



**HAL**  
open science

# Expanding Understanding of the Educational and Workforce Experiences of Women of Color in Science: What is the Utility of Integrating Narratives of Diverse Experience With Systems Level Historical Analysis?

Cynthia Winston, Michael Winston, Alexis Boyd

► **To cite this version:**

Cynthia Winston, Michael Winston, Alexis Boyd. Expanding Understanding of the Educational and Workforce Experiences of Women of Color in Science: What is the Utility of Integrating Narratives of Diverse Experience With Systems Level Historical Analysis?. Narrative Matters 2014: Narrative Knowing/Récit et Savoir, Jun 2014, Paris, France. hal-01098734

**HAL Id: hal-01098734**

**<https://hal.science/hal-01098734>**

Submitted on 29 Dec 2014

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

**EXPANDING UNDERSTANDING OF THE EDUCATIONAL AND WORKFORCE EXPERIENCES OF WOMEN OF COLOR IN SCIENCE: WHAT IS THE UTILITY OF INTEGRATING NARRATIVES OF DIVERSE EXPERIENCE WITH SYSTEMS LEVEL HISTORICAL ANALYSIS?**

**Introduction**

This project is a narrative exploration that integrates historical and psychological perspectives on how to expand understanding and scholarship on the experiences of Black women in science. Across and within different fields of study, narrative can be conceptualized in multiple ways and adopts many different forms (e.g. Freeman, 2009; Josselson & Lieblich, 1993; Bamberg & Georgakopoulou, 2008; McAdams, 2009). For example, in the field of psychology, Bamberg (2008) describes narrative as small stories, while McAdams (2001) conceptualizes narrative as life stories that make up persons' internalized and evolving self-narrative. In history, narrative is characteristically chronological, linear, and episodic, regardless of the type of evidence used to establish causation, or determine the validity of accounts of past events, or socioeconomic and political change. Biography is often used to illustrate the operation of such change. Winston (2011) describes the narrative work of historians in the following way,

“in history, biography research has evolved from what it used to be the standard life and times approach. Historians place the life within a historical period and context for the reader to learn about the historical period. In the last forty years, historians using biography have placed more emphasis on analysis of the life itself, rather than on the historical period. Over time, historians have become less interested in selecting the lives of “great men” for biography” (see Carlyle, 1841), and have instead selected subjects of study who were not necessarily famous but interesting. In the late 1900s it became much more common for the lives of women and individuals who were Black to be the subject of biographies of historians because of a shift in historians thinking about the importance of the lives of ordinary people” (see Logan and Winston 1982).

Our view of narrative in this paper can be considered from two vantage points. From a historical perspective, as researchers we are constructing a narrative based on biographical data. These we have gathered from various sources to construct a focused biographical account of a life. In contrast, using a psychological approach to narrative, we engage in what Josselson (2006) calls situated interpretations of autobiographical or first person accounts provided by the subject of study about his or her life experiences.

In this paper, we advance the idea that narratives in conjunction with systemic analysis, can facilitate discovery of opportunities and barriers for the U.S. to achieve its STEM education and workforce goals of broadening participation of larger numbers of Black women and girls. The biographical-archival research framework that we are developing in this manuscript is designed to serve multiple purposes. It will identify key research questions that need close examination using carefully appropriated theoretical and conceptual frameworks developed or identified by scholars across multiple fields including but not limited to history, sociology, and psychology. Another aim is to use our framework to contribute to recovery of some of the history of science, in which, conventionally, the actual presence and varied experiences of Black women are often overlooked.

**Recovery of the History of Science**

Like many research projects, this one evolved over time as sources for inquiry accumulated. Insights, questions, and approaches were dynamic. At its inception, this project was intended to answer the following question: *What can be discovered from archival sources about the experiences of Black women in science?* Some of the dynamics of the meaning and consequences of gender reflected in archival material on Black women led us to explore the experiences of White women in science. We will elaborate on this more throughout the paper. Ultimately, our archival research goal was to build a flexible framework of experiences of Black women in science that allows future researchers to explore the intersections of the consequences of gender and race as categorical markers, as well as the meaning of these intersections within individual lives.

***Why a focus on the intersections of race and gender?***

Although it is obvious that the United States has a remarkable array of STEM resources, personnel, infrastructure and educational facilities, they are not nationally distributed, geographically or socially. Instead, they are highly concentrated. Large areas of the country are in impoverished circumstances as far as STEM resources are concerned. Equally significant is the concentration of these resources with respect to social markers such as race, gender, income and social status. Thus, building on the work of Robert K. Merton and other scholars working in the sociology and history of science, we conceptualize science as a social as well as an intellectual enterprise. How the scientific and technical workforce of any society will be educated, recruited and employed will reflect the operation

**CYNTHIA E. WINSTON**  
**MICHAEL R. WINSTON**

*Howard University*

of the social system, especially in the mechanisms governing the distribution of opportunities to participate in the most productive and resource rich universities and other scientific research centers. Race and gender are two key social markers and levers that influence the ability of individuals to navigate through economic and social barriers to gain access to training and subsequent careers in science.

In a chapter for the Oxford Handbook of Cultural and Psychology, we developed a model to represent the individual and structural system dynamics of a racialized society (Winston & Winston, 2012). The Winston Framework provides a new organization and synthesis of cultural psychological concepts that operate at multiple systems and inter individual levels across time and different racialized systems of domination. It is proposed that a cultural historical psychology of race analytically requires a synthesis of race concepts appropriately placed in their historical context, including the dynamics of individuals, institutions, and societies.

