

ONE

INTRODUCTION

Who are Black mathematicians? What are their paths to the profession? Although this book provides some answers to these questions, it is by necessity a synthesis of many stories past and present. By one estimate, there are roughly 300 living Black mathematicians in the United States. They work in colleges and universities; for federal, state, and local governments and agencies; in private and public secondary schools; and in industry. Their fields encompass pure and applied mathematics, including operations research, analysis, game theory, topology, algebra, number theory, and statistics. The mathematics they do is elegant, relevant, and practical, as well as critical, for the sciences, technology, engineering, finance, public policy, national security, and a host of other domains relevant to the well-being of the country and the world.

Black mathematicians are indeed a rarity, as are mathematicians in the United States generally. Recent American Mathematical Society data show that roughly 1,400 people were granted the PhD in a mathematical science by a U.S. university in 2008–2009, the most recent year for which data are available. Half of those individuals hailed from outside of the United States. Of the 669 American citizens who received the PhD, 86 were Black, Latino, Asian, or Native American. Nineteen, or less than 3% that year, were Black.

In the public imagination, mathematicians seem to spring fully formed as individuals whose sole interest is mathematics, who are socially inept, and who are unconcerned with any topic other than mathematics. There is a prevalent idea that mathematics is a completely solitary enterprise, done in the absence of any community. Burton (1999) describes “a false social stereotype, promoted and reinforced by the media, of the (male) mathematician, locked away in an attic room, scribbling on his [sic] whiteboard and, possibly,

solving Fermat's Last Theorem" (p. 127). These notions of mathematics and those who do it are disseminated to American school students at an early age. Substantial research in mathematics education reveals that both elementary and secondary teachers and students share limited notions of mathematics and, further, narrow ideas about who mathematicians are and the work that they do (Cirillo & Herbel-Eisenmann, 2011; Moreau, Mendick, & Epstein, 2009).

Works focusing on the formative and educational experiences of mathematicians are relatively rare. Within these works, Black mathematicians are often absent altogether or represented by one or two individuals. For example, books exploring women mathematicians (Murray, 2000) or scientists in general (Hermanowicz, 1998) do not usually include more than one or two African Americans. Books addressing Black mathematicians and their research for the most part do not focus on their personal and professional lives nor on the journeys they took to become mathematicians (Dean, 1997; Dean, McZeal, & Williams, 1999; Newell et al., 1980). Books that provide more detailed personal information and include Black mathematicians (e.g., Albers & Alexanderson, 1985; Albers, Alexanderson, & Reid, 1990; Kenschaft, 2005) do so largely in the style of encyclopedias, with brief synopses of Black mathematicians' personal and professional lives; Kessler, Kidd, Kidd, and Morin's (1996) profiles of 100 Black scientists include 4 mathematicians. *Beyond Banneker* provides detail about Black mathematicians' early mathematical experiences and in-depth analysis of the relationships between their cultural, ethnic, and mathematical identities. In documenting, describing, and analyzing the formative, educational, and professional experiences of Black mathematicians, this book seeks to add a significant missing component to the national narrative about mathematics and mathematicians.

Throughout this book, I primarily draw on extensive interviews conducted with 35 U.S.-born Black mathematicians who earned their PhDs in a mathematical science between 1941 and 2008 and describe the richness and variety of Black mathematicians' experiences, from Banneker and Fuller's time to the present day. The interviews are augmented by data collected from books, texts, oral histories, articles, and essays written by and about Black mathematicians in the United States and by information gleaned from site visits to conferences, colleges, and universities.¹

I begin by telling the stories of the first Black persons in the United States to earn their PhDs in mathematics, Elbert Frank Cox and Euphemia Lofton Haynes, and of the three oldest Black mathematicians in the United States interviewed for this study, David Blackwell, Evelyn Granville,

and Clarence Stephens. These mathematicians, the “Vanguard,” reveal that a host of factors contributed to their becoming mathematicians. As they were among the first Black Americans to earn their PhDs in mathematics, their stories have inspired others to pursue mathematics.

