A Year That Makes the Difference: Achievements of Ford Foundation Postdocs in the Mathematical Sciences

Isom H. Herron

Beginnings

Launched in 1962, by 1979 the Ford Foundation Fellowship Program had become one of America's most prestigious and successful doctoral fellowship initiatives. The fellowships sought to increase faculty diversity at US colleges and universities "…by increasing their ethnic and racial diversity, to maximize the educational benefits of diversity, and increase the number of professors who can and will use diversity as a resource for enriching the education of all students" as stated in the 50th anniversary conference report [1]. So, in its early years the program had as a major objective to increase the number of PhDs. The "underrepresented racial and ethnic minorities targeted by the program were identified as Black (African-American); Chicano (Mexican-American); Puerto Rican; and Native American."[1] And in many ways the program succeeded. This redounded, by inference, to the benefit of the mathematical community, as numerous students were funded at this level. In their study of Ford Foundation Fellows, Arce and Manning [2, p. 44] learned from their respondents across all fields: "An impressive finding is that over 90% of the sample were employed. Of these 66.1% were in college or university settings." However, they went on to

note: "Most of the individuals who became faculty members, were in junior faculty positions. Surprisingly, those employed in academia were not as satisfied with their careers as one might expect. In fact, those outside academia seemed more satisfied" [2, pp. 46–47]. The study by Arce and Manning was based on extensive surveys and interactions with Ford Fellows. One of the summary conclusions was the need for "*post-doctoral professionalization*" (emphasis mine), which has as its core: "The process of career development in scholarly research and teaching" [2, p. 139].

A contention of this article is that the introduction of the Ford Foundation Postdoctoral Program has allowed this need to be met in great part. These profiles are meant to give the reader a sense of the value added to an individual's career by the Ford Postdoctoral Fellowship in mathematics. The objective here is to showcase minority accomplishments with a view to encouraging current minority graduate students to apply for this and other research opportunities.

The postdoctoral program. Within the Ford Foundation, the Postdoctoral Fellowship Program owes its genesis to Dr. Benjamin F. Payton, who was Program Officer, Higher Education and Research from 1972 to 1981. In 1979, he met with leaders at the National Academies of Sciences, Engineering, and Medicine to outline his vision: "to offer a respite from teaching so that fellows could focus on research."

The mathematical community was made aware of this initiative in an announcement that appeared in the November, 1979 issue of the *Notices*. Because of the seminal

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[1]*This language may seem outdated, but it is reflective of the viewpoint at that time.*

nature of this announcement, it is reprinted in full at the end of this article.

The announcement proposed that 25 awards would be given. However, because of the quality of the responses, in the initial group of recipients in 1980, there were finally 35 awards in all fields from among 400 applicants. *In referring to the recipients, their titles will be suppressed, with the understanding that they all hold a doctorate.* The first class contained two mathematicians, Robert Mena and Scott Williams. There were also physicists whose work was theoretical: Ronald Mickens and Sekazi Mtingwa. Mickens has gravitated towards how mathematics impinges science, while Mtingwa has had a distinguished career in physics and speaks highly of his Ford experience (www.aip.org/history-programs/niels-bohr-library/oral-histories/44300).

The next year, 1981, two awards went to mathematicians James Curry and John Ratcliffe. The following year, 1982, the lone mathematical award went to Carl Prather. In 1983, again one award went to Alain Lewis. And in 1984, two awards were won by Robert Hagwood and Donald King. There were no awards to mathematicians in 1985. In the year 1986, Anna E. Barón received the first Ford Foundation Postdoctoral Fellowship in Mathematics awarded to a woman.

Dr. Sheila Biddle became Program Officer for the Ford Foundation's Education and Culture Program in 1982. Besides instituting an annual conference of Ford Fellows across disciplines in 1982, she introduced dissertation-level awards and re-instituted predoctoral fellowships in 1986.[2] Though not a focus of this article, it is evident that reinforcing the predoctoral program has continued to pay dividends. There were "Sheila Biddle Ford Foundation Fellows," named in her honor.