We described racialized societies in the following way:

“Racialized societies are historically a phenomenon of the early modern world (beginning in the sixteenth century) when western Europeans developed the technical and military means to conquer societies in Asia, Africa, and Latin America and extract mineral wealth and other natural resources from some of those areas using native labor. During a second stage, millions of laborers, either through slavery or contract labor systems, were moved to frontier societies, such as those in North and South America, the Caribbean, East Africa, and South Africa. There, Europeans imposed a caste system in which race was made a functional boundary for economic and social roles (Du Bois, 1945; Frazier, 1957)” (Winston & Winston, 2012).

One of our goals in this project is to begin to give our Winston Framework new dimensionality. We want to explore how race and gender overlap as they operate in society as markers that have consequences and meanings for the lives of Black women in science. At the individual level we need to understand how these markers differ in detail and how individuals process their gender identity.

Stewart and McDermott (2004) in their review of gender in psychology argue for the use of gender as a conceptual tool in research, since “gender is increasingly understood as defining a system of power relations embedded in other power relations” (p. 519). In describing the state of knowledge and understanding about gender, they specify three basic conclusions. First, gender has been recognized as an important variable for understanding many aspects of behavior. Yet, it is used empirically without evident consciousness of its social or conceptual significance. Second, the majority of research in the field of psychology has focused on analyzing gender roles, gender differences (e.g. the ways in which boys and girls/men and women differ), and within group variability. However, this research has not incorporated a conceptualization of gender as a system of power relations embedded in other power relations. Stewart and McDermott (2004) suggests that an embedded power relations approach to gender would integrate social structural and individual approaches to understanding gender which can provide powerful descriptions of particular psychological phenomena. The concepts of gender and identity, for example, when analyzed from a perspective of embedded power relationship moves gender beyond merely characteristics of individuals and adopts a conceptual link between the psychology of the individual and the social system of power relations in which lives are situated.

Our research is focused on racial and gender identity and the operation of the American social system, along with its culture of assumptions about the distribution of intellectual ability in diverse populations. This research is particularly responsive to the situation the United States finds itself in with respect to the STEM workforce. On the one hand, STEM innovation and discovery are a national priority for the U.S., largely due to its impact on the economy and standard of living. On the other, the U.S. has a dismal record of providing equitable access to excellence in education in two rapidly growing racial and ethnic groups: African Americans and Latinos. The U.S. Department of Commerce (2011) uses recent national data to describe a “Gender Gap in Innovation”. The Department’s data indicate that the number of women who earn graduate STEM degrees is steadily increasing, but these women are less likely than their male counterparts to actually work in STEM jobs. Women make up only 24% of the STEM workforce (U.S. Department of Commerce, 2011). The reality of the impact of gender and race in science can further be illustrated by the fact that Black women comprise less than 2% of the STEM faculty at non-Historically Black Colleges and Universities (HBCUs) but comprise 22% of the STEM faculty at HBCUs (National Science Foundation, 2009). This is significant given two facts. First, HBCUs represent only 3% of the institutions in higher education, and yet, these institutions comprise over 40% of the top 49 baccalaureate institutions of Black science and engineering doctorate recipients (National Science Foundation, 2011). Second, faculty play an important role in preparing the next generation for the STEM workforce through providing education, mentoring, and serving as role models (Freeman, Winston, Gangloff-Bailey, & Jones, under review). At HBCUs, for example, the STEM students are more often predominately female. Recent studies suggest that same-gender role models have a profound influence on academic success in STEM disciplines, especially for women students (Bettinger & Long, 2005).

### Methodological Approach

In the earlier section of this paper, attention has been given to the systemic features of the social system in the United States that structures educational opportunity and distributes distinct populations among particular careers and professions, notably science and technology fields. That is necessary, of course, as a means of gaining an understanding of the “landscape” in which White and Black women may develop science careers. While systemic analysis and data about female participation in particular fields are necessary as a starting point, they are hardly sufficient, alone, to explain the actual operation and impact of discriminatory behavior by institutions on individual lives. Ultimately, an understanding of a phenomenon as complex as racial and gender discrimination operating over decades in thousands of different educational and workplace environments, cannot be derived simply from statistics and formal analysis. To arrive at that point requires particularity at the level of the individual woman, in a specific set of circumstances, to focus on individual lives, not simply as outcomes of a system, but as definite examples of how a system variously affects individuals who also have agency. Thus women in the same system will respond across a range of possibilities within the boundaries of the system. The purpose, therefore, of the biographical studies in our research is not simply to gather interesting information on how certain women overcame some of the obstacles embedded in the system, but to achieve a finer-grained understanding of the dynamics between aspects of the system and the individual. Some women, Black and White, broke through certain barriers, but most often found themselves still isolated, though relatively better off than most of their gender or racial peers.

Our comparative biographical studies are not designed to prove a particular point conclusively, but to illustrate patterns and variations suggested by the data. Typically, gender and race discrimination studies move from statistical data to an attempt at explanation, though the variations within individual lives and smaller groups are not captured. Biographical, historical and psychological narratives can, therefore, supply a missing part of the explanatory architecture of studies in this field.