The Vanguard

When I was growing up, it [was] highly unlikely that you would know a PhD. In fact, when I got to [this job] my good [White] buddy would say, “Wayne, when I was growing up I had an uncle who was a mathematician so I kind of knew what they did and I knew that I wanted to be one. But in your case, how did you know you wanted to be one?” *Now, in my case it was different: you could not see all the way to a PhD.*

—Wayne Leverett, PhD, interview² (my italics)

In any category of “firsts,” there is always an underlying question of how “the first” decided that it was within his or her power to become that which no one like him or her had become before. The answers Elbert Frank Cox and Euphemia Lofton Haynes (the first Black male and female Americans to earn doctoral degrees in mathematics) might have given to this question, unfortunately, are unknown. But what we do know about them—largely through remembrances from Cox’s students, colleagues, and family members and from Lofton Haynes’s collection of family and professional papers held at Catholic University—tells us something about their journeys as mathematicians and, also, the ways in which these journeys left blueprints for others to follow.

Elbert Frank Cox, who earned his PhD in mathematics from Cornell in 1925, was born in Evansville, Indiana, in 1895. Indiana’s location in the Midwest, bordering southern states but also serving as a home for abolitionists, meant that it had attendant characteristics of both the North and the South with regard to race relations. Cox lived on a neighborhood block that was considered to be racially mixed, but in 1903, the “most serious race riot in Evansville history broke out in his neighborhood” (Donaldson & Fleming, 2000, p. 106). Yet despite growing up in a racially mixed neighborhood, Cox attended segregated schools for most of his childhood. His father, Johnson D. Cox, was a teacher at the elementary school he attended. Cox’s accomplishments are all the more impressive given that he was born and came of age during a period considered to be the nadir of American race relations—a period of curtailed and withdrawn civil rights and extensive racial violence

against Blacks between the end of Reconstruction and the beginning of the new century (Anderson, 1988).

Cox enrolled in Indiana University in 1913 as a mathematics and physics major, earning all A's in his mathematics courses. After graduating from there in 1917, he became a high school mathematics and physics teacher in Kentucky. He then began teaching at Shaw University in Raleigh, North Carolina, in 1919. While teaching at Shaw, he began taking courses at Cornell University, beginning in 1920. He applied to Cornell's doctoral program in 1921 and solicited letters of recommendation from his Indiana University professors. One professor, S. C. Davisson, wrote that he "would be glad to have him in the graduate program in Indiana: 'he surpasses any colored man I have known as a student in mathematics'" (Donaldson & Fleming, 2000, p. 112). Another, probably Tobias Dantzig, wrote an official letter, and then wrote a second letter to Professor Tanner at Cornell because he anticipated "certain difficulties for the young man because of the fact that he is of the colored race" (Donaldson & Fleming, 2000, p. 112).

Kenschaft (1987) notes that Cox's Cornell advisor, William Lloyd Garrison Williams, was probably aware of the significance of Cox being the first Black person in the world to earn his PhD in mathematics and suggested that he submit his dissertation abroad in addition to Cornell so his "status could not be disputed" (p. 172). Cox finished the PhD in 1925, and after a few years as a professor at West Virginia State College, he began teaching at Howard University, in 1929. At Howard, he joined Dudley Woodard (PhD 1928), the second African American to earn his PhD in mathematics (from the University of Pennsylvania), who was the department chairman. Eventually, the mathematics department at Howard could claim as faculty five of the first eight African Americans to earn their PhDs in mathematics, including William Claytor (PhD 1933, University of Pennsylvania), David Blackwell (PhD 1941, Illinois), and J. Ernest Wilkins (PhD 1942, Chicago). Although Howard did not have a PhD program in mathematics until 1975, its master's degree program in mathematics was one of the first among historically Black colleges and universities (HBCUs) and produced several students who eventually went on to earn their PhDs. Upon Cox's retirement in the 1965–1966 school year, Howard's president remarked that Cox "had directed more masters degree students than any other professor at Howard" (Donaldson & Fleming, 2000, p. 121).

Since his retirement and death (in 1969), Cox's life and career in mathematics have been honored, most prominently with the Cox-Talbot Address by the National Association of Mathematicians (NAM), an organization

founded by Black mathematicians. Whether his path crossed that of a fellow Washingtonian who “in her spare time taught at Howard University,” Euphemia Lofton Haynes, the first African American woman to earn her PhD in mathematics, is unknown.