In the ensuing years, PhD graduates moved immediately into early postdoctoral positions. As the evidence of various such positions became more common on the resumes of those pursuing faculty careers, the Ford Foundation Senior Postdoctoral Fellowships were separated from the early career awards. Thus a postdoctoral fellowship could either help to launch a career or provide an impetus on the journey. In either case, the Ford Fellows conferences proved to be valuable. In the early years, they were held in Washington, DC under the auspices of the National Academy of Sciences. By 2012, the number of Ford Fellows had grown so that Senior Fellows also deserved recognition. For that reason, in 2012 as part of the 50th anniversary of the Ford Fellows Program, a Senior Ford Fellows meeting was held for the first time, in Irvine, California. The meeting's workshops on

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[2]*The National Research Council had advised the National Science Foundation on minority graduate fellowships during this interim period.*

professional development took on many of the challenges outlined in the report of Arce and Manning [2], mentioned earlier. Among the ten workshops, two very striking ones, where mathematicians made strong contributions, were "Moving through rank: beyond tenure" (James Curry) and "Moving forward, moving on: timing, negotiation and objectives in transitioning your academic position" (Carlos Castillo-Chavez). These workshops set the tone for mathematicians to consider leadership in academia at the highest levels.

A wonderful added outcome of the Ford Postdoctoral Fellowships to mathematics is the quality and extent of the research that the fellows have produced. From algebra, topology, and algebraic geometry, to analysis, combinatorics, statistics, and applications, to biology, chaos theory, mathematics education, and other areas, these mathematical scientists have made significant marks in their fields. Some, as we shall see, have opened fields of inquiry that are still being explored. It would no doubt give some of the research short shrift to attempt to highlight examples of these accomplishments. It is hoped that the survey to follow will prompt readers to explore the productivity of these individuals, whose full publications can be accessed on the internet. Also, at the end of the article there is a link for readers who may be interested in applying for the program.

The First Ten Years: 1980–1989

The first two recipients of the Ford Postdoctoral Fellowships in Mathematics were Robert Mena and Scott Williams.

Figure 1. Robert Mena and students Tyler Boogar (left) and Michael Richards (right).

Robert Mena from Houston, Texas, is a Mexican-American. He received his BS in 1968, MS in 1971, and PhD in 1973 in Mathematics, all from the University of Houston. [Dissertation: "Ideal Completions and Lattices of Ideals." Advisor: Jürgen Schmidt.] Mena was ideally suited for the Ford Postdoctoral Fellowship in 1980, having been a predoctoral fellow. Mena describes his postdoctoral fellowship year as career altering, as he was able to spend it at Caltech through the auspices of Herbert Ryser. He describes the effect of the fellowship on his career thus: "I have recently retired in May, 2021. I consider myself lucky in the sense that I have had a long academic life which I enjoyed very much. I spent 15 years at Wyoming and the remaining 33 years at Cal State, Long Beach. I had a very helpful

postdoctoral fellowship from the Ford Foundation in 1980–81 to Caltech that provided me with the opportunity to switch to combinatorics from abstract algebra. My sponsor was the kind Herb Ryser.…I sat in his class as well as Marshall Hall's and Rick Wilson's. I easily tripled my knowledge that year (in combinatorics)." He is proud of his teaching for which he has received considerable recognition, for example, MVP (Most Valuable Professor) Teaching Award, College of Natural Sciences & Mathematics, 1999, 2004, and 2005, among others. In the photo he provided for this article, he is pictured with two of his students.
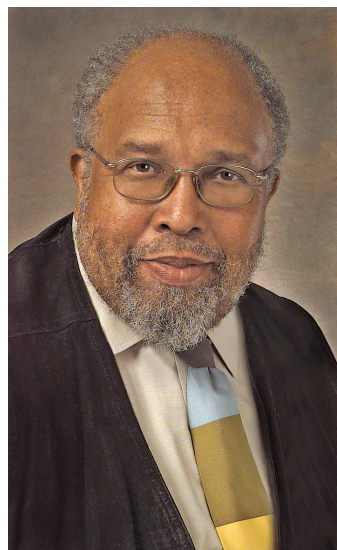

Figure 2. Scott Williams.