We are selecting two instrumental cases as a means of demonstrating some of the possibilities of our combination of methodologies. The cases could, of course, be multiplied. As they are, in our continuing work, additional facets of the phenomenon will be disclosed. But no particular number of cases would prove the validity of our argument and approach. In the first place, the number of cases is relatively small for social science research because of the discriminatory system itself, some of whose more pernicious features operate without any need for documents that leave traces of how decision makers thought or discussed issues with colleagues of similar views or assumptions about gender or race. Secondly, the variations at the level of the person frustrate any attempt to arrive at generalizations that have validity for entire cohorts of women. Equally complicating is the fact that patterns of discrimination varied significantly in the various STEM fields, each of which had distinctive cultures, in college and university departments as well as in industrial, government, and independent laboratories. While the end results were often comparable in terms of the exclusion of women from the most attractive and productive research environments, how those different cultures worked is an important research question. With this in mind, it is reasonable to propose, therefore, that studying a range of individual cases will yield an understanding of the relevant discriminatory phenomena, but will not prove that a particular analysis is correct in any sense that is consistent with the criteria of scientific proof. Our study is aimed at the former goal rather than the latter.

What did we look for in the individual biographical studies? We studied early family and community influences, which in many instances of scientists, male and female, first stimulated interest in academic excellence, generally and sometimes science specifically. High school, college, and university experiences were also examined as clues to understanding the later development of careers in science. In the transitions from one segment of the educational pipeline to another, mentors were often critical in providing encouragement and guidance. These general areas did not seem to be significantly different by race in the earlier part of the time continuum, but tended to diverge significantly after the graduate school, post doctoral phase and placement in science jobs in research universities, government laboratories, and independent laboratories. It is evident that gender barriers as such, at the level of the individual, affected both Black and White women scientists, but the combination with racial barriers made the circumstances of Black women scientists far more precarious, often to the point that they lacked entirely the opportunity to pursue research consistent with their training, either because they had no access at all to historically White institutions (segregated by law or custom) or they were employed in historically Black institutions that were teaching institutions lacking the physical and financial resources to support faculty research. Within these general categories, of course, there were variations within each life, depending on a wide variety of factors, from geography to position in the social stratification hierarchy. White women, for example, who were in the upper socio-economic distribution, who could attend colleges like Smith, Wellesley, Mount Holyoke, or Bryn Mawr, had advantages that could not be matched by Black women from lower-income families who attended public colleges and universities or the Historically Black Colleges and Universities, all of which were severely under-funded. Equally important were

**CYNTHIA E. WINSTON**  
**MICHAEL R. WINSTON**

*Howard University*

the differences in the networks of individuals to which White women and Black women had access. The “protégé chain” that existed in the Seven Sisters colleges had no fully developed analogue among Black colleges and universities.

Before discussing the specific cases that we will present, it is important to stipulate at the very outset that any presentation of cases cannot be a matter of “matching” comparable cases across the line of race. White women had access to education in the later nineteenth and earlier twentieth centuries that Black women did not. Even when some of the disparities of access began to be mitigated, the improvement was highly selective and limited. Access improved first in the social sciences, the arts and the humanities. The natural sciences and engineering lagged for at least two generations because the types of institutions to which most Black women had access did not develop properly staffed and equipped science departments until the second half of the twentieth century. The strongest of the Black institutions in the sciences, Howard University, did not have an adequate chemistry facility or faculty until the 1930s and another twenty-five years were required for a similar improvement in biology and engineering. In 2014, physics at Howard remains housed in a building constructed in 1910. The development of Black women scientists, purely in terms of numbers, shows that increases did not become significant until the 1970s. The research productivity of Black women scientists must be examined, then, in terms of a strictly “isolated pioneers” point of view for the period 1930 to 1980, and “contemporary careers still in progress” for those entering science fields in the period since the 1980’s. This point seems self-evident when one considers that it was not until the late date of 1933 that Ruth Ella Moore became first Black woman to earn a Ph.D. in a science field (Bacteriology, Ohio State University). For gender comparison, the first Black male to earn a Ph.D. in science, Edward A. Bouchet, earned the degree in physics, from Yale University in 1876. Not until 97 years later did Shirley Ann Jackson, the first Black woman to earn the Ph.D. in physics receive it from the Massachusetts Institute of Technology. For further perspective on the gap between Black male and female entry into science careers, it was not until 1940 that R. Arliner Young became the first Black woman to earn a Ph.D. in zoology (from the University of Pennsylvania), 33 years after Charles H. Turner earned that degree from the University of Chicago. The two generations of Black women scientists who followed Moore and Young were primarily college or university teachers who only occasionally had opportunities to pursue research or publish their findings. Young, for example, was able to publish some of the research she did during summers at The Marine Biological Laboratory in Woods Hole, but had no research facilities in biology at the two institutions in which she taught after she earned the degree—The North Carolina College for Negroes, in Durham, and Shaw University in Raleigh. We are not engaged, therefore, in studying comparable cases, but lives and careers that reflect the interaction of the individual in particular circumstances with a social system and those institutions that are the matrix for careers in science. Although White women experienced discrimination within that matrix, for the most part Black women were not physically in it, but preponderantly in an isolated and separate non-system. The intellectual and professional isolation are likely, of course, to have been even more significant than the physical isolation. White women scientists have been awarded the Nobel Prize in various science fields for several generations. No Black male or female scientist has been awarded one in a STEM field to this date (W. Arthur Lewis received the Nobel Prize in economics in 1979). Our cases, then are narrative examples but not, in the strictest sense, comparative studies. The cases are intended to show how these scientists forged careers within the racial and gender limitations of American science at that time.