Lofton Haynes’s accomplishment itself as the first African American woman to earn her PhD in mathematics was unknown for many years, and in fact, Marjorie Browne (PhD 1950, Michigan) and Evelyn Boyd Granville (PhD 1949, Yale) were each assumed at various periods to be the first African American women to earn their PhDs in mathematics.³ Despite the fact that some reports published around the time of Lofton Haynes’s death mention her receiving the doctorate in mathematics from Catholic University in 1943, no one in the mathematics community seems to have connected the dots until the late 1990s. Granville, born and raised in Washington, DC, herself an alumna of the same secondary school that Lofton Haynes attended, noted, “surprisingly, no one in DC ever mentioned the name of Euphemia Lofton Haynes to me and I did not hear about her until late 1999. This remains a mystery to me” (E. B. Granville, personal communication).

Born in 1890, Lofton Haynes was a contemporary of Cox, and although she lived in Washington, DC, for much of her life—the exceptions being her attendance at Smith College (bachelor’s degree in mathematics, 1914) and the University of Chicago (master’s in education, 1920)—it seems that their paths never crossed. Before leaving DC for Smith and the University of Chicago, Lofton Haynes began her education in the segregated city schools of Washington, DC, attending the highly regarded Dunbar School⁴ and graduating from it as valedictorian (Duffie, 2003).

What made Euphemia Lofton Haynes decide to pursue her doctorate in mathematics is unknown, but her commitment to education was clear. Teaching for 47 years in the DC public school system and also as a professor at Miner Teachers College in DC (now part of the University of the District of Columbia), she became a member and, eventually, president of the DC Board of Education. Widely acknowledged as a key factor in the integration of the DC schools in the 1960s and 1970s, she was a fierce opponent of tracking in schools. When she died in 1980, her status as the first Black woman to earn a PhD in mathematics was unknown, despite her leaving a substantial collection of family papers to Catholic University.

Many of the teachers at Dunbar, as Evelyn Boyd Granville attests and other chroniclers have described (Cromwell, 2006; Sowell, 1974), were highly educated and influenced their students to pursue postsecondary education. Lofton Haynes fondly remembered Miss Harriette Shadd, a teacher at

Dunbar and a Smith College graduate—“I just idolized her, that’s all” (Lofton Haynes oral history). It was due to her influence that Lofton Haynes wished to attend, and eventually enrolled in, Smith. All we know of Lofton Haynes’s decision to get her PhD in mathematics is what she told an interviewer in 1972⁵:

[I] approach everything from a philosophical point of view. Does that say anything? I have been a mathematics scholar all of my life, through high school, through college, and then to get my doctor’s degree in mathematics. Now I didn’t expect to get my doctor’s degree, never, in mathematics but I wasn’t surprised . . . because I enjoyed it so much.

Three of the oldest mathematicians interviewed for this book—David Blackwell (1919–2010), Evelyn Boyd Granville (1924–), and Clarence Stephens (1917–)—share some similarities with Cox and Lofton Haynes (including the fact that all of them have ties to the greater Washington, DC, area), although the three grew up in very different circumstances. Blackwell (arguably the most well-known) was born and educated in a predominantly White small town in Illinois; Granville was born and raised in predominantly Black Washington, DC; and Stephens was born and educated in segregated schools in rural and urban North Carolina.

Despite these different backgrounds, these three mathematicians share a common experience: they were Black and earned their PhDs in mathematics in an era when to be Black and highly educated was quite rare. David Blackwell was the seventh Black person to earn his PhD in mathematics, and he received it in 1941 from the University of Illinois, Urbana-Champaign. He was the first African American to be inducted into the National Academy of Sciences in any field, and he retired in 1988 from a long career as a professor of mathematics and statistics at the University of California at Berkeley. Despite his growing up in Centralia, Illinois—a predominantly White town that he noted was “*not* North of the Mason-Dixon Line”—Blackwell felt that he “really didn’t face any obstacles to becoming a mathematician” (D. Blackwell, personal communication, October 2007). For example, although he attended a predominantly White high school with an all-White teaching staff, one of his teachers recognized his mathematical talent and encouraged him to join the mathematics club.