Scott Williams was the first African-American to be awarded a Ford Postdoc in Mathematics. Born in Staten Island, NY and raised in Baltimore, MD, he received his BS in 1964 from Morgan State University and his PhD in 1969 from Lehigh University. [Dissertation: "The Transfinite Cardinal Covering Dimension." Advisor: Samuel Gulden.] For the Ford Postdoctoral Fellowship, he chose the Institute for Medicine & Mathematics, Ohio University, and was associated with J. M. Worrell, who had been a student of R. L. Moore at the University of Texas, Austin. At that time, Williams was already Associate Professor with tenure at SUNY, Buffalo. Indeed five years later in 1986, he became a full Professor, and is now Professor Emeritus. By his reckoning, these are among his most valued papers, products of his postdoctoral fellowship: "Gleason spaces, and co-absolutes of $\beta N \sim N$" [3], "Co-absolutes with homeomorphic dense subspaces" [4], and "Box Products" in *The Handbook of Set-theoretic Topology* [5]. A secondary interest of his was in Topological Dynamics, which first began during the Ford Foundation grant. His "most cherished" paper in the area was published in 1996 [6], part of a volume which arose from a meeting of the Conference of African-American Researchers in the Mathematical Sciences (CAARMS). Williams is also well-known as the founder of the website "Mathematicians of the African Diaspora" in 1997: `www.math.buffalo.edu/mad/00.INDEXmad.html`. It has since been revised and may now be found at `https://www.mathad.com`.
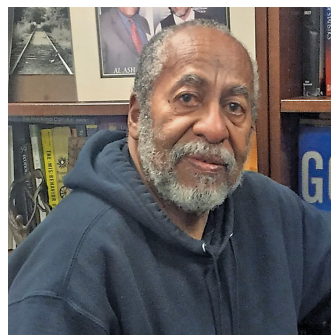

Figure 3. Ronald Mickens.

As mentioned earlier, two physics postdoctoral fellowships were also awarded in 1980. Here we refer to **Ronald Mickens**, an African-American, who is a mathematical physicist. Born in Petersburg, VA, he obtained his early education there. He received his BS at Fisk University 1964 and PhD at Vanderbilt University 1968. [Dissertation: "Branch Points in the Complex Angular-Momentum Plane." Advisor: Wendell Holladay.] His Senior Ford Postdoctoral Fellowship was tendered at Vanderbilt University, associated with Wendell Holladay. Mickens said: "When I received the 1980 Ford Postdoctoral Fellowship, I was already a senior researcher and did not go to study under anyone. By then, I had published approximately twenty-five papers and my book on nonlinear oscillations was about to be published. After my Ford year at Vanderbilt, I spent the next year at the Joint Institute for Laboratory Astrophysics in Boulder, CO, as a Visiting Researcher." In 1982, he became a Professor of Physics at Clark Atlanta University, and in 1985, he was named Distinguished Callaway Professor, retiring in 2020. Mickens is well known for his introduction of nonstandard finite difference methods [7]. He also contributed ideas on (i) the creation and extension of non-perturbative techniques for oscillating 1- dim systems, and (ii) the analysis and generalizations of the trigonometric functions, about each of which he has written books.

Figure 4. James Curry.