The two cases selected for examination in this paper are the Black scientist, Marie Maynard Daly (1921-2003) and the White scientist, Barbara McClintock (1902-1992). The account of each scientist is intended to illustrate some aspects of their careers, enabling us to view their lives in science in a way that recognizes the integrity of each narrative, rather than to isolate only certain parts of their careers for comparative analysis. Only a group of such narrative accounts could be the basis for deriving some probative generalizations.

### **Case One: Marie Maynard Daly**

Marie Daly was born in 1921 in Corona, New York. A growing Queens County magnet for European and West Indian immigrants, as well as Black Americans migrating from the South in the years following World War I, Corona’s public schools were far better than those generally available in the racially segregated South. Daly had the further advantage of having parents, Helen and Ivan Daly, who nurtured unusual aspirations in their daughter. Her father had been born in the West Indies and had aspired to become a chemist (Warren, 1999). Able financially to attend Cornell University for only one semester, he later transferred his own thwarted ambitions to his daughter when he had become a postal worker. Daly’s mother was American-born, from Washington, D.C., a city with the best public schools in a jurisdiction racially segregated by law, and a social environment strongly influenced by the presence of Howard University, the Freedmen’s Hospital, the Miner Teachers College, as well as a critical mass of the Black population that was well-educated and ambitious. Marie Daly’s family had a family library and

**CYNTHIA E. WINSTON**  
**MICHAEL R. WINSTON**

*Howard University*

encouraged her interest in reading and serious study of her school subjects. This family encouragement may explain Daly's pursuit of admission (via the required city-wide competitive examination) to one of New York City's elite high schools, the Hunter College High School (established in 1869 as the Female Normal and High School) which remained a high school for girls until 1974. Admission there placed her in a very small cohort of Black students enrolled in the selective public high schools of New York City.

After graduation from Hunter College High School, where she was encouraged to study chemistry, Daly entered nearby Queens College, a commuter school recently opened by the City of New York in response to the growing population in the Borough of Queens. Daly excelled in chemistry at Queens College, serving as a part-time laboratory assistant, an opportunity rare for Black students in predominantly White science environments of that era. A further distinction, with life changing consequences, was a fellowship that she received from Queens College to undertake graduate study at another institution. Graduating with honors in 1942, she entered the Graduate School of New York University, a private institution. She was awarded a master's degree in chemistry in 1943, and continued to work on the staff of the Department of Chemistry at Queens until 1944, the year that she entered the Ph.D. program in chemistry at Columbia University, New York's most prestigious institution (which had at that time quotas on the admission of Jewish students and a custom of severely restricted admission of Black students, male and female). Columbia's long tradition of being, since the mid-eighteenth century an exclusively male institution at the undergraduate level, and very limited admission of women in its graduate programs in the late nineteenth century, (except for Teachers College and The School of Library Science), would have been a part of the social environment that Daly encountered as a Ph.D. student. As pointed out by Wini Warren, in her study *Black Women Scientists in the United States*, the University Fellowship that Daly was awarded, as well as the opportunity to even be admitted, took place in the context of World War II, which created opportunities for women as male students and faculty were recruited for the civilian and military war effort. Additionally, the need for more scientists and engineers had become clear as the United States competed with the Axis Powers to create, through advanced science and technology, ever more lethal weaponry and synthetic substitutes for scarce raw materials. Daly worked with Mary L. Caldwell, a leader in the field of nutritional chemistry and was awarded the Ph.D. in 1948.

At this point in the account of Daly's career, it may be useful to pause the narrative for comment about some circumstances that might appear commonplace, and indeed were, in the case of White female scientists but not for their Black female age peers of that historical period.

First, one should note that while 77 per cent of the Black population lived in the segregated South, Daly benefited from the availability of good public schools in a northern city, underscored by her unusual attendance at one of the best high schools in the city. Secondly, that high school had an all female student body, meaning that the study of science would not have been considered by most students and teachers a "male" field. Daly also had excellent female science teachers at Hunter College High School who encouraged her pursuit of science as a possible career. A third factor worth considering is that she attended a new, and therefore non-elite college that had not existed long enough to have an exclusionary pattern in student choice of college majors. It was also true that the faculty of the public colleges and universities in New York City were well known for their social liberalism and political radicalism, which extended, for some faculty members, to their ideas about race and gender. While the gender of her Queens College chemistry teachers has not been determined in this study, we do know that Daly's principal mentor and the supervisor of her doctoral dissertation was a distinguished woman scientist. What difference gender made in that situation is not determinable in the absence of testimony from Daly. Given the social climate at the time, it is not unreasonable to believe that it played a role in Daly's success.