Blackwell did not suggest, however, that his induction into the profession was a completely color-blind one. He described this experience: after he

completed his undergraduate degree, he was being considered for graduate fellowships, along with other White candidates (Agwu, Smith, & Barry, 2003). One of the fellowships involved teaching; the other, with greater funding, was a nonteaching fellowship. One of his White peers told him that he would probably get the nonteaching fellowship, saying

“Well, you’re good enough to be supported one way or another. And they’re not going to put you in front of a classroom” . . . and of course, he meant because I was Black. And you know, he was right? (D. Blackwell, personal communication, October 2007)

Evelyn Boyd Granville (PhD, 1949) was one of the first African American women to receive a PhD in mathematics. Born in Washington, DC, she attended segregated schools, including the aforementioned Dunbar High School, which has been renowned for its history in educating Blacks in Washington, DC, for decades (Sowell, 1974):

Dunbar gave us inspiration, quality education, and, you know, they made us feel good about ourselves. So they gave us, I can’t think of a good word, but self-something-or-other. . . . It was a tradition at Dunbar to encourage us to go to the Ivy League schools. And Miss Mary Cromwell [one of Granville’s mathematics teachers] was the sister of Dr. Otelia Cromwell, a graduate of Smith in 1900, somewhere around there. Otelia Cromwell went to Smith, and then later went to Yale and got her PhD in English. And Miss Mary Cromwell and Dr. Otelia’s niece [Adelaide]⁶ also went to Smith. They encouraged me to apply to Smith, but I also applied to Mount Holyoke. And I was admitted to both Smith and Mount Holyoke, but I chose Smith, I’m sure at the urging of the Cromwells. (E. B. Granville, interview, 2009)

Granville completed her doctorate in mathematics at Yale, then spent some time in New York City doing postdoctoral work. Eventually, she accepted a position at the historically Black Fisk University in 1950, where she taught Etta Zuber Falconer (PhD 1969, Emory University) and Vivienne Malone Mayes (PhD 1966, Texas)—who once commented that it was the presence of Granville that influenced her and others to pursue the PhD. Then Granville began a career at IBM before returning to academe and retiring in Texas. Asked once to summarize her accomplishments, Granville

stated: “‘first of all, showing that women can do mathematics.’ Then she added, ‘Being an African-American woman, letting people know we have brains too’” (Young, 1998, p. 212).

Clarence Stephens (PhD 1943), like Blackwell and Granville, has been a faculty member at both HBCUs and predominantly White institutions. Born in rural North Carolina in 1917, he attended segregated elementary schools and an all-Black boarding school, the Harbison Institute, for secondary school. Graduating from Johnson C. Smith College, a historically Black college, he earned a master’s degree and a doctorate from the University of Michigan in 1941. He is the ninth African American to earn his PhD in mathematics. Starting at Prairie View University, Stephens then began an illustrious career at Morgan State College (now Morgan State University) in Baltimore, Maryland, in 1947, followed by a well-documented and equally successful career at State University of New York (SUNY) Potsdam (Datta, 1993; Megginson, 2003). Early in his career, he was committed to increasing the number of mathematics majors at Morgan State and began recruiting students from the segregated Black high schools in Baltimore:

There were two high schools in Baltimore: Dunbar and Douglass. . . . I went to Dunbar first. When I talked to the teachers they recommended [a top student], but they warned me that if we instilled ambition in all of the students they would be frustrated because they couldn’t get a job [due to job discrimination against Blacks]. They were telling me about some person who got an engineering degree. Once he got it, he couldn’t get a job. I said, “Nonsense,” . . . I never pa[id] much attention to that because I just feel that if you get a good education, you’ve got a good education. (C. Stephens, interview, 2009)

Despite low expectations for student success from some of his Morgan State colleagues and administrators, Stephens was successful at not only increasing the number of mathematics majors but also at facilitating students’ entry into PhD programs. Leaving Morgan State in 1962, he continued his model program at two campuses of the State University of New York (Geneseo and Potsdam) and has received numerous commendations for his mentoring and expertise in attracting college students to mathematics. By his reckoning, Stephens had about 10 students from Morgan—a small college in segregated Baltimore—in a 15-year period who earned a PhD in mathematics—and notably, Stephens’s program had at least three students from a

single class year at Morgan State who earned their doctorates in mathematics: Earl Barnes (PhD 1968), Arthur Grainger (PhD 1975), and Scott Williams (PhD 1969). As Arthur Grainger recalled:

Earl, Scott, and I met the very first day of orientation here at Morgan. We had all determined that we knew our major was going to be in mathematics.