In 1981, there were two awards to mathematicians. One was to **James Curry**, an African-American, Professor of Applied Mathematics at University of Colorado-Boulder since 1989. He has a lengthy list of prominent administrative appointments, including chair of the department. Most recently Associate Director of the Technology Cybersecurity Policy program at C.U. Boulder, he now has joint appointments in the Department of Applied Mathematics and Computer Sciences. He received all of his academic degrees in Mathematics from

University of California at Berkeley: BA 1970, MA 1973, PhD 1976. [Dissertation: "Transition to Turbulence in Finite-Dimensional Approximations to the Boussinesq Equations." Advisor: O.E. Lanford III.] Curry was ideally suited for the Ford Postdoctoral Fellowship in 1981, having been a predoctoral fellow. For his Ford Postdoc he chose the University of Minnesota, where his postdoctoral advisor was Richard McGehee (student of Charles Conley) in Dynamical Systems. He says that since completing his PhD, his research interests have included dynamical systems, numerical methods, and most recently applications of data science to modeling smart and connected ecosystems, e.g., cities. Curry said: "When I started, the most important theorem in mathematics was the contraction mapping theorem. But, now it is solving linear systems of equations. They are everywhere." I asked him about the impact of the Ford Fellowships on his career. His response was: "I would say that it changed my life. Being a Ford Postdoctoral Fellow led to international travel, being invited to be on a University of Colorado Presidential selection committee, being on all major tenure and promotion committees at the University, and it definitely helped me better understand, appreciate, and navigate the academic ecosystem. That ecosystem includes not only departments of mathematics, but also the academic enterprise as a whole, possibly one of the most complex dynamical ecosystems in existence. Using the dynamical systems framework is helpful in understanding and recognizing emergent behavior!" He was quick to honor the mentors in his life. Besides those already mentioned, he added Dr. Edward L. Dry, Mary P. Smith, Edward N. Lorenz, Warren M. Washington, and Ray Gamble. He concluded by saying: "My mentors nudged me. And I try to nudge folks I interact with; they can all transform the future. Ford taught me that!" Named a SIAM Fellow in 2022, Curry received the citation: "For pioneering work in computational dynamics, and for mentorship of young researchers, particularly in the African American community."

The other recipient in 1981 was **John Ratcliffe**, a Mexican-American, who recently retired as Professor of Mathematics at Vanderbilt University. He is from Detroit and received his BS in 1970, MA in 1973, and PhD in 1977 all in Mathematics from the University of Michigan. [Dissertation: "The Theory of Crossed Modules with Applications to Cohomology of Groups and Combinatorial Homotopy Theory." Advisor: James M. Kister.] Ratcliffe averred that although he had other postdoctoral positions (MIT, University of Wisconsin), it was his Ford Fellowship at the Institute for Advanced Study, Princeton with John Milnor that cemented his work in the area of hyperbolic

Figure 5. John Ratcliffe.

non-euclidean geometry and led to significant "career flourishing."

He said: "I have written, mostly with other authors, over fifty research articles, and asking me which one is most significant is like asking me which of my children I like the best. If I had to pick my most significant article, it would be my paper with Vincent Emery and Steven Tschantz [10], because it makes a strong connection between number theory and geometry. However, my most significant work by far is my book on advanced non-euclidean geometry [11]."

Carl Prather, a specialist in complex analysis, received one of the two awards in 1982. The first African-American faculty member in the Department of Mathematics at Virginia Tech, his training and academic pedigree were outstanding. He has degrees in Mathematics: BS Trinity College in 1972, MA in 1973, and PhD in 1977 from Northwestern University. [Dissertation: "On Special Classes of Entire Functions Whose Growth and Zeroes are Restricted." Advisor: Ralph Boas.] He joined the faculty in 1977, and was awarded a Ford Foundation Postdoc at University of Wisconsin in 1982 (Research hosts: S. Hellerstein and D. Shea). Two pieces of work which he acknowledged as being products of the fellowship year are the solution of the Bernstein problem for Fourier integrals [8] and extensions of his notable work on final sets for operators on real entire functions [9]. Prather retired in 2014 and died in April, 2021. When he was conferred the title Professor Emeritus by the Virginia Tech Board of Visitors upon his retirement, this was written about him: "Prather contributed to the continuing vitality of classical analysis with papers characterized by his peers as elegant and substantial. In the classroom, Prather taught a variety of mathematics classes with an enthusiasm for mathematics and with a theatrical flair that were widely recognized and appreciated by his students. He shared his love of mathematical challenges through his work on departmental and national mathematics competition committees" (Mark Owczarski, Associate Vice President for University Relations, Virginia Tech Campus Experience, 1 October, 2014).

