of *Nature* provides a window into the hierarchy of scientific research. The paper titled “Molecular Configuration in Sodium Thymonucleate” written by Franklin and Gosling is placed two pages after the article, “Molecular Structure of Nucleic Acids” written by Watson and Crick, where they propose a structure for DNA based on X-ray images taken by Franklin. Watson and Crick recognize in the last paragraph of their paper that they had been “stimulated by a knowledge of the general nature of the unpublished experimental results and ideas of Dr. M.H.F. Wilkins, Dr. R.E. Franklin and their co-workers at

King's College, London." Clearly referencing Franklin's unpublished experimental data, this statement highlights Wilkins' role in the transfer of the work as well. It is important to note that Watson and Crick only acknowledge Wilkins and Franklin here because Franklin was the one whose work was being used and interpreted, where Wilkins was just the messenger. The producers of the "experimental results" and the "ideas," respectively. The placement of Watson and Crick's research ahead of everyone else's, then, creates a sense of authority in their work. They become the authority on DNA research because of this placement, making other work mere additional components to the foundation they set in place. But what happens when this foundational research is built on the work deemed less important and only supplementary to what is represented as independent? Franklin's research becomes secondary when in reality, components of it were used to propel Watson and Crick's work into the frame of what *Nature* classifies as a "classic paper." The placement of Watson and Crick's research reinforces the discrimination Franklin faced as a woman in a laboratory comprised mainly of men. It is also the starting point to a narrative that regarded Franklin as a less qualified scientist than she was. Franklin had a PhD in physical chemistry, whereas Watson had a PhD in zoology, and Crick maintained a B.Sc. because the war in 1939 caused an interruption on his pursuit to a PhD. A narrative is crafted by Watson, who in writing several books about the discovery of the structure of DNA, creates an image of Franklin as a scientist who is much less capable than himself. Although some of his most recent books bring in current research on DNA, Franklin's work is still bogged down in the memory he creates of her.

Through Watson's narrative Franklin becomes the less involved scientist, the one who almost achieved something great but, because of a few details in her character, did not. Franklin was involved, however. She established herself in a position that worked to analyze fibers of

genetic material that would later be described as DNA. Franklin worked with DNA fibers extensively and mastered X-ray crystallography, a process that is used in determining the atomic structure of crystalline forms. Her background in physical chemistry that started at Cambridge University was utilized in her meticulous work with DNA (Maddox 143-144). Watson's writing in both the *Nature* article and *The Double Helix* brings gender discrimination from the laboratory into print and makes Franklin's position passive. The articles in *Nature* demonstrate how narrative persuasion plays out in scientific research as well as in literature. The publication of these articles corresponds to the exact moment when Franklin's work became secondary in the company of Watson and Crick. In the same way that Rachel Carson's *Silent Spring* was devalued by the chemical industry based on the notion that she was a trained biologist, but not one who worked in a research laboratory, Watson's memoir questions Franklin's identity as a true scientist. She is considered something of a novelty as a woman who is also a scientist. This sense that women in scientific fields go against the norm in the world of science allows for narratives that define women scientists as passive, non-contributing, and non-effective members of the scientific community. Franklin did work in a lab, and was trained to do the work, but Watson's narrative places her outside the general structure of science and creates an "other" in regards to her position in the field.

While it is true that not everyone could piece together the structure of DNA, James Watson maintained an opinion on who could be involved in the process at all. In *The Double Helix*, a memoir and personal account of the journey to discover the structure of DNA, Watson made it clear that Rosalind Franklin was one person who did not fit his standard for scientists. After wrongly introducing her as the assistant to Maurice Wilkins, referring to her as "Rosy," a name the scientists at King's College London "called her from a distance," throughout the text,

and commenting that “by choice she did not emphasize her feminine qualities,” he creates a character for Franklin that misrepresents who she was and highlights her gender performance over her academic aptitude and ability. Most importantly, he builds up a wall of inaccuracies and criticisms not only to separate Franklin from her training and her ability, but to distinguish himself as the right man for the job. Watson continues his critique by writing,

Clearly Rosy had to go or be put in her place. The former was obviously preferable because, given her belligerent moods, it would be very difficult for Maurice to maintain a dominant position that would allow him to think unhindered about DNA. Not that at times he didn't see some reason for her complaints. (Watson 17)

It is interesting that Watson argues that Franklin needed to be “put in her place,” which assumes that there was a sort of territorial battle going on and that Franklin didn't have a place at King's College at all, when indeed a place was specifically created for her: she was hired for her expertise in x-ray crystallography. Watson's language also asserts a dominance over Franklin as if he had the authority to decide where she should concentrate her efforts. Along with degrading her position in the lab, Watson describes what Franklin's supposed “moods” were like, calling them “belligerent” and citing them as possible future disturbances to Wilkins' work. Her suggestions about scientific work also turned into “complaints” in Watson's mind, which creates an image of Franklin that is whiny and arrogant instead of interested and astute. Watson's words suddenly turn a fully trained crystallographer into a distraction to a scientist conducting real research. It was no longer that Franklin was also at King's College to conduct research, but that her presence in what Watson deemed Wilkins' lab was interfering with the possibility of scientific discovery. She was not seen as a colleague, but rather a temporary divergence put in a place where she didn't belong. Watson noted that if she stayed, Wilkins might be able to endure

her presence and as long as she could manage to “keep her emotions under control, there would be a good chance that she could really help him,” because after all, she was only there to advance Wilkins’ career, not her own (Watson 18). Franklin was made out to be someone who was sent to King’s to aid in Wilkins’ research, not to be sufficient with her own, which is exactly the opposite of what actually occurred. Watson turned Franklin into an unworthy assistant, one who ended up in a position she wasn’t prepared for and that certainly wasn’t prepared for her.

Underneath all of the reasons that categorized Franklin as insufficient as a scientist that Watson listed was the threat that a woman might possibly win the race to discover the structure of DNA.

Watson used *The Double Helix* to frame Rosalind Franklin as a “real problem,” by studing his account of historical events with exaggerated and untrue instances of her character. Sir Lawrence Bragg, the director of the Cavendish laboratory at King’s during the time of the work with DNA, wrote a foreword to the book that describes Watson’s writing as a “drama of the highest order.” Sylvia Nasar, a journalist and biographer from Columbia University, who wrote the introduction to the book, also claims that it is a “wonderfully readable human drama that lets nonscientists share some of the intellectual excitement, high emotion, and incredible suspense.” Personal accounts of historical events are never completely accurate and Watson picks up on this in the preface of the book in that “no one will ever be able to write a definitive history of how the [DNA] structure was established.” Yet, while maintaining that no one will be able to give the full, unbiased story, Watson is quick to argue that because he had wanted to write the book since “the moment the double helix was found,” his version of the events is the one to be trusted (xii). By starting the book this way Watson aims to convince the reader that his recollection is the right one. He aims to garner the reader’s trust. What makes this problematic,

however, is when he begins to make gendered comments about Franklin beginning on page seventeen.

There is a difference between the way Watson discusses Franklin and the way he describes other scientists. In chapter two of *The Double Helix*, Watson explains that “a goodly number of scientists are not only narrow-minded and dull, but also just stupid,” which is a hearty insult, but does not, in this instance, pull gender in (14). Accusing someone of being narrow-minded and dull is one thing, but when one’s emotions, clothes, and appearance are scrutinized, things that have been historically associated with women, the level of criticism raises. In both instances science is left out of the equation, but the latter emphasizes how much women were considered to be a novelty. Watson comments that Franklin

might have been quite stunning had she taken even a mild interest in clothes. This she did not. There was never lipstick to contrast with her straight black hair, while at the age of thirty-one her dresses showed all the imagination of English blue-stockings adolescents (17)

This two-paragraph-long description reveals what differentiates Watson’s critiques of the typical scientist at the time and Rosalind Franklin. Throughout *The Double Helix* Watson goes through a constant shift back and forth between writing about scientific data and writing about either what he finds attractive in women or the possibility of meeting an attractive woman at the numerous social events recounted in the book. This shift between what the book claims to be (a telling of how the structure of DNA was discovered) and what it actually is (more of a personal diary) first becomes disturbing when Watson separates Franklin from her scientific qualifications to talk about her hair and her lack of lipstick. Going beyond calling her dull, Watson makes it clear that Franklin doesn’t live up to his standards as a scientist or as a woman. What this has to do with

the discovery of the structure of DNA is lost in comments that make Franklin out to be an emotional adolescent with a “good brain” if she could control everything else about her that (in Watson’s mind) set out to detract from it. Watson points out the ways in which the “problem” with Franklin was that she did not fit the role of the typical “popsie” (a term favored by Watson throughout the book) or the typical scientist. It was not only that he had a problem with the idea of a woman scientist, but he had a problem with the kind of woman she was. He leaves readers at the end of the second chapter with a feeling that not only was Franklin not welcome, but that women were not welcome in science in general: “the thought could not be avoided that the best home for a feminist was in another person’s lab” (20). It is interesting to note that Watson describes Franklin as a feminist. In fact, while Franklin’s achievements could be described as feminist, she herself had no explicit feminist agenda. What is clear, however, is that when Watson writes “feminist,” what he really means is “woman.” Rosalind Franklin went to King’s College and redefined what it meant to be successful in the sciences and for whom. She pushed the boundary that was set in place and was designed to be kept in place by separate break rooms for men and women researchers. Watson might have believed that the best place for a so-called “feminist” was in another lab, but without Franklin, his career and collaborative discovery would not have been the same.

Rosalind Franklin was a chemist and X-ray crystallographer born in London in 1920. Although she ultimately pursued a career in the sciences and was described as “alarmingly clever” at the age of six by her aunt, her family did not encourage her intellect (Maddox 15). Her ability in math was cause for alarm because it was unusual; it wasn’t something her family thought she wanted to pursue. Brenda Maddox notes that there was a sense of awkwardness

around Franklin's ability, "that, of Ellis Franklin's four children, three of them boys, the girl should be the brightest and most determined" was somewhat of a surprise (15). She was set apart from her siblings because of her willingness and enthusiasm for learning. With a private school education throughout her life (and the money to afford it) and access to "modern new science facilities," Rosalind Franklin excelled in both academics and sports (Maddox 15,16, 33). The privileges Franklin had as a child, to be able to attend great schools, as well as her aptitude for science put her in a position to not only be the best in her class, but also to attend Cambridge University.

At the time Franklin attended Cambridge, women were not given degrees at the end of their educational pursuits but were rather graciously offered the opportunity to learn. This opportunity was limited further when female students were allowed to attend "men's lectures," but up until the 1930s, "were expected to sit together in the front rows," and were "pelted with paper or greeted with stomping feet" if they were late to class (Maddox 44). An unwelcoming environment that might prove intimidating to some was not a bother to Franklin. She became interested in X-ray crystallography through William Lawrence Bragg (the same Lawrence Bragg that wrote the foreword to *The Double Helix*) who won the Nobel Prize for his work with X-rays and crystalline structures (Maddox 47). Franklin saw him at a meeting of the Association of Scientific Workers and was intrigued, "eager for such knowledge and technique" that was presented before her (Maddox 47). Franklin continued work at Cambridge, but given that the war was going on, she feared the school might close. Although she considered working as a chemist, her father disapproved and insisted that she spend her time in agricultural labor instead, which Franklin disregarded completely (Maddox 60). Her education up to this point was too focused on the hard sciences for her to accept anything else. Franklin wrote home to her father in a four-

page long defense of her aspirations, convincing him that, ““you look at science (or at least talk of it) as some sort of demoralizing invention of man, something apart from real life, and which must be cautiously guarded and kept separate from everyday existence”” (Maddox 60-61). The amount of pushback Franklin gave her father demonstrates how perfectly suited she was for a scientific career. She was determined and knew what she wanted to do with her interests.

The decision to stay at Cambridge to pursue a Ph.D. came with a bit of uncertainty as the Ministry of Labour, due to the war, announced that all women researchers at the university could be called into military service, while the men could continue on with their work (Maddox 76). Ultimately Franklin accepted a post-doctoral position at King’s College London to work in X-ray diffraction. Gender discrimination followed her there as well however where she “found herself in an environment friendly to everything she was not,” a Jewish woman interested in science as a career (Maddox 128). This however, proved to be the point at which gender discrimination dictated the course of her time at King’s College. She started work in a lab also used by Raymond Gosling, a doctoral student, and his supervisor, Maurice Wilkins, the assistant director of the biophysics department, who upon Franklin’s arrival at the College was absent. According to Watson, Wilkins believed that Franklin was hired to be his assistant, implying that there was tension between the two, while Brenda Maddox records that “[Franklin and Wilkins] worked on DNA separately but cordially” (135). The real problem however, and one that is oftentimes overshadowed by the tension between Wilkins and Franklin in Watson’s account of the story, was happening without Franklin’s notice.