Grainger vividly describes Stephens “setting the stage” for developing mathematics students:

[At Morgan State, Stephens] made the effort to try and get as many talented people in math together. We were in one of these calculus courses just for math majors. He came in the first day and he had a picture that he put on the bulletin board, a picture of a nice building. It was the Institute for Advanced Study at Princeton. That was the picture that he put up. And then he told us, “You are to aim for here; to get here at the Princeton Institute.” You know, where Einstein was. He said, “Even if you miss, at a minimum, you will have a PhD. Because to get there, you would have to have a PhD, so if you aim here, you can miss.” So in other words, establish that and set your goals very high in aiming at that so that if you don’t make it, you will be pretty well off. (A. Grainger, interview, 2008)

These short introductions to the first Black mathematics PhDs in the United States (including two living elders, Granville and Stephens) reveal that many factors, including their mathematical talents and interests; thwarted potential and the awareness of limited opportunity; the sense of being in the right place at the right time; the supportive and rigorous educational environment at their schools, whether segregated or not; and the importance of family and community networks, all contributed to their becoming mathematicians. These experiences shaped and formed these mathematicians and, in turn, inspired others to pursue mathematics. Their stories are largely overlooked reflections of American history, mathematics, and education across the 20th and 21st centuries. In many ways, their mathematical lives are metaphors for the Black experience in America—opportunities earned, granted, denied, rescinded; civil rights as citizens upheld as well as challenged; and an ever-present “double consciousness” of what it means to be Black in educational and professional settings.

One Mathematician's Story

To illustrate some of what is overlooked in discussions about mathematical excellence and how it is attained, here I present in detail one Black mathematician's rich narrative about his mathematical experiences. Wayne Leverett, who earned his PhD in the 1960s, represents roughly the midpoint of Black mathematicians attaining their PhDs: squarely between Cox and other early mathematicians' achievements in the 1920s and 1930s and those of the youngest mathematicians in this study, who earned their PhDs in the 1990s and 2000s. The structure of his narrative, as I present it—beginning with key mathematical memories and the role of family, community, and school in fostering mathematics learning, segueing into professional and induction experiences in the field—is the same organizing structure that is used for the rest of this book. Throughout Leverett's narrative—as well as throughout the rest of this book—there is an understanding that history plays a part in his mathematical journey. His narrative about his mathematics experiences describes how he became a mathematician and, importantly, demonstrates how community and historical contexts are integral to the development of one's identity and success. Within the narrative are the pervasive twins of obstacles and opportunities, as well as more than a few occasions of serendipity.

Mathematical Memories

Leverett recounts his first mathematical memory:

One thing I remember is that when I was in about ninth grade, my uncle worked for a construction company. He saw the foreman using a slide rule. He just got curious about it, so the foreman said, "Well next time I place an order for equipment, I will order you one if you'd like." So the slide rule came with a thick manual about trigonometric functions and those such things. It was way over my uncle's head. He was a carpenter, trained to do carpentry on the GI Bill. In the family, people thought that I was some sort of bookworm because I was always reading books. So he just gave it to me.

I wanted to get to the basics of the thing. I wanted to understand it, so I actually read the manual. I knew enough algebra and trigonometry to figure out most of the scales. For me it became a

hobby. So at school when the teachers discovered that I could use this thing, they were quite amazed. . . . This slide rule was one of my first memories about experiences that got me hooked on math for sure.

Leverett obviously had some school mathematics memories before this one—"I knew enough algebra and trigonometry to figure out most of the scales"—but this is, for him, a central formative mathematics experience. Why? Embedded in this story is his family's understanding that Leverett was something special—a bookworm who would appreciate the gift of a book, even if it was only a manual about trigonometric functions. Later in his narrative, it becomes clear that Leverett sees this moment as being critical to his pursuit of mathematics and development as a mathematics learner.

A related story that figures prominently in Leverett's mathematical memory is the experience he and a friend had with "mathematics in action."

When I was supposed to graduate [from high school], a good buddy of mine and I were idling time away walking down a country road headed home, I believe. We came upon a little White man who was surveying some land. He needed two strong fellows to help him pull some chains. He told us that he would pay us 75 cents per hour to do this. This is a lot more than you could make working on the farm. You could earn two or three dollars a day by working on the farm, but here is a guy who is going to pay 75 cents per hour. I thought that this was an enormous sum of money to pull these chains, however, when this guy starting talking to us, he had a transit. He would set it up in sight through here and swing around through a certain angle and sight through there. He could compute the distance between two far-away points. When he found out that I knew a little trigonometry, he started teaching me how to use this transit. He was so impressed with me and I was so amazed by how much money you could make using this trigonometry. So I said right away that I wanted to be an engineer because I thought that engineers made even more money than high school math teachers. I wanted to be a civil engineer.