Notwithstanding Daly's performance as an honors student in undergraduate and graduate work, she was not hired by any institution to teach science, undertake research, or work in any science-related field in New York, a city with an established reputation for opening some educational opportunities for Blacks, but rarely employing them in white collar or professional jobs, especially in the period 1920-1970, in either the public or private sector. In Daly's early and middle years, even employment as a public school teacher, elementary or secondary, was unlikely for Blacks, male or female, regardless of their academic achievement. It is not surprising, then, that despite her stellar record at Queens and Columbia, her first employment as a scientist was at a predominantly Black institution, Howard University in Washington. During her dissertation year Daly was appointed an Instructor at Howard in the Physical Sciences Program (undergraduate General Education), whose Director was the physicist and physical chemist Herman R. Branson. This fact is suggestive because it points to the role of Black institutions in nurturing Black scientists who were not their own alumni, particularly in light of the disinclination of White institutions to offer employment to Blacks.

To resume the narrative of Daly's career, it is not clear from the published accounts whether her Columbia or Howard mentors were responsible for focusing her research interest toward the medical field. Her Columbia dissertation was already in the direction of medical applications: *A Study of the Products Formed by the Action of*

**CYNTHIA E. WINSTON**  
**MICHAEL R. WINSTON**

*Howard University*

*Pancreatic Amylase on Cornstarch.* In any case, by the time that she was working at Howard she had developed the ambition to work with A. E. Mirsky of the Rockefeller Institute in New York. Mirsky was willing for her to work with him, but only on the condition that she raise her own funds. There would be none from one of his existing research grants or from the Rockefeller Institute. While teaching at Howard, Daly submitted an application for research funds to the American Cancer Society. The award of an ACS grant in 1948 enabled Daly to leave the heavy undergraduate teaching load at Howard (where she was not teaching in the Chemistry Department) and become an associate of Mirsky at Rockefeller. This grant can be seen as the “take off” platform for Daly’s later career as a science researcher. She would have no teaching responsibilities and could pursue research full-time, a rare opportunity for any scientist, male or female, especially in that era. Having overcome significant obstacles, Daly did follow, however, a pattern mentioned earlier in this presentation. Although in an environment rich with research support, she was isolated as the only Black scientist at the Institute. She remained there for seven years (Kessler, Kidd, Kidd, & Morin, 1996).

Daly was appointed a research assistant at the Columbia University College of Physicians and Surgeons in 1955. Her title is notable because it is consistent with the experience of many female scientists who were employed in science with titles (and, presumably, salaries that tracked the lower status) that placed them in roles with far less authority and autonomy than their training and experience would warrant, a phenomenon amply documented in Margaret W. Rossiter’s (1995) magisterial study, *Women Scientists in America: Before Affirmative Action, 1940-1972*. It was not until Daly was fifty years old, in 1971, that she was awarded the rank of Associate Professor of Biochemistry and Medicine at Yeshiva University’s Albert Einstein College of Medicine, where she had moved in 1960 with her research collaborator and Ph.D. dissertation supervisor, Quentin B. Deming. The two collaborators had undertaken a series of studies to determine the chemical basis of the mechanics of cardiac dysfunction. Determining that cholesterol was a significant factor in arterial blockages, their work was important in reducing the incidence of heart attacks and strokes. Later studies by Dr. Daly identified the effects of sugars on arteries and cigarette smoke on lungs.

In her later years, Marie Daly was actively involved in the effort to increase minority enrollments in historically White medical schools, and she established scholarships for minority students who study chemistry or physics at Queens College. She retired from the Albert Einstein College of Medicine in 1986 and died in 2003

### **Case Two: Barbara McClintock**

Barbara McClintock was born on June 16, 1902, in Hartford, Connecticut, one of four children of Sara Handy McClintock and Thomas Henry McClintock, a physician. Her paternal grandparents had been immigrants from Britain. As a child she very early exhibited unusual independence and a penchant for solitude, a characteristic that would be stable throughout her life. Her parents decided that her personality warranted a name change, from “Eleanor” to “Barbara,” because they thought the former was “too delicate” for her.

At the age of three she was sent to live with an aunt and uncle in Brooklyn, New York. Three years later the rest of the family moved from Hartford to Brooklyn, which was then experiencing a boom in population. A separate city until its merger with New York in 1898, Brooklyn’s population growth made it an ideal place for her father to develop his practice, and significantly, gave the precocious Barbara access to one of the finest public schools in a major city.

Established as an elite private academy in 1786 (Alexander Hamilton was one of its sponsors), Erasmus Hall was transferred by its trustees to the City of New York in 1896 during a period of school consolidation and major investment in public schools by the city’s government reformers, who believed that an excellent public school system would be critical in “Americanizing” the flood of immigrants who made New York the largest city in the country. McClintock benefitted from the fact that, unlike many elite high schools, Erasmus Hall had accepted female students as early as 1801, and by the time of her entrance had one of the finest physical plants and teaching staffs in the country. In that school she came to realize that she loved science and was encouraged to pursue it by her teachers. While her medically trained father supported her scientific interests, her mother thought that it was an odd choice of subject for a girl. After her high school graduation 1919, McClintock apparently came close to never having a chance at a scientific career because of her mother’s opposition to her entering college; such an education would make her “unmarriageable.” With her father’s support, however, she entered Cornell University’s College of Agriculture in 1919. Her study of botany took a fateful turn when she took a course in genetics in 1921 from Claude. B. Hutchison (1885-1980) a geneticist and agricultural economist whose work fascinated her. Hutchison encouraged her, and a year later invited McClintock to participate in the graduate genetics program at Cornell, despite still being an undergraduate. Earning her B.Sc. in 1923, McClintock decided to specialize in genetics, though her M.A. and Ph.D. degrees were earned in botany, not genetics (Rossiter, 1995).