James Watson and Francis Crick, two molecular biologists working in the Cavendish laboratory at King’s College along with Wilkins and Gosling were working toward identifying the structure of DNA. Franklin’s expertise in X-ray imaging and crystallography made her a

great competitor and unfortunately a target for gendered attacks against her credibility as a scientist. It is important to note that these attacks didn't just happen when the people that were involved were living. Rosalind Franklin died in 1958 when she was thirty-seven, yet James Watson went on to publish seven books, in 1968, 1981, 2000, 2002, 2003, 2007, and one (with updated information on DNA research) coming to bookstores on May 9, 2017, that all in their own way discuss the discovery of the structure of DNA. With these publications comes the reiteration of the "scandal" and the "drama" of the story, but also the preservation of gender discrimination. Watson might add new and updated information on research being conducted (research that is indeed needed and warranted), but each book introduces him as the one to discover DNA's structure, allowing a space for privilege in science based on gender and authority.

Rosalind Franklin was not the only one picked apart in *The Double Helix*. Watson goes through many of his colleagues and points out at least one thing that they lacked or could have been doing better. For example, Watson insults Crick, the man he worked most closely with in an account of one of his initial impressions, "although [Crick] knew he was bright and could produce novel ideas, he could claim no clear-cut intellectual achievements, and he was still without his Ph.D." (60). Watson first acknowledges Crick's intelligence and then makes it a point to include his supposed downfalls as well. At this point in time Watson hadn't had any "clear-cut intellectual achievements" either. He had been awarded the opportunity to study at King's College as a part of a fellowship, but he was doing just that, studying, and not yet making any breakthroughs. Watson also makes a nod at what he determined was a facet of Crick's borderline crazed character when he described him saying, "already for thirty-five years he had not stopped talking and almost nothing of fundamental value had emerged" (61). According to

Watson, Crick was an obsessed scientist with nothing to show for it. He had the knowledge, yet nothing to prove it. In both critiques of Crick, Watson acts as a superior, someone of a greater power than his own colleague. This sort of mindset occurs in every line of work, but what is important to note is the way in which Watson critiqued the men he worked with and the way in which he critiqued Franklin. Eva-Sabine Zehelein in her piece about gendered marginalization in the case of Watson and Franklin wrote that “the only comfort is that Watson is equally amiable in his treatment of men” as he is in his treatment of Franklin in *The Double Helix* (91). While it is true that Watson isn’t fair to his male colleagues, he at least acknowledges their intellectual pursuits and then attacks their academic merit, whereas with Franklin, Watson is more particular about how her gender plays a role in her weaknesses as a scientist. Watson admits that Franklin had a “good brain,” but it is the following comment, that “if she could only keep her emotions under control, there would be a good chance that she could really help [Wilkins],” that revokes any sort of compliment he might have been trying for (18). Her emotions, Watson urges, might be the inhibiting factor of future scientific endeavors of her male colleague. Subsequently, Watson creates a narrative by which focusing on Franklin’s supposed lack of emotional control is used to devalue her arguments and shape her reception as a scientist.

Watson entertains this back and forth, gender discrimination followed by criticism, when he remembers attending one of Franklin’s lectures on six months of her work with DNA (from when she first started at King’s). He also reinforces the idea that her gender is a distraction when he describes the lecture:

There was not a trace of warmth or frivolity in her words. And yet I could not regard her as totally uninteresting. Momentarily I wondered how she would look if she took off her

glasses and did something novel with her hair. Then, however, my main concern was her description of the crystalline X-ray diffraction pattern. (69)

In sharing this perspective, Watson reveals an instance of his own sexist and objectifying thinking when he says that Franklin was not “totally uninteresting,” with the majority of the recollection aiming to fix her. Watson becomes distracted by what he thought might improve Franklin but then quickly corrects himself by noting his “main concern.” Why put these lapses in attention in writing? Although the path to discovering the structure of DNA is exciting, there is no need to record every thought that went through Watson’s mind, especially the thoughts that aimed to devalue and disregard Franklin. These instances of complete objectification of Franklin by Watson are inappropriate and show just how fascinated he was by the idea of a woman conducting scientific research. By writing memoir rather than history, however, Watson had the privilege to write this way. In the same way that he pivoted between objectification and discrimination, Watson continued recounting Franklin’s lecture by noting that “the years of careful, unemotional crystallographic training had left their mark,” explaining the ways in which her expertise in the field showed through her presentation (69). Yet, only a paragraph later, he fell back into the same routine. He remembers the audience’s reaction to the lecture by saying, “Maybe their reluctance to utter anything romantically optimistic [...] was due to fear of a sharp retort from Rosy,” defending their behavior because a sure fire way to ruin an evening was “to be told by a woman to refrain from venturing an opinion about a subject for which you were not trained” (70). There is a sense that because she was smart, she was also threatening. But the important thing to note is that Watson sees her as threatening in three ways – in her appearance (which he wished to alter), in her gender performance, and in the event that she, a trained scientist, would be able to educate other scientists (in this case the men) on something they did

not understand. His fear stems from not only being told how to approach a scientific concept by someone other than himself, but being told how by a woman.

Franklin's gender continues to be an obstacle for Watson as *The Double Helix* continues. Upon learning about Linus Pauling's proposed model for DNA, Watson found holes in his theory that he wanted to check with Franklin. Again, this introduction to the twenty-third chapter of the book seems promising – Watson writes about wanting to exchange ideas with Franklin like a typical scientist would do. This attitude changes soon after Watson presents the information to Franklin, however. According to his account she “became increasingly annoyed” with what he was pointing out to her and went into a “harangue,” opposing everything he said (165). After making an argument himself about nucleotide order, Watson writes that Franklin “by then was hardly able to control her temper,” insisting that her “voice rose” as all of this was happening (165). Although this sequence seems to fit with the rest of the dramatic situations that unfold in Watson's recitation, what is different is his use of specifically gendered language. Franklin not only has a temper, but is unable to control it. Watson uses Franklin's disagreements to create an image of her that was not only aggressive but also animalistic. He makes a case for her to seem out of place in a laboratory setting. Watson “implied that she was incompetent in interpreting X-ray pictures,” ones she had taken herself in a position for which she was fully trained (166). What follows this conversation with Franklin is an exaggerated sequence of events that startled Watson. He writes, “fearing that in her hot anger she might strike me, I grabbed up the Pauling manuscript and hastily retreated to the open door,” because although she was much less intimidating to his tall stature, she was likely to defy the odds (166). Watson writes that he was thankful that Maurice Wilkins had shown up in the doorway of the laboratory at the most opportune moment to stop “Rosy from assaulting [him]” (166). Franklin is depicted as a

dangerous person who is not in control of her emotions, actions, or her research. Further excluding Franklin were the remarks about this situation becoming a bonding moment between Watson and Wilkins. Wilkins informed Watson that he had endured some of the same sort of behavior from Franklin, that “some months earlier she had made a similar lunge toward him” (167). The term “lunge” here is problematic because it insinuates the idea that Franklin was not as professional as Wilkins and it dehumanizes her, while also hinting at mental instability. This language also creates a sense that what Franklin was doing was not only uncharacteristic of a scientist, but of a human in general. Additionally, Watson notes that the only positive part of this interaction was that it gave him and Wilkins something to bond over. He could understand what Wilkins went through on a daily basis and noted that he “could treat [Watson] almost as a fellow collaborator rather than as a distant acquaintance” because of the experiences they shared (167). These shared experiences however, this shared knowledge, was that of fearing Franklin and anything she represented. Their common ground was agreeing that they did not like Franklin not because of her science, but because of her presence.

The Homosocial Relationship of Watson and Wilkins

Watson’s recollection of his interactions with Wilkins points to a relationship that was based on and strengthened by its association with Franklin. It is worth noting that Wilkins has a savior-like quality during his encounter with Watson after he discusses Pauling’s model of DNA with Franklin. This is the moment when Watson realizes that Wilkins is no longer just a colleague, but someone he can confide in, someone who he shares common ground with. This common ground, however, has more to do with disregarding women, specifically Franklin, as scientists, and using that to propel collaboration and common interest, and is only secondarily

concerned with authentic scientific interest. More specifically, Franklin became the subject that bound Wilkins and Watson as collaborating scientists more readily than X-ray crystallography itself. While Watson deemed Franklin as an impediment to scientific progress in his introduction of her at the beginning of *The Double Helix*, his relationship with Wilkins, which develops as a result of Franklin's "hot anger," changes this dynamic (166). In the way that Watson describes it, "[his] encounter with Rosy opened up Maurice to a degree that [he] had not seen before," a side that not only helped him somehow understand Wilkins as a person, but also as a researcher (167). Wilkins became someone with whom Watson could envision himself working well because of their common "encounter" with Franklin. In this instance, Franklin went from being someone who threatened Wilkins' "dominant position" in the laboratory, thereby threatening the research being conducted, to someone who, by association, encouraged collaboration amongst scientists who were formerly just "acquaintances." Her position then, according to Watson's recollection, served as both an impediment and advancement to science, but never directly, only through the men she worked with. Her presence provoked Watson to regard his newfound understanding of Wilkins in a way that used his interaction with Franklin as a means of forming a deeper relationship:

Now that I need no longer merely imagine the emotional hell he had faced during the past two years, he could treat me almost as a fellow collaborator rather than as a distant acquaintance. (167)

It is absurd and disturbing to think that a woman's presence in a scientific setting was so unappealing that it caused men to collaborate on their own separate research endeavors, but this discrimination was happening in every part of science. Watson's empathy for Wilkins provides a basis for the homosocial relationship that helped exclude Franklin from the work on DNA that

she had been conducting on her own accord. This relationship helped Watson become “more aware of [Franklin’s] data than she realized” (165). It is important to note why this scene is included in the recitation of the discovery of DNA’s structure apart from the fact that it gives an impression of what Watson believed Franklin and Wilkins’ temperaments and personalities to be. Watson includes this dramatic sequence, which lives up to his stated hopes of creating a work comparable to *The Great Gatsby*, to create an image of scientific collaboration in spite of the obstacles set up by women scientists (Watson 120 *A passion for DNA*).

It is not without a certain degree of struggle that scientific collaboration is made possible. Watson recounts being physically stuck between Franklin and Wilkins upon attempting to leave Franklin’s lab: “My escape was blocked by Maurice, who, searching for me, had just then stuck his head through [the door]” (166). It is important to note that while seeing Wilkins was a relief for Watson, he remained in the way of his path out of the laboratory. What follows is Watson’s realization that the same sort of debacle, or attempted assault, occurred between Franklin and Wilkins just a few months prior. This realization dissolves Watson’s first impressions of Wilkins and instills a sense that this shared experience bridges whatever divide that had been built up preventing collaboration between the two scientists. Wilkins no longer blocked the path to collaborative research because he too understood what it meant to be in a position of power that was challenged by someone who was not characteristic of the position she was occupying. It is also important to note Watson’s hesitancy over Wilkins’ loyalties. After the exchange with Franklin, and after Watson “inching [his] body from between [Franklin and Wilkins]” had managed to exit the laboratory, Wilkins remained in his place inside the door (166). Watson’s anxiety is clear when he writes, “when Maurice failed to disengage himself immediately, I feared that out of politeness he would ask Rosy to join us for tea.” Although this fear in potentially

interacting with Franklin outside of a laboratory setting is absurd, what is more significant here is the opposing comfort levels that Watson associates with Wilkins and with Franklin. Watson writes that Franklin “had blocked the door” in her supposed confrontation with Wilkins, which not only parallels his own obstructed passageway in his interaction with her, but further insists that Franklin is the source of scientific obstruction in both cases. In Watson’s case, Wilkins was there to liberate him, but in the unfortunate case of Wilkins, “no third person was on hand” (167). The way in which these scenes are described leaves Franklin in the position of the obstructer, someone not contributing, but whose only purpose is to get in the way of what was actually taking place in the laboratory. It is important, then, to point out that Franklin also becomes the reason that Watson views Wilkins in a new light in terms of research. Franklin “opened up Maurice” to Watson, and in this way provoked collaboration. In Watson’s view, she no longer posed a threat to Wilkins at this point in time, as apposed to when she arrived at King’s. By recounting the events in this way, Watson makes the case that Franklin’s actions unlocked a sort of bond between himself and Wilkins. This newfound relationship provided Watson with access to Franklin’s data in a way that would have been impossible before. Instead of interacting with Franklin, Watson could go directly to Wilkins, who, “with the help of his assistant Wilson [...] had quietly been duplicating some of Rosy’s and Gosling’s X-ray work” (167). Because of Watson’s new relationship to Wilkins, Franklin was no longer an obstacle blocking him from the kind of collaboration that he could tolerate, namely, collaboration with other male scientists. Watson even recounts that because Wilkins was obtaining data from Franklin and Gosling via Wilson, his “research efforts were in full swing” at last (167). To Watson’s satisfaction, Wilkins was able to get past the fact that Franklin was working in the same lab, which he was concerned about upon her arrival, suggesting in the first few pages of the

book that she might hinder his ability to conduct DNA research. Because of this, Wilkins was not the only one benefitting from stolen data.