This was a moving experience. I wish that students at tenth grade level could see something like this where here is something I am learning in school that is being used to earn money. Meeting that engineer who was surveying land. . . . I am glad I remember that story because of the fact that this guy could give \$1.50 from his

salary. Based on salaries that I knew about, from farmers, this guy must be making a lot of money. And he was friendly enough to teach me things about how he was actually measuring the distance in doing this without having to jump across that ditch over there to get to here. Now we had studied about triangles and all—if you know this side and you know this side and you know the angle between you can get the length of the third side and all that. But here it was in action. This was very powerful. So by the time I graduated from [college], I had not forgotten about being an engineer, all of that money.

Although the preceding stories tell us something about Leverett's out of school experiences with mathematics, it is clear that in-school and out-of-school mathematics reinforced each other in powerful ways:

I remember, maybe in the tenth grade algebra class, she [the teacher] gave me half the class [to teach]. My first memory of doing math [in school] was as a show-off. I was having fun, but I think the fact that the teachers gave me praise really encouraged me to do a bit more. When we were taking algebra, Mrs. Barr gave me a college algebra book because I think she feared that I could keep up with the regular algebra easily. She gave me a college algebra book and would check off a couple of problems and say, "See if you can do these tonight." I would go home determined to do them because I wanted to stay in her good graces. She thought I was smarter than I was and I wanted to keep it that way. So I would work on the problems, sometimes, half the night before I would figure out how to solve them, but I would come in the next day as if I had solved them in 15 minutes. "Here is the solution, give me some more." I managed to keep that going until I graduated. . . . [A]t the end of the year when I tried to return the book, she said, "Wayne, you keep that book. It will do you more good than it will do me." I thought it was such a great treasure to have her book.

The only thing that I have taken to everywhere I go is to remember what teachers did for me when I was in high school. Because if Burgess had ignored me, or if Barr had ignored me, or [his college professor], I don't know where I would be today. I certainly wouldn't be here. So when I see a student who has some ability and is trying, I always try to pull them aside and do something special. I keep looking for students to befriend and yes, I try to find a good student to mentor and watch them and see how they grow.

Throughout Leverett's narrative about his early mathematical journey, he makes connections to his own current practice as a mathematician and his own philosophy about mathematics. He highlights the importance of young people understanding the real-world implications of the mathematics they learn in school and also seeks to emulate his own high school teachers and college professor in his work as a mathematician at a research university.

Socialization Experiences within the Field

One of the most telling quotations from Leverett's narrative is a question from a colleague who was working with him in private industry: "Wayne, when I was growing up I had an uncle who was a mathematician so I kind of knew what they did and I knew that I wanted to be one. But in your case, how did you know you wanted to be one?"

The assumption of Leverett's colleague that Leverett would not have known "how he wanted to be a mathematician" in the traditional way—via a close network or family member—was not an unfounded one, given the era. In addition, what we know about Leverett's family from his own story suggests that most were not college educated, and this underscores that the traditional routes to mathematics careers might not have been available to Leverett.

But it would be dismissive—and erroneous—to discount the critical contributions of Leverett's family members (who had not received the same opportunities for education as those of his colleague's family) to his development as a mathematician. In particular, two of Leverett's uncles, in addition to his father, figure prominently in his narrative:

My uncle was a unique person. He was always curious about everything: art, technology. The rest of my family, of course, always supported and encouraged me to be a good student, but they didn't know technology, and they couldn't help me with algebra. He couldn't help me, but at least he was brave enough and curious enough to be interested in the slide rule.

My parents had been divorced and my father moved to [another city] and worked for a steel company. My dad had a brother in that city, Uncle Fred. By then they all assumed that I was a pretty good student. They all thought that I was smarter than I was. I really thought that I was pulling a great big scam on all of them, but I never told them that. So one day I am [visiting and] riding around

with my uncle and he says, “Wayne, you say you want to go to college and blah blah blah.” I said, “Yes. I would like that very much.” He says, “We have a college here; let’s try it out tomorrow and take a look at them.”