Francisco Samaniego, a Mexican-American scholar, also received the award in 1982. His was the first fellowship awarded with the specific designation of Statistics, in

which he has had a distinguished career. His academic degrees are all in Mathematics: BS from Loyola University of Los Angeles in 1966, MS from The Ohio State University in 1967, and PhD from UCLA in 1971. [Dissertation: "Finite Memory Inference for Coin-Tossing Problems." Advisor: Thomas S. Ferguson.] After one postdoctoral year in Statistics at Florida State University, he began in Statistics at the University of California, Davis where he rose through the academic ranks. He retired as Distinguished Professor of Statistics in 2013. He was a Ford Senior Postdoctoral Fellow in the Department of Biostatistics, University of Washington, in 1982–83. He describes his research interests as "Mathematical Statistics, Reliability and Survival Analysis, Sampling Techniques, Bayesian Methods, Comparative Statistical Inference, Statistical Applications in Education, Engineering and Public Health." He has published six books and over 120 articles. He has been recognized internationally in several scholarly professional organizations as: Fellow, American Statistical Association, 1982; Fellow, Royal Statistical Society, 1984; Fellow, Institute of Mathematical Statistics, 1990; Elected Member, International Statistical Institute, 1994.

Alain Lewis, an African-American researcher, was a 1983 Ford Postdoctoral Fellow. He obtained a BA in philosophy, economics, and statistics from George Washington University in 1969, and a PhD in applied mathematics from Harvard University in 1979. [Dissertation: "A Nonstandard Theory of Games." Advisor: Kenneth Arrow.] Lewis was based at Lawrence Livermore Labs from 1978 to 1979, RAND from 1979 to 1982, the University of Singapore from 1981 to 1983, Cornell University from 1983 to 1987, and the University of California, Irvine from 1987. It was during his first year at Cornell, where his sponsor was Anil Nerode, when he enjoyed his Ford award. The work [12], which is an important application of game theory, is described by Mirowski as "…now considered in some circles as an underground classic in the theory of computational economics" [13, p. 428].

Charles Hagwood, an African-American researcher, was a 1984 recipient. His research area involves applied statistics. He retired from the National Institute of Standards and Technology (NIST) at the end of 2021. We learned from his NIST webpage: "Charles Hagwood received his BS degree in mathematics from North Carolina A&T State University, Greensboro, NC. Afterwards, he attended the University of Michigan, graduating in 1979 with a PhD in mathematics." [Dissertation: "Discrete Nonlinear Renewal Theory." Advisor: Michael Woodroofe.] "Between 1979 and 1981, Hagwood was a John Wesley Young Research Instructor in the Mathematics Department at Dartmouth College. During 1981–1987, he was an assistant professor in the Mathematics Department at the

University of Virginia. In 1984, he received a Ford Foundation Fellowship and spent one year at Stanford University, in the Statistics Department. He has worked at NIST since 1987, providing consulting in areas that include reliability, uncertainty, and stochastic processes."

Figure 6. Donald King.