The dynamic between Franklin, Watson, and Wilkins became Watson's self-prescribed permission to work efficiently with data that did not belong to him and that would allow him eventually to complete a model of DNA with Francis Crick. Because Franklin was unaware of this exchange (as Watson writes, "Rosy, of course, did not directly give us her data") she remained in a position of ambiguity that was controlled by Watson and Wilkins. In *Between Men*, Eve Kosofsky Sedgwick describes the relationships between characters in *The Country Wife*, a play by William Wycherley, and notes that one of the characters, Sparkish, believes that, "men's bonds with women are meant to be in a subordinate, complimentary, and instrumental relation to bonds with other men" (51). What Sedgwick picks up on in Sparkish's character, that women are either in lower social positions than men, are just an addition to a man's life, are connected to the success of a relationship between men, or a combination of all three is evident in Watson's retelling of the DNA story. Franklin becomes the social lubricant that makes a way for collaboration between Watson and Wilkins. Watson regarded Franklin as a lesser scientist, one who understood the material, but didn't have the right to establish any sort of credibility for her work. In Watson's view, she was a temporary installment in the laboratory, who would help provide key information in determining the structure of DNA, but would not share the spotlight with him.

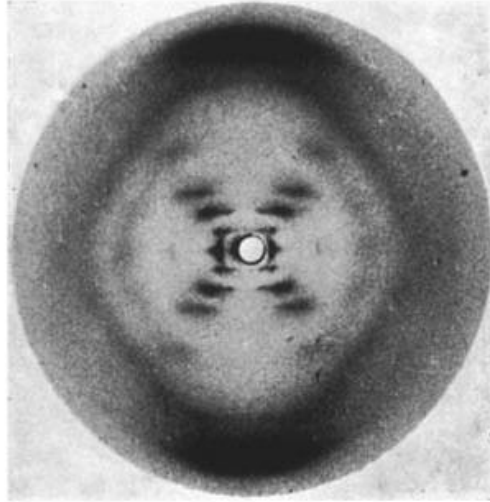


Figure 3. The “B” form X-ray photograph taken by Franklin, May 1952.

After Wilkins revealed the “B” form X-ray photograph (an image taken by Rosalind Franklin that showed the diffracted visual representation of crystallized DNA fragments) of the helix to Watson, anticipation started to build regarding who would figure out its structure first. Because the photograph was Franklin and Gosling’s work, however, Wilkins attempted to slow the progress of identifying the structure until Franklin was no longer working in the lab. Sedgwick brings up the idea in her interpretation of *The Country Wife*, that women are considered to be “exchangeable property among men,” that they are traded between husbands almost as if they were pieces of property (53). Although Sedgwick is analyzing a play, a piece of fiction, this notion of subordination to the point of becoming something of trade also makes its way into Watson’s rhetoric in *The Double Helix*. Early on in the book Watson makes it clear that the best place for Franklin was in “someone else’s lab,” and this notion of wanting her to vacate her current work space reappears after finding out about the “B” form photograph, or as it is infamously known, Photo 51. It is important to note that Wilkins was very particular about when modeling of the obtained photograph would begin. Watson explains that Wilkins “emphasized

that he wanted to put off more model building until Rosy was gone” (179). Franklin was leaving King’s College to work at Birkbeck College with J.D. Bernal, a fellow crystallographer, but before she made the move, Wilkins remained uneasy with the idea that they should move forward with interpreting her data. There is a transference here not only of data, but also of Franklin between laboratories. From the beginning of the book, Watson expressed interest in pushing Franklin out of his own space in order to prevent her from getting in the way of scientific endeavors. The same attitude is observed here too, as Franklin was ready to make the transition between laboratories. In this case, scientific research, according to Watson’s recollection of Wilkins, could not resume until Franklin was at a safe distance from their work with her data. In the way that Watson recounts the story, Franklin is used for establishing the X-ray photographs and has then served her purpose and leaves. These photographs were essential to the eventual structural work that Watson and Crick experimented with because they provided a visual representation of DNA fragments. Although it was her own decision to leave King’s College, the way in which Watson describes her transition from being a part of their scientific community to joining a new laboratory makes her seem as though she was only there for their benefit, that her personal career aspirations were not important, and that it was a relief to have her under someone else’s watch. The obstacles that she had put in place to prevent Watson and others from conducting research would soon be gone, according to Watson. In the same way that Sedgwick refers to women being exchanged as property between men, Franklin was exchanged for an environment that was conducive to Watson’s comfort.

Transition of Power and Knowledge

Although Watson and Crick were able to devise a model of DNA based on Franklin's photograph, it still required peer review. A crucial part of scientific research is peer review, a process that allows the researcher to step back from their own work and allow other qualified scientists to critique and give constructive suggestions about what was done. As much as Watson would have liked to think that a structure as "pretty" as the one he and Crick composed into a model existed, he knew that it had to be confirmed with his colleagues (205). What is important to note here, however, is who was deemed fit to be the first one to see the model. Maurice Wilkins was the first person called to review it. According to Watson, he "needed but a minute's look at the model to like it" (208). Watson was apprehensive about what Wilkins would say because he feared that he was "unhappy that [he and Crick] had seized part of the glory," not from Franklin, disregarding that the X-ray evidence was in fact hers, but from Wilkins who had only obtained the image that provided the basis for Watson and Crick's model (209). Instead, Watson writes that Wilkins seemed "thoroughly excited" in regards to what he and Crick had devised.

After Watson was satisfied with Wilkins' response to the model, it was presented to Franklin for inspection. It is important to note that while Wilkins' reaction is highly anticipated with anxiety that covets his opinion, Franklin's reaction is described in ways that bring back Watson's control over her societal perception as a scientist. Instead of feeling "relieved" after Franklin sees the model, Watson writes as though her reactions were justified based on the quality of the work that he had been a part of. Although he admits to at first being amazed by her acceptance of the model, fearing that she might "dig up irrelevant results" that would again deter scientific research by doubting the "correctness of the double helix," but what follows his initial

impressions of her response is of particular importance (210). Watson might have been surprised at first to find out that Franklin accepted their model, but it was the product of her data, of her work. This reality is emphasized in what Watson was writing, no matter how much he tried to subdue her involvement:

The X-ray evidence had been forcing her more than she cared to admit toward a helical structure. The positioning of the backbone on the outside of the molecule was demanded by her evidence. (210)

Watson does two things with this explanation. First, he implies that Franklin was ignoring the results of X-ray evidence, which he initially neglects to mention is hers, thereby skewing her perception of what the structure was actually like. By saying that it was convincing “her more than she cared to admit,” he forces the reader of this story to think of Franklin as a scientist who worked on personal belief rather than fact, rather than what the data showed. He makes it seem as though she was neglecting evidence provided by her data (uncharacteristic of a good scientist) in order to prove a point. Secondly, in this explanation, Watson openly states that what he and Crick had constructed “was demanded by her evidence” (210). Upon looking at Watson and Crick’s model, Franklin was effectively inspecting her own work. It is obvious why she approved, because she was approving a 3-D image of what she had been working with for three years. In this way, Watson’s narrative shifts Franklin from someone who conducted sound scientific research into someone who couldn’t understand the scope of her data until it was explained for her. Watson makes himself and Crick, but mostly himself, agents of scientific authority by explaining the ways in which Franklin had misunderstood her own data. Watson makes it abundantly clear to the reader that the DNA model is based on Franklin’s photograph 51, and uses this insight to depict her as a less capable scientist. Franklin might have had the

skills to isolate DNA fibers and take the photograph, but it was Watson and Crick who put the pieces together. In this way, Watson's narrative makes the case that Franklin's "good brain" was used for the purpose of advancing the research of actual scientists like himself and Crick.

Authority and Time

James Watson is currently a professor at Cold Spring Harbor Laboratory in New York. The institution celebrated "Double Helix Day" in March 2016 with presentations of current research and a talk with Watson himself. It has been sixty-four years since the publication of Watson and Crick's proposed model of DNA in *Nature*. Nonetheless, Watson brought back some of the events from that time in his talk. Watson also gave advice about working in science and about what a proper scientific education looked like. One particularly important piece of advice concerned which science courses to take while in college. Watson spoke of personal experience when he said,

The easiest way to get good grades, it turned out was to take biology courses. [Laughs].

Because physics and chemistry was, you know, for boys, biology was girls. You know, it was just a lower level. And, so, I always got A's. (Cold Spring Harbor Laboratory)

Watson's gendered categorization of physics, chemistry, and biology indicates the perception of who could be involved in certain academic subjects at the time, but also emphasizes Watson's discriminatory view of the sciences. He enforces that because biology was a "lower level" science, it was best suited for girls, or anyone who couldn't handle what chemistry and physics had to offer. This statement of inequality in studying the sciences completely contradicts what Watson wrote in the epilogue of *The Double Helix*. In the epilogue, Watson aims to counter his discrimination and objectification of Franklin throughout the rest of the book by listing the ways

in which her contributions to the research were important. In the second to last sentence, Watson displays some sort of empathy towards Franklin when he notes that he had realized “years too late the struggles that the intelligent woman faces to be accepted by a scientific world which often regards women as mere diversions from serious thinking” (226). It is important to note that Watson emphasizes the “intelligent” woman here as having a difficult time being accepted in the scientific community, when upon remembering his own educational endeavors considered biology as an easier science that was suitable for girls. Why then would the intelligent woman have a difficult time being accepted into science? Because, according to Watson, “mere diversions from serious thinking” were allowed to be in the same workspace as those who could handle the more serious sciences like chemistry and physics.

Despite what he wrote later, *The Double Helix* demonstrates that Watson did not think of women scientists as scientists. Evidently, he still does not. What Watson continues to focus on in his talk at Double Helix Day is creating a narrative that shapes the role of Franklin and his other colleagues in the discovery of the structure of DNA. Nearly sixty years after Franklin’s death, Watson continues to provide the details of the story that disqualifies her from thinking and researching in a way that lived up to his standards of a scientist. More specifically, Watson’s constant narration of this story further suppresses Franklin’s role in scientific discovery and elevates his own. Watson made it seem as though Franklin’s science was based on social pressures and emotions, not actually her own intuition and intellect. He describes her initial rejection of the helical structure of DNA by saying, “she didn’t want a helix because Wilkins had said helix, I had said helix, Francis had said helix. She didn’t want it.” Watson implies that because everyone working in the Cavendish laboratory believed one thing about DNA, Franklin would always prefer to believe the opposite, which diminishes her individuality as a researcher

and downplays her knowledge of the field. By creating this narrative, Watson makes Franklin the less competent scientist. In this narrative Franklin is not able to think on her own accord or make her own observations without them first being compared to those of her male colleagues. Watson acts as another filter as an author, writing the narrative of a female scientist whose ideas were first filtered through the men she worked with before they could be interpreted.

Anne Sayre, a biographer and close friend of Franklin, interviewed Watson on August 19th, 1970 in preparation for her book *Rosalind Franklin and DNA*. After arriving four hours and fifteen minutes late to meet Sayre at his office at Cold Spring Harbor Laboratory, Watson was unconcerned with what she was writing, admitting, “I can’t remember what you’re here for,” and then when reminded of the biography, he asked, “Why are you writing a book about Rosalind Franklin?” The interview lasted only an hour, but the awkwardness between Sayre and Watson lifts off the page of the transcription when their conflicting opinions about Franklin and about women in science emerge. Besides calling Franklin “impossible,” Watson claims to know little about her background but then gives his extensive opinion on her relationship with her family. The word he uses to describe her most ardently throughout the interview is “stubborn.” At this point, Sayre makes the case that the stubbornness Watson notices is really just her need for “demanding proof for statements, about not taking things on faith or by guesswork,” but by requiring the facts of the research she consulted or conducted. Watson disagrees and claims that her stubbornness was a part of her disapproval for the double helix model (8). By describing Franklin’s stubborn character in reaction to science, he makes it seem as though she did things her own way and did not bend to the traditional rules of a working scientist. In this way, Franklin’s attitude towards science is shifted into an almost juvenile sentiment of not getting her own way, which Watson cites as her inhibition in being accepted by the scientific community.