I remember he was quite a brave guy because we went to the registrar’s office and there was some person there like a receptionist or secretary. She tried to give us some application papers to fill out. My uncle said, “We don’t want to fill out papers, we want to talk to the registrar.” They actually brought him out and we spoke to him. Uncle Fred told him how smart I was in his opinion. [The registrar] basically said, “Look if he is all you say he is, we will admit him. Have him send his high school transcript when he gets back home. It is going to cost \$350.00 a semester or year.” I can’t remember, but I remember the \$350.00. So I basically signed up there on the spot just pending my high school transcript being as good as my uncle had claimed it was. So I went home and told Dad that I had signed up for college that day. The good thing is this: they said, “If your father has been living here all these years, you could be admitted as a resident of this state.” So there is another lucky break, that some uncle who really thought I was smart decided to take me over and at least investigate this college.

My Dad worked there [at the steel mill]. It was a very strong union. It was amazing. So the pay was good for unskilled labor. But he used to say to me in college, “Wayne, I hope you never have to work at this company.” Actually, there was a lot of pollution and dirt and smog. I could tell by the black stuff that would be on his clothes from burning coal, which is something that they did to cook the steel. But yes, he made quite enough money to pay my tuition. So I went through college without having to work.

This network of African American men, none of whom had gone to college, supported Leverett’s development in multiple ways. The first uncle arguably set Leverett on the path to wanting to learn as much as he could about mathematics. The second uncle single-handedly (and later backed up by Leverett’s strong high school record) got him enrolled in a Black college that happened to have a strong emphasis on mathematics. And Leverett’s father had the vision of wanting more for his son than a good-paying union job and supported him financially throughout college so that he could focus on his studies.

As Leverett reveals, at every stage he saw more and more opportunities for his life and career:

Well, I mean, when I was in high school and in [the rural South] in farming country, and segregation, and hardly any industry anyway, Black professionals tended to be preachers or teachers. Everybody else was a farmer. So I thought that being a teacher was a good occupation that provided a fairly good lifestyle and that is what I wanted.

Now I didn't know anything about PhDs. I didn't know any PhD. My goal was to earn a BS degree in mathematics and become a high school math teacher. But when I got to [college], there was Dr. Stephens, who has won all kinds of awards for his teaching. He really stretched us and he started talking to us about the PhD. When I got to [college], I had changed my plans. I said, "Well, you know, I think I would rather teach at [this college] than to teach at East Side High." So I kind of started to think about teaching in college rather than teaching at the high school level. [When I realized] that the college professors get to talk about more interesting math at a higher level and how you learn more beautiful things and work with smart students, then of course, I changed my goals.

What Leverett likens to a contemporary research undergraduate program in mathematics (research experiences for undergraduates, or REU) was really his induction into a community of mathematics doers. He met other talented mathematics students, and all of them were supported by a talented professor of mathematics. Stephens's program, in addition to Leverett's father's financial contributions, ensured that his focus could be on his mathematics work and on excelling in mathematics. His excellent grades and performance on the Graduate Record Examination (GRE) ensured Leverett's fellowship and his smooth path through graduate school on the way to the PhD.

Opportunities Then and Now

As Leverett stated earlier, in his case, "it was different: you could not see all the way to a PhD":

You know, it's different these days. Kids have the internet. They can look up a whole bunch of information about [careers]. And it's

scary, I mean, I think back how it happened, I went [to the company] without knowing very much about [what the company did]. I mean, I didn't know what they made, what kind of problems they were trying to solve. It was a lucky stroke, which I don't think happens today. I think they hire mathematicians but they're much more project-oriented. They will hire somebody who can come in on day one and help out with this signal processing thing they're interested in and they don't just look at somebody's transcript and say, "Come on in, you got good grades, we're going to try to get you interested in some problems we have and hopefully you can help us out." They don't do that anymore. But I'm sure any old person you talk to will say that things are much different today than when I grew up and that's all I'm saying. One has to be envious of the opportunities that young kids have these days.