**CYNTHIA E. WINSTON**  
**MICHAEL R. WINSTON**

*Howard University*

From 1927 to 1931 McClintock was employed as an Instructor in botany and pursued a special interest in genetic crossing in maize, the area of research that would occupy her for the remainder of her life. McClintock's opportunity to pursue research at Cornell in her 20s was especially unusual for a woman at that time. Equally unusual was the fact that she was a leader in assembling a group of male and female researchers who focused on the cytogenetics of maize. This group included two future Nobel laureates, George Beadle and Harriet Creighton. In 1930 McClintock became the first scientist to describe the cross-shaped interaction of homologous chromosomes during meiosis (a special type of cell division during which chromosomes exchange information). McClintock and Creighton jointly published an article in cytogenetics in 1931, which was a milestone in McClintock's early career. In the same year she was named a Fellow of the National Research Council and had the further distinction of conducting research at several institutions: Cornell, the University of Missouri at Columbia and the California Institute of Technology. Her 1929 paper in *Genetics*, characterizing triploid maize chromosomes, stimulated the development of an emerging research field. She was credited with 10 of the 17 important advances in the field accomplished by Cornell researchers between 1929 and 1935. With her collaborator Harriet Creighton, McClintock demonstrated the link between chromosomal crossover during meiosis and the recombination of genetic traits. The same year, McClintock produced the first published genetic map for maize. The status of a NRC Fellow, and the research opportunities that were thereby opened, marked McClintock as one of the rising scientists of her generation, which seemed to be validated by her appointment in 1933 as a Fellow of the John Simon Guggenheim Memorial Foundation and the rare opportunity to be invited to the Kaiser Wilhelm Institute for Biology in Berlin and the Botanical Institute in Freiburg, Germany. Returning to Cornell from 1934 to 1936, McClintock then moved to the University of Missouri at Columbia at the rather surprising rank of Assistant Professor. In 1940, McClintock was denied tenure at Missouri, a remarkable outcome for a scientist of McClintock's reputation, at a university not generally regarded as one of the leading state universities. Despite her pioneering work, after many slights by colleagues, including being excluded from faculty meetings, she came to realize that she would have no advancement opportunities within the university. She wrote to a colleague: "I have decided that I must look for another job. As far as I can make out, there is nothing more for me here. I am an assistant professor at \$3,000 and I feel sure that that is the limit for me" (United States National Library of Medicine).

The Missouri decision is striking as an example of a woman scientist of unusual accomplishment hitting a dead end in career terms after a remarkably productive period of research. Taking a one-year leave from Missouri after the shocking negative tenure decision, McClintock used her network of colleagues to secure a temporary position at Columbia University. Her former Cornell colleague, Marcus Rhodes, was then a professor at Columbia and also had a research plot at the Carnegie Institution of Washington's Cold Spring Harbor Laboratory on Long Island that he offered to share with McClintock. After a year, she was offered a temporary position at Cold Spring Harbor, eventually converted to a permanent position. She remained there for the remainder of her career, working alone, in virtually complete isolation. The Carnegie Institution's various research laboratories became in the 1940' and 1950s havens for female scientists (all of them White) who found in them more congenial, if isolated, research environments than in universities or government laboratories in the same era.

During her fifth year at Cold Spring Harbor, McClintock wrote a revealing letter to her friend and Nobel laureate, George Beadle, "I am very much a wanderer and haven't much personal ambition in the usual interpretation of this phenomenon. The goals that I have aimed at cannot be compared with the goals that many people are able to aim at. If I aimed at them, my life would have been a series of frustrations" (Rossiter, 1995, p. 242) Paradoxically, McClintock was able to convert her isolation into scientific triumph because she stubbornly chose her own theoretical and experimental path. She had chosen a medium of research, maize, that did not require elaborate equipment or staff. Yet she went on to win the Nobel Prize in Medicine/Physiology in 1983 for her path breaking cytogenetic research. When she made her Banquet Speech as part of the Nobel Prize ceremonies, McClintock made some interesting comments about the response she gave to younger investigators who asked her about how it felt to be isolated and have her findings marginalized by unanchored skepticism: "At first, I must admit, I was surprised and then puzzled, as I thought the evidence and the logic sustaining my interpretation of it, were sufficiently revealing. It soon became clear, however, that tacit assumptions—the substance of dogma—served as a barrier to effective communication" (Nobelprize.org).

Among the notable aspects of McClintock's award of the Nobel Prize was the fact that much of the research on which the award was based was, in fact, accomplished in the early 1930s, before she was denied tenure at the University of Missouri. Another is that prior to 1941, McClintock was, unlike many women scientists of the era, "in the mainstream" of contemporary science, a close collaborator with highly productive men and women who were clustered in the same research field, a part of an institutional network originating at Cornell University. Yet she was obliged to seek employment in Missouri. When the Missouri episode in her career ended, despite her productivity and pioneering cytogenetic research, she could find nothing better than the almost accidental, initially temporary



**CYNTHIA E. WINSTON**  
**MICHAEL R. WINSTON**

*Howard University*

appointment at the remote Cold Spring Harbor Laboratory of the Carnegie Institution, not a position in a university (Keller, 1983). While her inclination to be solitary may have been very important in her management of her professionally isolated position, her case is a rather robust test of the gender permeability of American science from the 1920s to 1970s (in some respects similar to the test of the racial permeability of science represented by the case of the eminent Black cytologist, Ernest E. Just of Howard University). The late award of the Nobel Prize can have the effect of giving a retrospective glow to a very bleak story of gender exclusion that had some striking similarities to racial exclusion at the same period.