Watson ignores the reality of gender discrimination in science laboratories, even regarding the exact place where he took part in discriminating against Franklin. He expressed to Sayre, “I don’t think there’s any discrimination or whatever you call it about women in the sciences.” Sayre was then quick to point out that many people thought of King’s College as discriminatory when Franklin was there, to which Watson argued that Franklin wanted to eat lunch by herself and not with “the rest of the guys.” The discrimination that was occurring, however, was much more than not being accepted at the lunch table. Watson’s view of Franklin in the 1970 interview was still consistent with what he wrote in *The Double Helix*. He continued shaping the narrative of Franklin as someone who was an impediment to her own research and whose personal characteristics prevented her from becoming an accomplished scientist like himself. The interview with Sayre ended with Watson again questioning her reason for writing the book, saying, “Well, I wonder if it’s worth writing.” Sayre explains that Watson was extremely proud of his own work in *The Double Helix*, which he only referred to as “the book,” when they discussed it in the interview. She described their meeting as “highly unpleasant” and remarked that Watson’s demeanor “varied between sneering and superior” throughout. Based on Sayre’s interview, Watson seems to be the stubborn one in the situation. Watson is the one, who after twenty three years at the time of the interview, was still creating a false image of Franklin because “that’s how [he] saw it,” and no authority was going to convince him otherwise. Sayre best describes his attitude when she notes after the interview that, “He either doesn’t think he has harmed anyone (or anything, such as the ethics of science) or if he does think so, then he doesn’t give a damn.” Their interactions throughout the interview indicate that Watson is fixed in his ways. His stubbornness then prolongs the discrimination of Franklin. Because he has authority

from being regarded as one of the leading pioneers in science research, he continues to publish under that persona, making Franklin's work less valuable.

Chapter Two: The Modern Biologist Who Could Write

A few weeks after Rachel Carson published her second book, *The Sea Around Us*, she was highlighted in numerous newspaper articles, even the most favorable of which displayed a gendered response to both her physical characteristics and her writing. Cyrus Durgin, a staff writer from *The Boston Globe* profiled Carson in an article entitled “Overnight Miss Carson Has Become Famous”:

Would you imagine a woman who has written about the seven seas and their wonders to be a hearty, physical type? Not Miss Carson. She is small and slender, with chestnut hair and eyes whose color has something of both the green and the blue of sea water. She is trim and feminine, wears a soft pink nail polish and uses lipstick and powder expertly, but sparingly.

Durgin’s rhetorical question is meant to convince the reader that a woman writing about and researching the ocean did not in fact look like a creature pulled from its depths, but rather a slight woman with a good understanding of make-up. This description is placed before an interview in which Carson discusses how she became involved with her research and what led her to be interested in science from the time she was a young girl. By prefacing the interview with such a detailed description of Carson’s appearance, Durgin detracts from the science behind the scientist. By detailing Carson’s life, he also humanizes a field of study that was and still is considered impersonal. While this may have been his goal, the gendered observations in the article take away from the importance of Carson’s work and shift the focus instead to her gender performance. Durgin describes Carson’s research and life work in the sciences as a function of her physical appearance. Her eyes, as he notes, have hints of “both the green and the blue of sea water.” Durgin’s descriptions of Carson display a fascination with how she looked, which

displaced her by connecting her physical attributes not only directly to her field of study, but to the object of her study as well. On the one hand, she is being made to stand out as feminine (shifting the focus away from her research), but she is also made to become part of her research, which displaces her as the scientist that conducted it. This skewed perception is present in numerous newspaper articles. Media representations in this case shift the general perspective of Carson by focusing more on her appearance and the surface-level criticisms of the inaccuracies of her research than what her research contributed to the scientific community.

By focusing on Carson's appearance, Durgin plays a part in contextualizing the way in which women who conducted scientific research were perceived. His comments contributed to the general perception of women scientists because of the wide-ranging audience of the *Boston Globe*. Carson was set apart. She was featured not only as a scientist but as a human being, which was rare in the sciences and especially for women. This feature, although positive press for Carson, focuses more on her physical appearance and her femininity than her scientific work, and as a result perpetuated the idea that scientific work was more of a hobby for women scientists and emphasized the obsession with their appearances. By shifting the public's attention more toward who Carson was apart from her science (with comments on her appearance), Durgin unintentionally created a way of reassuring people that women scientists were in fact normal women. This unintentional reassurance is not malevolent in any way on Durgin's part, but rather points to the societal expectations for women which women scientists were challenging and outstepping. Because scientists like Carson were reaching beyond what society had planned for them, and their abilities were equaling or surpassing those of men in the field, the public, and especially male scientists were being forced to think differently than in the past. This created a response that was somewhat mixed. As Michael Smith argues in "Silence Miss

Carson!’ Science, Gender, and the Reception of *Silent Spring*,” women in science, and Carson specifically, were set “outside the nexus of the production and application of conventional scientific knowledge” because of the history of western science itself (734). Rachel Carson was not supported by any major university or company and was, as Smith suggests, producing knowledge that surpassed the standards put in place by the “conventional” scientist. Although this unconventional science was certainly true of Carson’s work, it was also true of the research conducted by all women in science. What was historically considered a man’s pursuit was becoming the life’s work of many talented women, with or without institutional backing. This change triggered a response that was intentionally focused on the preservation of the way science had been carried out. Science was considered reserved for men, and the pushback *Silent Spring* received from the chemical industry is just one example of how much control these scientists had over the public’s perception of who a scientist was and what they did. Exclusively claiming science as a man’s field left little room for the voices of women. Carson’s work was attacked because “she was speaking in a man’s world, the inner sanctum of masculine science in which, like the sanctuary of a strict Calvinist sect, female silence was expected” (Smith 738). Carson was fighting against what was expected of science in her research, and, industry scientists were combatting her efforts because they challenged their engrained societal role. Criticisms of Carson’s work and of other women in science through gendered language and a distortion of the credibility of their work pointed out exactly what was at stake – an unwanted female presence in science.

Rachel Carson, a marine biologist, conservationist, and writer, was one of the first scientists to make complex scientific concepts accessible to the general public. Carson’s studies, although thorough, were contested by other scientists who maintained previous publishing

success and authority. They gained and maintained this authority by publishing their scientific research in academic journals and other formats that historically have favored the male scientific opinion and research over what women were working on and theorizing (Ceci and Williams). Women scientists were often doing the same work in the same kind of laboratories as their male colleagues, but what they were working on would go unnoticed or underrepresented in scientific literature. As Sandra Harding notes, it is only recently that “a new generation of historians is bringing to bear on the lives of these women” who were previously “ignored or devalued in the androcentric mainstream literature” (22). When women are excluded from the historical narrative of science, their contributions become misrepresented. It is important to note that Carson worked as a government scientist for the Fish and Wildlife Services, where she collaborated with other scientists on projects and reports that involved both laboratory research and literary ability. While working on such projects, Carson was able to “turn out interesting and scientifically accurate feature stories” (Lear 83) that captivated anyone who read them. This set her apart from those she worked with, but made her work as a scientist all the more important. Communication is a vital part of scientific research that not only conveys tables, graphs, and other forms of data into a coherent body of work, but also helps create connections within the scientific community as well as those outside it. Because Carson had both an aptitude for writing (she was originally an English major at the Pennsylvania College for Women before her advisor suggested she switch to Biology) and for science, her work and interpretations could easily be understood by almost anyone. What became problematic was when scientists (with as much training as Carson) began to treat her work as unscientific based solely on the fact that she was a “female scientist without a Ph.D. or an institutional affiliation, known only for her lyrical books on the sea” (Lear xvii). Her writing style and freedom to work outside the boundaries of traditional academic

standards benefitted her own worth as a scientist but were the focus of criticisms by those who maintained a strict standard in their minds of what scientific work looked like and who conducted it. This work was considered the objective of man and any exception to this did not fit in with the bracket of “real” science. The reception of women’s involvement in the field highlights the “gendered ways Western culture has constructed science” to be a man’s practice (Smith 734).

Gendered resistance to Carson’s work came to a head with the publication of her second book, *Silent Spring*, in September of 1962. The book not only challenged the public’s perception of pesticides, but also changed the way people thought about who was conducting scientific work. It served as a warning against the overuse of pesticides and argued against the methods of the top chemical manufacturing companies in the nation. Scientists associated with such companies went on the attack, claiming that not only was Carson’s work wrong, but ultimately not needed. Responses to *Silent Spring* took all forms – newspaper articles, journal articles, chemical company magazine segments, and news report specials. The quantity of such responses suggested that the book was reaching a vast and varied audience. Carson was contributing to the scientific community and received several reactions on their behalf, but what was unusual about her writing style was that it also spoke to the non-scientific reader. Because of this accessibility, however, industry scientists were able to frame an argument against Carson’s work that overlooked offering suggestions to her claims and plainly opposed what she was writing.

By disregarding Carson’s claims, the chemical industry moved forward in an attempt at reinforcing any cases of weakened confidence in its members. An anonymous article published in *Chemical Engineering News*, titled “Industry Maps Defense to Pesticide Criticisms,” spills industry fears and as the title suggests and identifies modes of dealing with Carson’s critiques of

their line of work. It is important to note that this article was published ahead of *Silent Spring* and was in response to the excerpts of the book printed in *The New Yorker*. The article presents a sizable picture on its first page of Carson looking into a microscope and informs the reader that the Federal Council for Science and Technology is planning a meeting with an “ad hoc committee” to review “present government activities with respect to pesticides and other chemicals in the environment,” reassuring readers that they have things under control. It is even noted that the people participating in the committee are to be “government personnel,” further reassuring readers that the situation is being handled by those with authority. In highlighting these reactions, the article reinforces the idea that there are more capable scientists responsible for the issues at hand. These articles make it clear that industry scientists and writers “were trying to preserve the public’s credulity in the ability of science and technology to solve problems both presented by nature and those that developed as unforeseen consequences of applied science” (Smith 740). Scientists wanted to make sure that what they were publishing made the public and other scientists with the same mindset feel secure in their positions. Studied in between reactions from different industries affected by Carson’s writing are individual quotations from “scientists [who] take issue with Miss Carson’s views” and a quotation from Carson of her perspective on the pesticide industry. This not only breaks up the unsupportive reactions, but very clearly positions the industry against Carson. Quotations from three scientists—all white men—who oppose Carson follows directly after a reprint of the excerpt from *The New Yorker*. Entomologist George Decker insists that *Silent Spring* “poses leading questions, on which neither the author nor the average reader is qualified to make decisions” and later claims, “I regard [*Silent Spring*] as science fiction, to be read in the same way that the TV program ‘Twilight Zone’ is to be watched.” In referencing the “Twilight Zone,” Decker makes

Carson's writing equal to entertainment. Regarding *Silent Spring* as science fiction created a disparity in the reader's mind between what real science was and what was written as entertainment, as an oftentimes-exaggerated story. This perception, created by industry scientists, skewed what Carson was really putting forth.

The motives and tactics of industry became clear as defense publications began circulating. This industry response to Carson's work was not gendered in the way that the individual critiques of her science and her gender performance were. However, these publications provided a path for a more gendered response from industry scientists writing on their own as consultants of the field. The industry's position permitted their scientific staff to publish critiques of Carson's work that were gendered because they already maintained the credibility from their corporations. Because the industry opposed what Carson was doing (perhaps less gendered and more related to business security), scientists were also able to critique Carson but in a way that brought sexism to the forefront and left scientific progress behind. In creating a response system to Rachel Carson's claims, the chemical and agricultural industry was very specific about what steps they would take to combat accusations made against them. For example, in "Industry Maps Defense to Pesticide Criticisms," it is noted that "ten or 12 companies are preparing point-by-point rebuttals to *The New Yorker* series for their own use," and it was emphasized that this approach would "take time, [and] mean many man-hours of literature searching and writing." This, however, is exactly what went into creating *Silent Spring* – hours and hours of writing and making connections between studies to find patterns in chemical use and its role in the environment. In this way, Carson's work is glossed over and not given the proper credit. Somehow "man-hours" only counted when they were actually completed by men. The industry took longer than expected to present its reactions, however. As noted in the

article, “several reasons [were] behind the delay,” namely the notion that each company’s argument would be more effective if presented as a part of a team, one that would “coordinate actions, to work as an industry” rather than separately as a part of a “company-by-company basis.” This delay points to an uncertainty in their response, a hesitation in trying to collectively gather a cohesive perspective on Carson’s work. Frustrations were expressed in the *Chemical and Engineering News* article about the process of creating a response, that it was “time-consuming,” and the general arguments of those on the committee were inconclusive. Overall, a lack of effort and interest were shown through statements like, “[the] industry has not been able to agree on whether or not to ignore [Carson’s] attack,” claiming that paying attention to her writing would place too much of a focus on her published inaccuracies according to the industry. This act of ignoring the situation at hand in order to steer the public away from Carson’s work created a gap in the perception of the research that was being done and in the perception of Carson’s credibility.