Wayne Leverett's narrative shows the influence of his earliest memories of mathematics: they are rooted in the recognition that his father and uncles helped hew a path for him to become a mathematician, and that serendipitous encounters—with a surveyor, with a professor, and with like-minded students at his undergraduate HBCU—helped him see that mathematics could be a career goal. Although much of Leverett's mathematical journey follows the traditional path for professional mathematicians—college attendance and apprenticeship with a mathematician and graduate school immediately following—his story reveals much more about how people might find their way into *becoming* mathematicians. These stories, although largely missing for Elbert Frank Cox and Euphemia Lofton Haynes in their own words, are critical not only to understanding how more of our talented citizens might fully reach their potential but also to illuminating a field that privileges itself as largely unknowable to most. The goal of this book is to share these stories, in an effort to make mathematical lives known and knowable. The remaining chapters of this book show the paths, spaces, and communities that contributed to these mathematicians becoming who they are.

Organization of Remaining Chapters

Beyond Banneker describes the formative, educational, and professional experiences of 35 mathematicians interviewed between 2007 and 2010. Throughout the remaining chapters, I draw on the experiences of mathematicians I interviewed. To provide some context vis à vis the time periods that

mathematicians “came of age,” I have divided the 35 into three “generations.” The first generation includes three mathematicians who are referenced without pseudonyms (David Blackwell, Evelyn Granville, and Clarence Stephens) throughout this book. First-generation mathematicians earned their PhDs before 1965, largely before the gains of the Civil Rights Movement. There are 12 second-generation mathematicians who earned their PhDs between 1965 and 1985, four of whom earned their PhDs before 1970. Many second-generation mathematicians attended high school in the 1950s and 1960s, at the zenith of the Civil Rights Movement. Finally, there are 20 third-generation mathematicians who earned their PhDs between 1985 and the present; four of them earned their PhDs before 1990. Most of these mathematicians were high school students in the 1970s, 1980s, and 1990s.

The remaining chapters follow the “mathematical life spans” of mathematicians from early interest and educational experiences in mathematics to their professional lives as mathematicians. Chapter 2: Kinships and Communities describes how most mathematicians’ first mathematical memories are rooted in family experiences and critical school experiences in childhood and adolescence. It also lays the foundation for descriptions of how fictive kinship networks emerge for Black mathematicians within schools, professional networks, and the field. Chapter 3: Navigating the Mason-Dixon Divide, focuses on “border states” of being: the chapter title takes its cue from David Blackwell’s statement about his hometown of Centralia, Illinois, being “*not* North of the Mason-Dixon Line.” In particular, it examines the role of the space and place of the South in facilitating mathematics learning and development in caring all-Black schools and colleges and also posing challenges to opportunities for learning. These experiences cut across generations of mathematicians and are shared by some of the youngest participants in the study as well as some of the oldest. This chapter also focuses on the mathematical and educational experiences of those who were among the first to desegregate all-White high schools and colleges, including a number of second-generation mathematicians who did so in the 1960s. Chapter 4: Representing the Race takes its title from a 10th grader who once commented to me that being Black in a math class and getting called on meant that one was representing the entire race when answering a math question. Being wrong in this setting would have had dire consequences in terms of how Black students were viewed. This chapter revisits the histories of Thomas Fuller and Benjamin Banneker and describes Black mathematicians’ narratives of their induction into the profession as adults, focusing on their experiences in graduate school and their professional careers. Further, it explores how they see themselves represented by others and how they define themselves. It

examines how these representations present opportunities for and challenges to their mathematical performance and participation. In addition, this chapter discusses the place of Black women mathematicians, whose race and gender operate together to present unique opportunities for and obstacles to their mathematical development. Chapter 5: *Flying Home* describes the importance of historically Black colleges and universities in cultivating mathematics talent, the nostalgia held by mathematicians (those who were and who were not educated at HBCUs) for them, and the mission of some mathematicians to return there. Further, it describes the efforts of Black mathematicians at predominantly White institutions to create structures and communities that in some ways mimic those of HBCUs. This chapter builds on the discussion of the networks initially described in chapter 2. Chapter 6 is the conclusion, which revisits the lives and experiences of the Vanguard in light of what we have learned from the lives and experiences of contemporary Black mathematicians in the United States. It revisits the paths to the doctorate and the profession of mathematics, the challenges that still face Black mathematicians, and the opportunities that they have seized for themselves and created for others. It describes emerging efforts of mathematicians to reach younger and younger generations of Black students and suggests additional avenues for exploration and research.⁷