### **Comparative Analysis**

Although our research is not in the strict sense a comparative study of particular cases in a theoretical framework, there are some similarities between Daly and McClintock that are worth noting. First, both were residents of New York City who attended public, not private schools. In each case their high schools were high quality institutions. The contemporary significance of that fact in terms of the future development of Black female scientists, particularly, is the general decline of urban public high schools. That well documented trend eliminates one of the key academic bridges to science opportunities in colleges and universities. Their social backgrounds differed considerably because of the racial dynamics of the city and the relatively modest position of each family in the social order of that time. The two cases began to differ after their graduate training, with Daly in a more marginal position than McClintock, who very early became a part of a research group clustered at Cornell in which McClintock was a leader. Sources on Daly do not indicate that she was ever a part of the type of network described in accounts of McClintock prior to 1941. Daly was attached to her Ph.D. supervisor, Quentin Deming for much of her career, a very different phenomenon. Interestingly, it does not seem that she was ever allied with any White women scientists in research, and is not recorded as being active with Black scientific or medical groups, such as the research groups within the National Medical Association, the Black analogue to the AMA (though that point deserves further research). Daly, then, was in some respects also isolated, with some variations, like McClintock.

The paucity of first person accounts by Daly or McClintock leaves many questions either open or unanswerable. What, for example, were Daly's salient points of personal identity – gender and race? In what dynamic proportions? Did McClintock's stubborn determination to go along her own scientific path have anything at all to do with a gender identity? She does not seem to have had any of the characteristics of the successful "female isolates" in science who were, in Margaret Rossiter's view, "the grateful few;" in a sense, "honorary men" in science, avoiding conspicuous gender identities before the era of Affirmative Action?

The answers to these questions may be beyond the reach of scholarship, but the fragmentary elements for coherent narratives that have survived the passage of time suggest that a new understanding of gender and race may be derived from close study of the individual lives and professional careers of Black and White women in science. Such knowledge may provide the clues necessary to finally equalize opportunity in the STEM fields across the continuum from elementary schooling, through higher education, to opportunities for productive careers in established teaching and research environments.

### **Conclusion**

Based on this archival research project, we have three strands of recommended research objectives and targets for future research. First, is the importance of adopting a cohort approach. This would entail the researcher selecting a cohort of biographical subjects that will, as a group, illustrate one of the phenomena we identify as a systemic barrier to the recruitment and advancement of Black women in STEM. The advantage of this cohort approach is that we do not then have to strain to illustrate too much with only one or two cases. If we have a group, say, of ten who are roughly contemporaries, we should be able to find commonalities with respect to their recruitment and advancement. While this is not the same thing as "proof" of a proposed explanation, it may be more persuasive than one or two cases.

A second recommendation is to be more precise about the types of science work environments that have been more hospitable to the advancement of Black women scientists than others, and explain why. What, for example, made research universities less hospitable than government laboratories, or independent laboratories like Cold Spring Harbor and other Carnegie centers more permeable by women than the elite educational institutions? It may very well be that "elite" in the United States was partly defined by the absence of minorities and women. That is true of top-tier universities prior to the 1960's and of private clubs until even later. The elite science academies and the more general ones, like the American Philosophical Society and the American Academy of Arts and Sciences, fit the same pattern. One argument, of course, is that minorities and women simply did not qualify by reason of less than stellar achievement. The argument is contradicted by the exclusion of admittedly great women and minority scientists prior to the 1960s. Those are well known. The evidence suggests that degrees of whiteness

**CYNTHIA E. WINSTON**  
**MICHAEL R. WINSTON**

*Howard University*

and maleness were indicative of elite status. The presence of token exceptions may not be a significant weakening of the concept, since in psychological and social terms there was and continues to be the operation of what might be called the “masking of exclusion by the grateful few.”

Finally, we recommend more exploration of institutional cultural change. Although we are familiar with the phenomenon of a “cultural change” in institutional settings when it comes to exclusionary patterns, the question is “how is this demonstrated through systematic research”? When the process begins, there is some tokenism at work. In some institutional environments the tokenism never advances to widespread acceptance and the establishment of new norms in terms of how women and minorities are treated. What accounts for the difference? In some colleges and universities that were formerly all male, women have become an integral part of the institution, although some departments may remain outliers. Can further research identify what policies or practices accelerate the change?

Although research makes it clear that there have been great disparities in access to science education and careers in science based on race and gender, the record also reveals that formerly excluded groups respond to changes in the opportunity structure and to positive encouragement to enter various fields of science. The changes in educational access that occurred in the 1960s and 1970s produced new cohorts of Ph.D.s in science fields, with notable increases in the number of women and racial minorities. What remains to be determined are the ways in which their research productivity and career success may be increased in a wider range of science environments. It is important to note, for example, that a high percentage of Black women scientists are employed in Historically Black Colleges and Universities. Sustaining science careers in those environments, which are predominantly colleges, rather than universities, will require more nuanced national science policies. The significance of achieving that is evident when it is recognized that those institutions prepare a disproportionately high percentage of future scientists in the Black college population. In the contemporary situation, many Black women scientists have been obliged to sacrifice their research careers in order to develop the next generation of Black scientists in the HBCUs where they currently teach. Such a circumstance produces an unnecessary loss of research productivity (a national need) in order to help the United States achieve the policy objective of a more diversified science workforce.