Science is such a controversial field because of the nature of research and its susceptibility to contrasting interpretations. Much of what Rachel Carson was arguing in *Silent Spring* was not given the chance to enter into scientific debate. By refusing Carson’s work the merit it deserved, the industry framed a way in which to approach science that they deemed unimportant. Naomi Oreskes and Erik M. Conway pick up on this discrimination in their book, *Merchants of Doubt*, which records the accounts of several groups of scientists who obscured the “truth” when it came to controversial issues. Oreskes and Conway point out that companies realized that in responding to potential controversial situations, “if you could convince people that science in general was unreliable, then you didn’t have to argue the merits of any particular case,” which reinforces the proposed response to Carson’s work. In an attempt to keep public

attention at bay, companies and industry scientists used their authority as highly regarded figures to convince people that what Carson was writing about was irrelevant. The industry mapped their response based on their privilege. As Oreskes and Conway claim, “In the demonizing of Rachel Carson, free marketers realized that if you could convince people that an example of government regulation wasn’t, in fact, successful [...] you could strengthen the argument against regulation in general,” which is exactly what the professionals in industry were doing. Much of what they were arguing for was based on first discrediting Rachel Carson for the work she had done, making it seem impractical, and then in rerouting people’s interpretation of real science by providing their esteemed opinions. It is an argument that assumed a response to Carson was not needed, that surface-level criticisms sufficed and distracting the reader with comments on her appearance and gender was adequate. In creating their own sense of this controversy in the public’s mind, the industry was able to manipulate their reactions as well.

An emphasis is put on the role of “educating the public” in journal coverage of the *Silent Spring* controversy. In an article titled “How do you fight a bestseller?” published on November 30, 1962, what is argued is that the majority of the industry’s response has been to prove Carson wrong by communicating to non-scientists exactly what was happening from the industry’s point of view, perhaps the more trusted voice. Companies were infiltrating the general public’s mailboxes, radio programs, and televisions with information from “trusted” sources. As it is pointed out in “How do you fight a bestseller?” information was being sent in the form of an advice column from a chemical journal “on the benefits of chemical pesticides to 2,200 publications a month,” in addition to what was already being presented on air. The mission was to provide context to the issue at hand, a frame that Carson apparently had not given. The chemical company American Cyanamid, which was supported by Robert White-Stevens (a

particularly harsh critic of Carson), sent out “a barrage of news and feature material to daily papers on the benefits of pesticides and ha[d] structured articles for agricultural users to put the controversy into perspective.” This perspective was one that was informed by scientists who believed they had some sort of precedence over Carson, even though their training, although perhaps in separate fields of study, shared the same scientific roots. In addition to these responses, other companies like Wyandotte Chemicals Corp. and Velsicol Chemical Corp. were adamant in their methods of educating the public. Velsicol even, as the article notes, “published an 18-page article, complete with a bibliography, entitled, ‘The Necessity, Value and Safety of Pesticides’” which created a sense that the issue at hand was to be taken seriously. These responses, although disguised under the implication that they were educating the public, forced Carson’s perspective out and brought in what was considered the right point of view. In effectively diminishing Carson’s input on the effect of pesticide use, the industry took matters into their own hands.

One of the most aggressive responses from any company arguing against Carson was that of Monsanto Chemical Company. Monsanto’s response took the form of an article, “The Desolate Year,” published in their monthly magazine, which was distributed internally within the company. Monsanto’s main goal in publishing this piece was to undermine Carson’s work and communicate their predictions of a world without pesticides. Because this magazine was only sent to employees, Monsanto was able to mock and downplay her work to protect their livelihood and the morale of their employees. It is important to note that the article was published in October of 1962, a mere four weeks after *Silent Spring*. The rhetoric used directly mimics the writing style in chapters written by Carson and aims to convince readers that a future without pesticides is bleak at best. It also aimed to convince Monsanto employees of their job

security. In imitating Carson's writing style, Monsanto not only mocked her, but convinced their staff (on the basis of the article's publication) that what they were doing was important for public health and that scientific debate was not needed. In order to reassure its employees, Monsanto had to display the stronger response and solution.

Although "The Desolate Year" was only sent to employees of Monsanto, thereby reinforcing company security, the content of the article showed the ways in which gender entered into this capitalist defense of the pesticide industry. The article highlights two hypothetical situations to show how both men and women would be impacted by the destruction of pesticide companies. An imagined citrus farmer, who Monsanto depicted as male, stands "petrified, a pierced and wormy grapefruit in his hand and the frightening Medfly flitting through his trees," as if completely derailed by the horror of insects without pesticide use (5). It is important to note that the male farmer, someone who undertakes physical labor, relying on his own strength, is contrasted with a "New York housewife" in which both a difference in location and physical capability are emphasized. This housewife is described in a similarly helpless way as dog ticks crawl through her apartment. This contrast sets the reader up not only to assign men and women specific roles in their professional lives, but also suggests who is equipped to handle such disasters. The character descriptions are also similar to the coverage of Rachel Carson's persona in newspaper articles and other mediums as a shy and timid woman, who surprisingly also maintained a career in researching and publishing scientific work. The woman's role is designed to cause more of a reaction, more of a noticed concern, as the housewife in this case "caused more widespread alarm," compared to the farmer who stands in disbelief of a world without pesticides. This heightened reaction on the part of the housewife is comparable to the ways in which Rachel Carson was described as being over dramatic when writing about pesticides.

Although the causes of the responses are different (the overuse of pesticides in Carson's case and the lack of pesticide use in the housewife's case), the characterization of the amplified responses is the same. The article evokes a sense of alarm by describing what a year without pesticide use would look like in a similar writing style to Carson's. In this way Monsanto mocks her and does essentially what they claimed Rachel Carson did with *Silent Spring*. They exaggerate scenarios of mass infestation and write in a style of language suited for a piece of fiction. They mock her writing style without really contesting her results.

Most of what was said about Carson was tied to the idea that what she was arguing for so fervently was nonsensical. Industry scientists perceived her as a threat to their entire operation. Scientists participated in lectures like the one given at the Agricultural School at Rutgers University in 1963 to give perspective on the recent events in the industry. As a "spokesman for the chemical industry," who worked for the agricultural division of the American Cyanamid Company, Dr. White-Stevens was introduced by professor of horticulture Norman Childers, who began by saying, "Well, I guess you all know that Rachel Carson has stirred up a fuss." In prefacing the event this way, Childers not only exposes his immediate opinion, but also frames White-Stevens' remarks in a way that suggests he is against Carson too, before he says anything. In referring to Carson's work as a "fuss," Childers implies that the research of a successful scientist and published author is not warranted. The word also suggests a feeling that Carson's concerns were not important, that they were not worth the attention she was drawing to them. This word invokes sentiments of "a needless or excessive display of concern" (See OED, "fuss," *n.2.*, 1.a) and suggests that the person creating such a display is in "a state of (more or less ludicrous) consternation or anxiety" (See OED, "fuss," *n.2.*, 2). Childers downplays Carson's concern when he describes it this way. He invalidates her research by assigning a word that

implied what she was doing was unnecessary. The term implies that Carson was childish, and it downplays her expansive knowledge when it is used to describe someone who was writing on pertinent issues affecting every part of human and animal life. In using the word “fuss,” Childers implies a sense that Carson shouldn’t have wasted her time (or others’) with her research, that she shouldn’t have gotten herself all worked up about something so unimportant. Childers goes on to admit that he did not even bother to read the book and did not “imagine [the audience] did either.” This prelude to White-Stevens’ remarks set the tone for the entire lecture in its ability to dismiss Carson’s capability as a scientist and author from the very beginning.

White-Stevens, although a bit “ill-at-ease” after Childers’ introduction, goes on to give his personal perspective of what was referred to by Childers as the “Rachel Carson thing.” Norman H. Dill, from the Botany department at the University, reported on the lecture. Dill noted that, “many of White-Stevens’ points were scored by first telling [the audience] what Miss Carson had said in the book, and then building a logical argument to tear it down.” Dill adds that Carson’s claims in *Silent Spring* were not as White-Stevens had described them. White-Stevens presented factual information about the use of pesticides by the agricultural industry to the audience and displayed a general sense of calm in the wake of the claims he was defending his industry against. Dill notes that White-Stevens even asked, “Just how many human beings is one robin worth anyway?” This rhetorical question references Carson’s study of birds and questions the authority upon which the chemical industry is doubted. By asking this question, White-Stevens undermines Carson’s right to conduct research that is not in line with the goals of the chemical industry. He makes her claims less meaningful and significant by intervening.

Like Childers and White-Stevens, William Darby, Milton Carleton, Thomas Jukes, and William Bean are among the main critics of Carson’s work who also describe it as “alarming”

and “emotional,” terms which set a specific gendered frame around the response to her publications. The industry attacked Carson’s work because it threatened their profits, but the language used in subsequent criticisms from scientists with institutional backing, who either spoke or wrote independently, referenced Carson’s gender as the problem that got in the way of what she was trying to accomplish with her research. In most cases of criticism, Carson’s identity as a woman was seen as the primary thing that made her work untrustworthy. What most industry scientists were concerned about was Carson’s discussion of the properties of chemical pesticides such as DDT and Dieldrin. In the chapter titled “Elixirs of Death” in *Silent Spring*, Carson outlines the characteristics and effects of the chlorinated hydrocarbons in great detail, even noting that, “an intake of as little as 1/10 of one part per million in the diet results in storage of about 10 to 15 parts per million” (Carson 21). The amount of detail Carson provides goes beyond a basic understanding of organic chemistry and enlists 70 sources for a 22-page chapter. These sources include everything from research conducted by the American Journal of Veterinary Research and the Journal of Agriculture and Food Chemicals to historical research (giving context to the use of these chemicals over time) found in the A.M.A. Archives of Industrial Hygiene and Occupational Medicine. This amount of detail, however, was deemed an exaggeration. Carson was not only providing an understanding of chemical properties in a way that a general audience could make sense of, but she was also contextualizing the use and overuse of these chemicals throughout history. Industry scientists took this information and claimed that Carson was overemphasizing the role of these chemicals in nature to make a point, to “rule out” the use of certain chemicals, when what she was really doing was educating the public about the possible dangers of overusing pesticides.

Industry scientists worked to create a perception that what Carson was writing was not

just wrong, but unneeded and unnecessarily alarmist. The tone of her writing was consistently described in a way that would depict her as “hysterical and emotional” (Oreskes 220), making claims that were not supported by real science. As Michael Smith points out, “these writers also engaged in gendered critiques of what they called Carson’s emotionalism and her vision of progress rooted in ‘sentimentalism’ rather than reality” (737) by creating arguments that suggested her gender was responsible for these faults. They believed that her ideas were not valid because of the history of women’s societal roles. Sandra Harding describes women in science as historically being “unusual in their own day,” and that their experiences were “not typical” (25). The gendered response to Carson’s work came out as a result of the adjustment to women being in positions in society that they hadn’t been assigned to. While it is true that the chemical and agricultural industries attacked Carson’s work because it opposed and threatened their productivity, the way in which they approached their criticisms through gendered references suggests that there was more at stake than just losing business.

It is also important to note that the gendered interpretation of Carson as a scientist did not stop after she died and was not just written by people who did not agree with her work. Michael Smith, although providing a detailed argument against the gendered approaches to Carson’s critiques, makes one in his own writing. In describing her response to the progress of the pesticide industry, Smith notes that, “Carson shook her finger at the careless, regressive path science had taken with regard to pesticides” (749). Smith, perhaps unintentionally, creates an image of Carson that is reminiscent of a wise grandmother who knew better than the industry scientists and responded with a sentiment of “I told you so,” rather than providing scientific evidence to back up her claims. In this way, Smith writes in the same manner as Cyrus Durgin from the *Boston Globe*, who had all the intentions of writing something positive about Carson,

but ultimately created a gendered lens through which to view her as a scientist. Anne Fausto-Sterling picks up on this when she notes that “hidden agendas, non-conscious and thus unarticulated, bear strong resemblances to broader social agendas” (42). What is written in critiques and sometimes even praise may not be intended, but may point to larger disparities in society between what is expected of men and women in general and in the sciences.

At the 29th annual meeting of the National Agricultural Chemicals Association in 1962, White-Stevens spoke on how to effectively communicate ideas within the industry. What is important to note is that White-Stevens warns, especially in relation to the media, that one should “avoid exaggeration, hyperbole and misrepresentation,” as a way of using technology appropriately. He also speaks on writing and advises, “that the responsible speaker or writer [should] meter his words to the facts with careful precision,” so as to not veer from the truth. White-Stevens creates a specific rhetoric for scientific communication, which he deems acceptable and introduces to others. He goes on to explain (and quote) some of the recent misinterpretations and exaggerations he had explained. There is a sense of fear and assurance in the tone of his writing that implies the extent to which he aims to reassure the industry that their profession is indeed right. White-Stevens makes this feeling of support apparent when he says, “This gross misunderstanding, punctuated all too frequently by crises and synthesized by sensationalism, is the target at which we need to fire our ammunition of fact, reality and scientific truth.” According to White-Stevens, misinterpretations of science were being published and circulated without being subjected to real science first. The argument made for scientific fact pushes Carson’s perspective aside and assumes that it is not up to standard. White-Stevens bolstered his instructions to the industry based on the fact that what they were doing was sound science. It was in this way that for scientists like White-Stevens, “whose power in shaping

society through expert scientific advice hung on their credibility as both protectors of the public interest and exemplars of the ‘true’ science, [that] Rachel Carson’s conclusions and analysis were terrifying” because they flipped the societal roles that these men were trying to uphold (Smith 743-744). Carson was making a path through a field that had historically been populated by male opinions and discoveries. White-Stevens argues that what he writes is science and he implies that what Carson writes is sensationalism. His response suggests that what Carson was writing was a mere exaggerated “gross misunderstanding,” rather than a call for concern backed by scientific evidence. He reinforced the idea that the industry’s position was one that was calm and qualified where Carson and other scientists merely sounded “alarums.” This authoritative assumption over the right perspective is shown when White-Stevens remarks, “One would think that the munificence around us would be evidence enough to decide,” which perspective to believe in regards to the issues surrounding the chemical industry. This assumption displays the defensive reaction of the industry while also alluding to the emotional response that they thought was characteristic of anyone opposing their claims.

Although White-Stevens acknowledges Carson’s “extraordinary, vivid touch and elegance of expression” in her writing and explains to the members of industry present at the meeting that they should model her writing style, he opposes the content behind it. He makes the case that while Carson’s writing is well articulated and detailed, it also provides audiences with information that is inaccurate in his opinion. More specifically, White-Stevens urges that her lyrical style helped her make arguments about science that were wrong. He proceeds to call her articles in *The New Yorker* (what would eventually be published as *Silent Spring*) “illusory” and claims, “Surely she cannot be so naïve as to contemplate turning our clocks back” to a time before modern inventions and technology. White-Stevens makes Carson’s work seem archaic

and outdated. He pushes the idea that “real” science should be moving things forward and not back in time. He used the “general public’s willingness to accept science as it was being practiced as the ultimate authority” (Smith 744) to his advantage. White-Stevens was playing into the role of the ultimate authoritarian, which was set up by a society that put men in positions of power that went unquestioned by the public. What is further troubling is the use of gender roles in describing science and nature. White-Stevens describes the peril of *man* in a world destined to go back in time:

He cannot now go back; he has crossed his Rubicon and must advance into the future armed with his reason and the tools of his sciences, and in so doing will doubtless have to contest the very laws and power of Nature herself .(Agricultural Chemicals Association)

It is man’s calling in life to use what he’s learned and the technology and knowledge he himself maintains to move forward against whatever nature will throw his way. “Man” in this instance is the one to move forward, the one to advance using the science that is solely his own. The science that belongs to men is being used against a female presence, that of Nature. The idea that nature here is feminized and also being fought against rather than worked with shows exactly how science became male-dominated. It becomes clear in this case that science is not only controlled by men but that it also belongs to them. White-Stevens implies that it is the men of science who are working against the unpredictable Mother Nature. White-Stevens describes science as belonging to men by referring to “the tools of his sciences,” a phrase which invokes a certain authority over the domain of science. The tools of science are ones that only men are able to utilize. It is important to note, too, that Nature, as in Mother Nature, is contrasted with the men using science. Automatically in defining nature as female, there is a sense of opposition set in place. Not only is man aiming to control nature in White-Stevens’ description, but he is

controlling a force that is female. This control in a way excludes women from participating in the science of nature and reinforces the idea that women need to be controlled or should be submissive. In the way that White-Stevens describes the advancement of men using “tools of [their] sciences,” he sets up a battle against Mother Nature. It was a way of “advocating man’s role as conqueror, master, and controller of nature” (Smith 738). Man is depicted by White-Stevens as the one to be in a constant struggle to control nature as a scientist which directly opposes his view of Carson’s role in the sciences. By defending nature and calling for its preservation rather than its containment, Carson’s standpoint was not one that was characteristically scientific. The description of reserving scientific work for those men who worked to control nature parallels the sentiments of industry scientists in regards to Carson’s writing. Her claims are made to seem dramatic and untrustworthy, which are characteristics much like the irregular and erratic changes in the environment. Because it was man’s prerogative to battle nature, Rachel Carson’s role in managing and working with nature, seemed insignificant and not helpful. It was not her place to weigh in on the issues of man. If it was up to man to control all of the variables of Mother Nature with science, then it was also in his authority to regulate the science and the perceptions of the science conducted by Carson.

Thomas Jukes, a biologist who was heavily involved in the DDT scandal, took issue with the type of science Carson was conducting. He believed that her writing was problematic and wrote to the Department of Agriculture to warn them of her work. In April of 1963, Jukes wrote to the Department concerning a broadcast they produced that aired on CBS called “The Silent Spring of Rachel Carson” which featured Carson and her perspective on the current issue. Jukes’ letter was sent only five days after the broadcast, and expressed his immediate concern over what was being shown to the public. Jukes not only urged, “Miss Carson’s book is full of

misquotations and misinformation,” but that her “ideas on toxicology are vague, alarmist, and mystical.” By describing her perspective this way, Jukes implies that what Carson was writing about was not actual science but rather something that was unidentifiable and wrong. In using the word “mystical” to describe Carson’s standpoints on toxicology, Jukes invokes a feeling that her work is “mysterious, enigmatic, obscure” (OED, “mystical,” *adj.*, 2.a), and that through her writing she is “obscure in speech, [and] mysterious in behavior” (See OED, “mystical,” *adj.*, 2.b). By introducing the terms “vague,” “alarmist,” and “mystical,” Jukes aims to convince the Department that Carson is untrustworthy and that her science is not real. He claimed that she was misleading the public and advised that the Department take “close scrutiny of the statements made by any representatives of wildlife or conservation organizations with regard to pesticides.” Jukes in his own way did exactly what he accused Carson of doing – creating a cause for alarm. It is also important to note that many conservation organizations were overseen by the Department of Agriculture. By insisting that the work conducted by conservationists be looked at carefully, Jukes emphasizes his characterization of what kind of science should be trusted. His critiques also point to his concern with who was conducting the unreliable science.

The most insistent criticisms of Carson’s work came from those working in the chemical and agricultural industry. Through gendered references, Carson’s critics attempted to convey that there was something missing from what they were reading in her writing, namely an authentic scientist. Scientists like William Darby created a sense in the reader’s mind that Carson and her work should not be compared to what he deemed an actual scientist. In an article published in October of 1962, a month after *Silent Spring*, in *Chemical and Engineering News* titled “Silence, Miss Carson,” Darby emphasizes how distant Carson was (at least in his mind) from the scientific community. He recounts, “Miss Carson’s book adds no new factual material not

already known to such serious scientists.” Darby not only criticizes Carson, implying that her work did not do a service to the scientific community, but by using the word “serious” to describe scientists other than Carson, what is shown is a complete lack of consideration of her as a worthy academic. This divide is continued in a concluding statement where Darby insists that,

In view of the mature, responsible attention which this whole subject receives from able, qualified scientific groups such as those identified in the foregoing (and whom Miss Carson chooses to ignore); in view of her scientific qualifications in contrast to those of our distinguished scientific leaders and statesmen, this book should be ignored. (60)

Darby completely dismisses her existence as an able and qualified scientist when he points out his insecurity with women in science. He values authority, and implies that a “mature,” “responsible,” “qualified,” “distinguished,” “leader]” is exactly what Rachel Carson was not. His description of the ideal scientist stops short of identifying the scientists as male (unlike the “statesmen”), but makes it clear through denoting her “scientific qualifications” that she does not fit within who he considered able to make scientific arguments. It is as if he is threatened by Carson’s role in the scientific community. Michael Smith is correct to point out that Darby was not just giving “a judicious review of a controversial book but a defense of the ideology of modern science and progress against feminine sentimentality” (738) on the basis that it was not qualified as actual science. Modern science, in Darby’s view, did not include the input of women, as they were not what he considered to be actual scientists. Rachel Carson embodied everything Darby opposed. She was a woman without a doctoral degree who was receiving attention for the work she had conducted without adhering to the conventional standards of both scientists and women. In his opinion she was not the person to move science forward because she was not qualified. The authority and privilege Darby exercises in his writing is evident from

the very basis of the publication of this article in *Chemical and Engineering News*, a publication geared toward a specific audience with an even more particular educational and powerful background. Darby's ability to have this article published in a journal that reached people in industry and science puts him at an advantage and his perspective on a pedestal.

William Darby was able to push his perspective further because of the authority he maintained as a trusted scientist. His article took an informative tone, convincing readers of his own credibility and the credibility of other scientists by directing their attention away from Carson's work, in effect saving them from any trouble they would have faced in reading her book. He distracted readers in "Silence, Miss Carson" with statements like, "It is doubtful that many readers can bear to wade through [*Silent Spring*'s] high-pitched sequences of anxieties." By creating this diversion, Darby forced a perspective that saw what Carson was writing as some sort of whiny emotional outcry instead of sound research. The notion of hysteria is highlighted in the gendered reference to Carson's writing as "high-pitched" and it being described as an "anxiety." Laura Briggs reinforces the idea that, "hysteria [was] at once a diagnostic gesture of [the] dismissal of women as competent participants in public life, a social role uncomfortably inhabited by suffering women, and a warning about the dangerous consequences for women of engaging in 'unfeminine' behavior" in her article, "The Race of Hysteria" (247). The capacity to view Carson as an incompetent participant in science is afforded by criticisms that undo her research by using language that underscores improper emotion and hysteria. Carson's existence as a female scientist was unsettling to Darby. This switch in societal roles, abandoning the notion of "unfeminine behavior" was what prompted the gendered response to her work and worth as a scientist. Darby's interpretation of *Silent Spring*, although absurd, was powerful because of who he was – a well-respected biochemist with institutional backing. He hoped to be able to persuade

readers because of the authority and privilege that allowed him to be published in a publication that was popular with other scientists. In describing Carson's writing almost as a physical hardship that the people had to endure while reading her research, Darby aimed to convince the reader not to waste their time. By adding the phrase "high-pitched sequences of anxieties," he reinforced the stereotype of women scientists as being hysterical and identified her work as an outpouring of "anxieties," a series of concerned statements rather than well-informed hypotheses. Industry scientists who saw Carson as a threat to their own work supported this sort of interpretation. As Linda Lear notes in her introduction to *Silent Spring*, "the industry spent a quarter of a million dollars to discredit her research and malign her character" (xvii) because of what she was writing. In doing so, high profile scientists formed something of a coalition against her claims.

The controversy and the gendered representations of science were brought to the homes of the public on April 3, 1963 when CBS premiered its broadcast of "The Silent Spring of Rachel Carson." The hour-long segment featured interviews conducted by Eric Savareid and Jay L. McMullen from Carson's critics and supporters as well as an interview of Carson herself. Numerous letters were sent to CBS, when news of the broadcast was made public, to urge the network not to televise the segment. What is important to note too, is that articles were published by the chemical industry to reassure its employees in response to the broadcast in the same way they responded after the publication of *Silent Spring*. The National Pest Control Association sent out a statement which reinforced the idea that their "industry's position with the public must continue to be to provide service for them with full consideration of public safety." Phrases like "your Association" are used again to encourage employees of their rightful position in industry. It is almost as if the CBS Reports broadcast was a national tragedy, and the chemical companies

were reiterating their commitment to their people in a time of uncertainty. There is a sense that the industry had just taken a major setback with statements like, “we are using our pesticides as wisely as we can learn how. We are following the best scientific leadership of our country.” It is important to keep in mind that the broadcast hadn’t even aired at this point, and already the industry was in a position of defense. They claimed Carson did not have the “proper perspective” and expressed their wishes that “CBS Reports [would] provide some of the balance lacking in the book.” This kind of presupposed notion of what the segment was going to be extends the idea that the chemical industry was not ready for a change.

The way in which the broadcast was structured is indicative of the response to *Silent Spring*. First, the interviews of Carson’s critics (from entomologists to toxicologists) explain their perspectives on the controversy, in which the majority of airtime is given to Robert White-Stevens. White-Stevens is interviewed in his laboratory among test tubes and other equipment, dressed in a long white lab coat. This depiction contrasts sharply with the way Carson is shown. After fourteen minutes of critiques of her work, the broadcast cuts to Carson, dressed in modest clothing and seated with Eric Sevareid in her home. In juxtaposing Carson and White-Stevens in this way, the CBS broadcast puts an image in the viewer’s mind of what a scientist looks like. This image paired with claims made by White-Stevens about the faults in Carson’s work further suppressed the public’s perception of her role in shaping a scientific revolution. White-Stevens maintained his usual perspective and insisted that Carson “discounts and deliberately depreciates all those safety measures which research laboriously has developed.” By pointing out the effort required to produce scientific skill and qualification, White-Stevens denies Carson of having those qualifications. He is again focused on her supposed inaccuracies and exaggerations as a main source of why she shouldn’t be trusted.