#### References

- Bamberg, M. (2008). Twice-told tales: Small Story analysis and the process of identity formation. In T. Sugiman, K.J. Gergen, W. Wagner & Y. Yamada (Eds.), *Meaning in action* (pp. 183-204). New York: Springer.
- Bamberg, M., & Georgakopoulou, A. (2008). Small stories as a new perspective in narrative and identity analysis. *Text & Talk, 28*(3), 377-396.
- Bettinger, E., & Long, B. (2005). Do faculty serve as role models? The impact of instructor gender on female students. *American Economic Review, 92*(2), 152-157.
- Carlyle, T. (1841). *Heroes, hero worship and the heroics in history*. Toronto: Archibald MacMechan.
- Cole, E. R. (2009). *Intersectionality and research in psychology*. *The American Psychologist, 64* (3), 170-180.
- Freeman, M. (2009). *Hindsight: The promise and peril of looking backward*. New York: Oxford University Press.
- Freeman, K.E., Winston, C.W., Gangloff-Bailey, F., & Jones, J. (under review). Insider perspectives on the educational value of HBCUs. In I. Toldson, K. Freeman, & C. Mango-Ambrose (Eds.), *The 2014 compendium of U.S. government sponsored research and programs at Historically Black Colleges and Universities*. Washington, DC: U.S. Department of Education White House Initiative on HBCUs.
- Jaynes, G.D. & Williams, R. M. (Eds.) (1989). *A common destiny: Blacks and American society*. Washington D.C.: National Academy Press.
- Josselson, R. & A. Lieblich. (Eds.) (1993) *The Narrative Study of Lives*, Volume 1. Newbury Park, Ca.: Sage Publications.
- Josselson, R. (2006). Narrative research and the challenge of accumulating knowledge. *Narrative Inquiry, 16*, 3-10.
- Keller, E. F. (1983). *A feeling for the organism: The life and work of Barbara McClintock*. New York: W. H. Freeman and Company.
- Kessler, J.H., Kidd, J.S., Kidd, R.A. & Morin, K.A. (1996). *Distinguished African American scientists of the 20<sup>th</sup> century*. Phoenix, AZ: The Oryx Press.
- Logan, R. W., & Winston, M. R. (1982). *Dictionary of American Negro biography*. New York: Norton.
- Mack, K. M., Rankins, C. M., & Winston, C. E. (2011). Black women faculty at historically black colleges and universities: Perspectives for a national imperative. In H. T. Frierson Jr. & W. F. Tate (Eds.), *Diversity in higher education: Vol. 11. Beyond stock stories and folktales: African Americans' paths to STEM Fields* (pp. 149-164). United Kingdom: Emerald Group Publishing Limited.

**CYNTHIA E. WINSTON**  
**MICHAEL R. WINSTON**

*Howard University*

- McAdams, D. P. (2001). The psychology of life stories. *Review of General Psychology*, 5, 100–122.
- National Science Foundation, Division of Science Resources Statistics. (2009, January). *Women, minorities, and persons with disabilities in science and engineering: 2009*, NSF 09-305. Arlington, VA. Retrieved from <http://www.nsf.gov/statistics/wmpd/>.
- National Science Foundation, Division of Science Resources Statistics. (2011, February). *Women, minorities, and persons with disabilities in science and engineering: 2011 digest*, NSF 11-309. Arlington, VA. Retrieved from <http://www.nsf.gov/statistics/wmpd/>.
- Nobelprize.org Retrieved from [http://www.nobelprize.org/nobel\\_prizes/medicine/laureates/1983/mcclintock](http://www.nobelprize.org/nobel_prizes/medicine/laureates/1983/mcclintock).
- Rossiter, M. W. (1982). *Women scientists in America: Struggles and strategies to 1940*. Baltimore, MD and London, England: Johns Hopkins University Press.
- Rossiter, M. W. (1995). *Before affirmative action 1940-1972: Women scientists in America*. Baltimore, MD and London, England: Johns Hopkins University Press.
- Stewart, A. J. & McDermott, C. (2004). Gender in Psychology. *Annual Review of Psychology*, 55, 519-544.
- United States Department of Commerce (2011). *Gender gap to innovation*. Washington D.C.: United States Department of Commerce.
- United States National Library of Medicine. Retrieved from <http://profiles.nlm.nih.gov/ps/retrieve/Narrative/LL/pnid/48>.
- Warren, W. (1999). *Black women scientists in the United States*. Bloomington, Indianapolis: Indiana University Press.
- Winston, C. E. (2011) Biography and lifestory. In S. Lapan, M. Quartaroli & F. Riemer (Eds.) *Qualitative research: An introduction to designs and methods* (pp. 106-136). New Jersey: Jossey-Bass.
- Winston, C. E., & Winston, M. R. (2012). Cultural psychology and racial ideology: An analytic approach to understanding racialized societies and their psychological effects on lives. In J. Valsiner (Ed.) *Oxford handbook of culture and psychology* (pp. 559-581). New York: Oxford University Press.