The broadcast, although it highlighted many of Carson's critics, favored Carson's perspective on the issues at hand. Perhaps the most powerful part of the broadcast was when Carson spoke on the state of science and how it was evolving. Of course her presence as a female scientist was one of the driving factors in the changing field, but Carson described a people that were struggling in their understanding of the natural world. Carson emphasized:

We still talk in terms of conquest, we still haven't become mature enough to think of ourselves as only a very tiny part of a vast and incredible universe. Man's attitude towards nature is, today, critically important simply because we have acquired a fateful power to alter and to destroy nature. But man is part of nature.

By pointing out science's historical role of conquest, Carson highlights the importance of understanding nature from a different perspective. She was aware of what it took to comprehend and work with nature in a way that was respectful not only to the environment but the people she collaborated with. In a society where man was put in charge of nature, Carson changed the narrative. She realized that in science it is our duty to "prove our maturity and our mastery, not of nature, but of ourselves."

Chapter Three: Computers, Calculations, and Cinematography

Two weeks after starting work at NASA's Langley Research Center, Katherine Johnson was transferred from the West Computing Group to the Flight Research Division. She was one of four female mathematicians working in the division, and was one of only two African American women assigned to the position (Shetterly 250). Upon arriving at the division and settling into an open cubicle, Johnson was shot a glare from the engineer sitting next to her. He promptly left his seat after she sat down, and:

Bemused, Katherine considered the engineer's sudden departure. The moment that passed between them could have been because she was black and he was white. But then again, it could have been because she was a woman and he was a man. Or maybe the moment was an interaction between a professional and a subprofessional, an engineer and a girl.

(123)

Although her degree from West Virginia State College (which she received when she was eighteen) and her extensive knowledge of mathematics had earned her a spot in the division, nominated by Dorothy Vaughan, mathematician and head of the West Computing Group, none of that seemed to matter in this moment. Margot Lee Shetterly emphasizes the ways in which this interaction is multifaceted with discrimination. It could have been the result of the perception of her race, gender, or ranking as a mathematician mistaken for just a "girl," or a combination of all three. It is important to note here, though, that Johnson did not want the possibility of these scenarios to offset the plan for her career. According to Shetterly, she gave herself the opportunity to "decide [that] it was her presence that provoked the engineer to leave, or she could assume that the fellow had simply finished his work and moved on" (124). Instead of focusing her energy on what might have been, Johnson concentrated on her new position in

flight research. After all, she had been selected for a position that suited her whether or not her coworkers agreed.

Katherine Johnson, a research mathematician and physicist, grew up in West Virginia and calculated the flight path for the first manned mission to the moon in 1969. She enrolled in college at the age of fifteen and, graduating by the age of eighteen, taught high school classes before working for the Langley research group (Ignatofsky 75). She was particularly good at analytical geometry, which helped her excel at NASA and made her an essential part of their space programs, specifically in the Space Task Force. Throughout her 33-year career at NASA, she co-authored 26 papers, a series of which focused on using visible stars to navigate a path through space, and helped develop components of the space shuttle and satellite programs with Al Hamer and John Young (Shetterly 249). In 2015, at the age of 97, she was awarded the presidential Medal of Freedom by President Obama, and in 2016, at the age of 98, she was able to see her story (and the stories of the women she worked with) come to life in the film adaptation of Shetterly's book, *Hidden Figures*. After retiring from NASA, Johnson continued to inspire people, especially young people interested in STEM, by visiting schools and speaking about how mathematics shaped her life (Shetterly 249). Because of her age, traveling is somewhat of a hardship now, but students continue to visit Johnson at her residence seeking inspiration and wisdom from the woman who helped redefine what it means to be a female mathematician.

Johnson's story has oftentimes been distorted and exaggerated. Shetterly notes that while Johnson's achievements are significant, they "can't quite match some of the myths that have grown up around her," that many times disfigure the reality of what she accomplished (250). The

problem with making Johnson somewhat of a mythical figure is that it removes her individual achievements and involvement in the field of mathematics and it emphasizes the scarce coverage of the stories of African American women in STEM. The risk of treating Johnson's story as superhuman or unfathomable based on her circumstances not only makes her career seem like something future generations of scientists will be unable to attain for themselves, but removes other women (like the other women computers Johnson worked with) from the narrative. Having only one distorted view of what one woman accomplished creates what Shetterly describes as a "vacuum caused by the long absence of African Americans from mainstream history" (250). This narrow perspective limits the role of an entire history of mathematicians and scientists - those who worked alongside the ones whose stories are featured. What is important to note about the accurate reporting of Johnson's story is that it "can be a doorway to the stories of all the other women, black and white, whose contributions have been overlooked" (Shetterly 251). The telling of Johnson's story paves the way for curiosity. Shetterly wrote that the most common question she encountered after publishing *Hidden Figures* was, "Why haven't I heard this story before?" Interest in the stories that were buried under the coverage of the accomplishments of men in the field is creating a way for these stories to be told. Like Rachel Carson and Rosalind Franklin, Katherine Johnson was just doing what she loved to do, not worrying about the recognition, but rather that her research was done right and that progress in the field was being made.

Exaggeration in Film

The film adaptation of *Hidden Figures* is noteworthy based on the fact that it showcases the lives of three underrepresented NASA professionals. It includes several moments that incorporate the experiences of Katherine Johnson, Dorothy Vaughan, and Mary Jackson in ways

that highlight their fight to be seen as equal, while providing a storyline that keeps the attention of audiences. The attention to small details within the film is perhaps the way in which the most potent arguments and statements are made. For example, on Mary Jackson's first day at the Supersonic Pressure Tunnel, where capsules are tested with varying pressures of wind to see what they can withstand, her shoe gets caught in a metal grate just a few seconds before a test is run. Jackson leaves the shoe and runs into the observation room, which is shown to only have white male engineers. Jackson takes off her remaining shoe and walks up to the window that her fellow coworkers are watching the test from and the camera pans back to show the height difference between Jackson and the other engineers. This subtle visual fits in with exactly how women, and especially women of color, were, and still are, not seen as equals to those who had the same training as them. It also shows how first impressions are often wrong.

On Katherine Johnson's first day at the Space Task Force, imagined by the filmmakers, she is mistaken for a custodian. A trashcan is placed on top of the belongings she carried with her to her new position from the West Computing Group, and the recognition of her as a highly trained mathematician is lost. Although this scene was created for the film, its initial shock value works to reinforce the idea to the audience that even at NASA, discrimination was still commonplace. Not only was Johnson's presence as an integral member of the workplace ignored, but it was assumed that she must be a custodian because she was not white. If she had been a white female mathematician for example, she might have received the same strange looks that said, *what are you doing here?* but she never would have been handed the trash. This scene is paralleled later on when Al Harrison, the leader of the task group, a character based on Robert Gilruth and other members of NASA, holds a meeting to inform the Task Force that their full dedication to their work is needed to put a man into space. The scene opens on an actual

custodian, an African American woman who is shown emptying the trashcans around individual desks, whose aquamarine dress blends in with the color of the wall of the room she is in. The camera then cuts to Al Harrison's office where Katherine Johnson stands in the middle of her colleagues in white collared shirts, wearing a teal jacket and skirt. Not only does the color of Johnson's clothing match that of the custodian just outside Harrison's office, but it reminds the audience of her first impression within the group. It implies a closeness between the perception of Johnson as a custodian and as a mathematician, between the fact that outside of the office (and oftentimes within the office), she could easily be mistaken for someone who she was not. The way in which this scene makes the audience think about stereotypes when it comes to seeing women, and particularly women of color in STEM roles, is key to the importance of the film.

Film adaptations of books are known to exclude sections and emphasize others, sometimes even fabricating entire storylines for effect. When this occurs in nonfiction stories, however, what is created for emphasis oftentimes leaves the viewer with inaccurate information. Perhaps one of the most powerful scenes in the film version of Shetterly's book is one where Johnson, portrayed by Taraji P. Henson, returns to the Space Task Force after walking half a mile in the rain to use the West campus bathroom. She explains to an angry Al Harrison, that the reason she had been late was because of her lengthy walk to the bathroom across the campus. Henson's powerful performance helps capture a tension in the scene that stems from the action behind the script, the idea that Johnson had to go through so much because of the discrimination she faced. Henson delivers the charged scene and reinforces just how impossible the circumstances were by saying:

There are no colored bathrooms in this building, or any building outside the West campus, which is half a mile away. Did you know that? I have to walk to Timbuktu just

to relieve myself [...] And I work like a dog day and night, living off of coffee from a pot none of you want to touch. So, excuse me if I have to go to the restroom a few times a day.

Henson's voice echoes through the room in this scene as she stands in the middle of a sea of white men in white collared shirts with black ties sitting at their cubicles. What is important to note, however, is that this was not an experience Katherine Johnson went through. Shetterly notes that the bathrooms for black employees were marked as such, but ones meant for white employees did not have a clear sign, and, "as far as Katherine was concerned, there was no reason why she shouldn't use those as well" (129). Although the film uses this moment to bring this reality to light, it was not a reality of Johnson's. This scene is scrutinized by a critic from the A.V. Club, who writes, "for one Oscar-clippy scene, [Taraji P. Henson] throws in some traditional noisy overacting as she stands up to her uncomprehending boss." Although this scene and Al Harrison are fictitious, it is important because of the way in which it emphasizes the experiences of minorities employed by NASA at the time. By saying that Henson overacted in order to win an Oscar, what Jesse Hassenger, the author of the critique, implies disregards the importance of the scene. The moment we criticize confidence (particularly on behalf of those who stand on unequal ground because of workplace hierarchies and racism), and negate the right to have equal opportunity as "overacting," or forced and unusual, is the moment we regress in terms of equality. In other words, why is it that when Johnson's character in the movie stands up for her rights it's labeled as "overacting," when what is being portrayed is a mathematician fighting for how she should have been treated and perceived upon entering the Space Task Force? Why is a woman's fight for her rights, even in a fictional way, seen as excessive? Because Johnson is a mathematician who is also an African American woman, comments like

these disregard the idea that standing up to a superior, or anyone who thought they were superior to those being discriminated against, was powerful on its own. It was not an act, not overreacting, but rather an attempt to shake sense into people who could not accept equality.

The decision to follow this scene in the movie with a scene that shows the character Al Harrison breaking down the sign at one of the “colored ladies room[s]” makes for a heartening resolution, but impairs Johnson’s agency in the movie and historically. Johnson chose to use the bathroom at Langley that was closest to where she was working, because it was just what made sense. Shetterly explains that no one confronted Johnson about the bathroom she used until a few years after she had been working at the Space Task Force, and “by then, she simply refused to change her habits – refused to so much as enter the Colored bathrooms. And that was that. No one ever said another word to her about it” (129). Something as trivial as following absurd bathroom rules was not even on Johnson’s radar, as it was not what she was there to do, she was there to calculate trajectories of space shuttles, she was there to do research. What is problematic about the way this scenario is played out in the film, however, is the fact that Johnson’s choice to use the bathroom in the building she worked in is removed from her abilities and put in the hands of a white male superior. By fabricating this moment into Johnson’s story, the film not only takes away some of her agency as a woman, but also builds up her individual experience to encompass that of all African American women computers at the time.

In fact, Mary Jackson, an aeronautical engineer who also worked at Langley and was featured, was the one who had the experience represented in the film. Jackson was working on a project in the East side of the NASA campus among many white computers. Because she had recently been transferred to the position and was unfamiliar with the layout of the East campus, she asked her fellow colleagues where to find the bathroom. In the film, this interaction is told

through Katherine Johnson's perspective. Jackson's white female colleagues responded to her question with laughter, implying that it would be absurd for them to know where *her* bathroom was (Shetterly 108). This interaction emphasizes the way in which even though Jackson was on an equal playing field with the same amount of education as her colleagues, discrimination allowed for that to completely disappear. Shetterly picks up on this when she writes, "to be confronted with the prejudice so blatantly, there in that temple to intellectual excellence and rational thought, by something so mundane, so ridiculous" was to degrade all that Jackson had worked for (108). She was no longer a researcher in that moment, she had "been demoted from professional mathematician to a second-class human being, reminded that she was a black girl whose piss wasn't good enough for the white pot" (108-109). Even at a place that was meant to foster education and scientific progress, incidents of blatant discrimination and racism worked to prevent productivity in all aspects. The degrees Jackson and others earned were disregarded in these incidents and the importance of the actual work they were doing for NASA was lost among the heightened importance of senseless bathroom policies. By displacing this experience into Johnson's story and exaggerating a moment that didn't happen to her, the film makes it seem as though Johnson was the sole African American woman at NASA that experienced this, that she was all by herself on the East side of campus. Something of particular importance is the fact that Al Harrison's character, and his act of tearing down the bathroom sign, was not present in Mary Jackson's experience that was grafted onto Johnson's storyline in the film. Implementing it into Johnson's story not only takes away her own agency, but the agency of others like Jackson, who put up with incident of discrimination on her own will, without anyone's, especially a white man's, help. What is problematic in this case is what Shetterly discussed regarding the absence of African American stories from mainstream history. Because Johnson's story is featured

throughout the film and the experience with the bathrooms is tacked onto her narrative, the pattern of covering only a few African American stories throughout history is being repeated. Johnson's experience at Langley depicted in this scene limits the actions she took to stand against racism. It generalizes her individual story, with her own choices and capabilities, to include the experiences of others, and thereby focuses less on Johnson.

A need to push beyond the racism and sexism Johnson experienced at NASA is what helped her propel her career with a positive outlook. Yet, when experiences of discrimination like Johnson's are glossed over in literature about women in science, as only triumphs of character, what is focused on less is the actual discrimination. By solely focusing on the way in which women in science move on from situations of discrimination, the acts of discrimination themselves become commonplace and accepted as a part of their professional lives, almost as a part of their acceptance into their fields. It is the subtle forms of discrimination that are the most harmful to maintaining an increasing number of women in STEM fields. An article by Joan Williams in Harvard Business Review lists five patterns of discrimination against women that work throughout the STEM workforce, especially in research positions. The study conducted by Williams and fellow collaborators on the experiences of U.S. scientists, where 60 women were extensively interviewed and 557 were surveyed, lists the following patterns of workplace discrimination: prove-it-again (the need to prove oneself or one's data over and over again), the tightrope (feeling obligated to act in masculine ways to seem competent), the maternal wall (commitment to the field questioned because of having children), tug-of-war (competing against other women in the field for "the woman's spot"), and isolation. Unlike James Watson's blatant discrimination towards Rosalind Franklin, these types of discrimination are less defined and can

take multiple forms. In this way, they are also more difficult to combat. The Williams study reported that out of the 557 women scientists surveyed, 77% of African American scientists, 65% of Latina scientists, 64% of Asian scientists, and 63% of white scientists identified with the “prove-it-again” pattern. Almost half of the African American and Latina scientists surveyed also reported that they had been mistaken for administrative or custodial staff during their employment. According to the study, more (100%) women of color surveyed experienced gender bias in their field, compared to white women (93%) who were surveyed. These types of discrimination are detrimental to the futures of women in STEM fields. Because they are not talked about as extensively and are not given the same kind of consideration as the moments of perseverance in the coverage of women’s stories in science, they may be overlooked. This is not in any way to say that giving attention to the successful parts of a woman scientist’s career is not important or should not be the focus of inspiring young women towards pursuing STEM fields. However, if patterns of discrimination are not discussed, they become obstacles one must face to advance in science.

In *Hidden Figures*, Shetterly brings Johnson’s (as well as Dorothy Vaughan and Mary Jackson’s) strength and story to light by reinforcing the idea that Johnson bypassed the discrimination she faced by redefining the standards her colleagues set for her. Johnson displayed her knowledge at work and as Shetterly notes, her “confidence and the bright flame of her mind were irresistible to the guys in the Flight Research Division. There was nothing they liked more than brains, and they could see that [she] had them in abundance” (130). What eased Johnson’s acceptance into her work environment at NASA was her ability to operate in the segregated south, in a field dominated mostly by white men, as a researcher of equal value. She had to show that her qualifications were up to par for her position. After the initial incident upon

arriving at Flight Research, Johnson became “comfortable in the office,” which allowed her to function and collaborate with people, who otherwise might not have socialized with her outside of work. Shetterly notes that, “outside the gates [of NASA], the caste rules were clear [...] At Langley, the boundaries were fuzzier” (123). There were still separate bathrooms, lunchrooms, and computing groups, but for the first time, African American mathematicians and scientists were entering a professional world that they were previously kept from. Although positions were becoming available, racism permeated NASA, which Johnson recognized, she “knew just as well as any other black person the tax levied upon them because of their color” (Shetterly 131). She may have been comfortable in her new position, but that did not mean she became suddenly unaware of what was going on around her both in and outside of work. After all, *Brown v. Board of Education* had just passed during the beginning of Johnson’s career and did not go unnoticed. What made Johnson’s experience at work run smoothly, apart from her superb qualifications, was her willingness to see everyone as equal to herself. Shetterly emphasizes:

Perhaps as much as Katherine’s expectation that she should be treated as the equal of the engineers she worked with was her willingness to treat *them* as equals – to acknowledge that their intellect and curiosity matched hers, that they were bringing to the professional relationship the same sense of fairness and respect and goodwill that she was – that paved the way for her ultimate success. (135)

It is true that, while Johnson treated her colleagues as equals, at times that they did not do the same for her. This, however, as Shetterly explains, is one of the components to her success as a research mathematician. Johnson was working toward the same goal as her colleagues (to progress space and mathematical research), which is what tore down the remnants of a hierarchy

established to keep minorities out of the field. She and others, like Dorothy Vaughan and Mary Jackson worked to make their careers a normal part of the structure that kept NASA running.

Changing Conventions

What has previously been overlooked in the narratives of the women working at NASA are their efforts to integrate into a community that, even though was well-respected, enforced exclusion principles throughout the workplace. In addition to separate bathrooms, the main cafeteria was split into sections. Labeled only by a cardboard sign that read, “colored computers,” the area where some ate their lunch was another reminder that even though they were within the walls of a place that employed them for their talents, social hierarchies still subsisted. Katherine Johnson ate lunch at her desk, again removing the insistent need to separate people who worked together (Shetterly 43). The acts of separation “were a reminder that even within the meritocracy of the US Civil Service, even after Executive Order 8802, some were more equal than others” (Shetterly 43). This unequal standing, though, did not prevent mathematicians like Johnson from proving that they had every right to be there. After all, what they wanted was to fit in because of what they could do to propel NASA further into research and not stand out because of something that had nothing to do with their job title or their capabilities (Shetterly 251).

By telling Katherine Johnson’s story in a way that makes her out to have experienced all there is to experience as an African American woman working at NASA in the segregated south of Hampton Virginia, her efforts become less valid. Encompassing the experiences of all African American women computers into one narrative not only distorts reality, but also forces a mindset that women, especially those who aren’t white, in mathematics or science are truly out of the

ordinary. This goes against the ways in which employees at Langley, especially the West Computing Group, worked to make having a job at NASA something anyone who was qualified could have. Shetterly notes that some of the white employees at Langley, like Margery Hannah and Robert Jones, helped to “[defy] southern conventions” by inviting the West Area women to work-related social functions, or, in the case of Jones, standing up to a police officer who was harassing a black man and spending the night in jail because of his actions to prevent the man from being harmed (Shetterly 47). People like Hannah and Jones and other engineers understood that the women in the West Computing Group were there to accomplish all they could with advancements in technology. They were “open to giving a smart person – black or white, male or female – the chance to work hard and get the numbers right” (Shetterly 47-48). Yet, as if this wasn’t enough, the women in the West group still needed to prove their worth more, “needing to be twice as good to get half as far” as their white colleagues, even the ones who worked with them to achieve this goal of workplace equality (Shetterly 48). These efforts are subverted when an unattainable narrative is created.

When storylines are enhanced to make more of an impression on an audience, the power behind individual characters is redirected in a way that keeps the audience’s attention while at the same time reaches unfeasible standards. In the case of portraying women in STEM through film, it is necessary to make an impact on forthcoming generations who might be watching while also giving them a future they can see for themselves. Reporting Johnson’s actions as they actually happened might not have lived up to cinematic standards, but in the case of sitting at her desk among her black and white colleagues at lunch and using the white restroom, audiences would have been able to see her own efforts to shape the path and quality of her career. It is

when these experiences (alone, without the addition of others) are not deemed a sufficient enough portrayal of a life in STEM that dramatization becomes problematic.

Current Standings

The way in which science is packaged and presented not only to the public, but also to future generations of biologists, physicists, and engineers, influences who becomes involved and who remains outside of the field. Society dictates who becomes involved in scientific careers by shaping what is deemed an acceptable standard of a scientist. Dr. Chanda Prescod-Weinstein, a theoretical astrophysicist and research associate in the department of physics at the University of Washington, notes that science is interpersonal and is more readily available to those who have the privilege to see it untarnished by racism and sexism:

If you grow up in a community that scientists have traditionally abused, in a body that scientists have traditionally abused, or with a heightened awareness of morally ambiguous choices that required scientists' collaboration, then perhaps your early conceptions of science are negative. (from "Intersectionality as a Blueprint for Postcolonial Scientific Community Building")

Science is not as groundbreaking when the events leading up to discovery involve the systematic oppression of women of color, to the point at which progress is only made through data collections and analyses and not in equality. Henrietta Lacks and Sarah Baartman, for example, both experienced the way in which science was particularly abusive. Henrietta Lacks, an African American woman from Virginia, had cervical cancer and her tumor cells were used without her permission to conduct research. Lacks' cell line is still in use today, and is an important part of biomedical research, but is also tied to a history of violation. Sarah Baartman's body was

analyzed during her life and her bones were preserved well after her death because white male scientists of the late 1700s and early 1800s liked to compare her to the “average” woman.

Baartman’s body and human rights were violated when she was measured, caricaturized, and put on display as a specimen of scientific racism. In a world where women’s bodies are put at risk in the name of “science” and where a movie critic writing for the A.V. Club describes Katherine Johnson’s character as a “nerdy, unglamorous math prodigy,” something needs to be said. This critique of the movie and comment on Johnson’s character not only emphasizes being “nerdy” and “unglamorous” before being a math prodigy, but it reinforces the negative language surrounding people in STEM fields. By continuing to use words such as “nerdy” or “unglamorous,” the stigma against being a scientist or a mathematician, especially to those who have been historically underrepresented in the field, heightens. It forces future generations to think that being in science is unappealing and something that only applies for certain people. Sometimes, if you’re a field biologist, it is unglamorous. Sometimes you fall in the mud, but that, in its own way, can be glamorous because maybe you fell in the mud and obtained the samples you needed. By going against the use of this rhetoric, there is a chance for revamping the way in which people think about science and who does it.

Modern representations of women in science are important in shaping each scientific field for the future. Dr. Prescod-Weinstein became the 69th Black American woman to get a PhD in physics, a field which currently is composed of 20% women, and she continues to advocate for the issues facing minorities in STEM, specifically physics (American Physical Society). The importance of proper representation in film adaptations like *Hidden Figures* is highlighted when representation within STEM fields is lacking. Between 1973 and 2012, 22,172 white men received a PhD in physics, compared to 66 black women (NSF). This means that on average, for

every 568 white men that entered into the post-doctoral world of physics each year, only 1.7 black women earned the same positions. This is problematic. Dr. Prescod-Weinstein remarked in an interview with Gizmodo that it wasn't until six years after earning her PhD that she was able to work with a female advisor. The timing of the book and movie release are essential to the constantly changing fields of science, but what is important to remember is that the experiences portrayed in the movie and the book, might have been set in the past, but they are still present today. Dr. Prescod-Weinstein fears that "people will walk away from [the film] and situate it in the 1960s, not 2017," not as something that still occurs today. Although the movie portrays the story of Johnson, Vaughan, and Jackson as a triumph of the past, there continue to be scenarios similar to those shown in the film that need focus as well. Moving forward, there needs to be more coverage and visibility of women in science, more "modern examples that [young adults] can relate to in a more day-to-day way" (Prescod-Weinstein, Paoletta). When women in STEM are seen as normal within their field, phrases like "women in STEM" will not be used as a reminder that because you are a woman who is also interested in science, you are different from other people in the discipline you chose for a career.

Accurate portrayals of diverse lives in science are needed to help tell the stories of those that history has neglected to tell. Instances of discrimination still happen in the sciences today, but by making people more aware through film and in literature, perhaps the future of STEM is one of informed, respectful individuals who appreciate the opportunity to learn and advance knowledge. In using film, television, literature, and other forms of representation, we can change the historical perception of a scientist to encompass anyone who is qualified, not based on race or gender. Katherine Johnson's story and Dr. Prescod-Weinstein's continued effort to combat discrimination in the sciences both aid in making sure science is a field that anyone can see

themselves in. It is important to recognize that although narratives from the past, such as Johnson's were relevant then, they are even more relevant today.

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