Donald King, an African-American algebraist, was a 1984 postdoctoral fellow. He is a native of Greenville, SC. A longtime faculty member in the Department of Mathematics at Northeastern University in Boston, MA, he retired in 2018. He obtained a BA from Harvard in 1968, and a PhD from MIT in 1979. [Dissertation: "The Primitive Ideals Associated to Harish Chandra Modules and Certain Harmonic Polynomials." Advisor: Bertram Kostant.] King explains his career trajectory thus: "In 1979, I took a mostly teaching position at Northeastern immediately after finishing my PhD at MIT. I was previously a Ford Predoctoral Fellow beginning in 1974 and throughout most of grad school. In 1980, an old Harvard classmate of mine, Thomas Enright, invited me to fill a visiting assistant professor position at the University of California, San Diego. He was an important influence during my visit. Floyd Williams also continued to mentor me. I returned to Northeastern in 1982 to fill a tenure track assistant professor slot." Because Northeastern and MIT are so geographically close, King was able to make use of the Ford Foundation Postdoc award to re-connect with MIT: "I did work under David Vogan." Still active, King says: "My research focuses on the representation theory of semi-simple Lie algebras and Lie groups, especially the role played by nilpotent conjugacy classes." One of his proudest achievements was being the PhD advisor of Alfred Noel who finished his degree at Northeastern University in 1997 and is now Professor of Mathematics at the University of Massachusetts, Boston. King also has ongoing commitments to the Math Alliance (www.mathalliance.org) and the National Association of Mathematicians (nam-math.org).

Anna Barón, a Mexican-American, received a Ford Postdoctoral Fellowship in 1986, the first such fellowship in the Mathematical Sciences awarded to a woman. She is a native of El Paso, Texas. She obtained her BA in 1977 in Mathematical Science from Rice University, her MS in 1980, and PhD in 1984 in Biometry from

Figure 7. Anna Barón.

University of Texas School of Public Health (Houston). [Dissertation: "Distributional Properties Affecting Classification in Multiple Group Discrimination Analysis." Advisor: David W. Scott.] One interesting note: Barón had been an undergraduate student of Richard Tapia, who was a doctoral advisor of Scott. She describes her fellowship year as follows. "At the University of Colorado Health Sciences Center, School of Medicine, Department of Psychiatry, National Center for American Indian and Alaska Native Mental Health Research, I was sponsored by Spero Manson. The course of study was Quantitative Methods in Psychiatric Epidemiology." Today she is Professor of Biostatistics and Informatics at the Colorado School of Public Health. She has been a faculty member at the University of Colorado Denver since 1984. She is also a Senior Biostatistician with the VA CART (Veterans Administration Clinical Assessment Reporting and Tracking) Program on cardiology outcomes research, Co-investigator with the Denver-Seattle VA Center of Innovation, and MPI (multiple principal investigators)[3] on a randomized clinical trial, joint with Vanderbilt University Medical Center, testing the clinical utility of biomarkers and CT (computed tomography) imaging features in the management of intermediate risk pulmonary nodules. Her methodological expertise is in the design and analysis of observational studies and her research focuses on cancer prevention and control, especially in lung cancer. By her own admission: "I have a strong passion for teaching and mentoring, developing many introductory and advanced courses, and I have mentored numerous M.P.H., MS, and PhD students in biostatistics, PhD students in epidemiology, bioinformatics, and clinical sciences, and junior faculty in biostatistics and public health." Barón averred that holding the Ford Postdoc completely changed the course of her career for the better.

Carlos Castillo-Chavez, who recently retired from Arizona State University as Regents Professor and Joaquin Bustoz Jr. Professor of Mathematical Biology, was a Ford Postdoctoral Fellow in 1987. He is Mexican-American, one of the most prolific applied mathematicians of his generation, who has produced numerous PhD students. He has had three notable White House awards. In 1992, he was selected as one of 30 scientists and engineers to receive the first US Presidential Fellowship. He was awarded a Presidential Medal for mentoring in 1997 and again in 2011. This whole section could easily have been taken up with a survey of his remarkable career. He has said this about his academic journey: "I immigrated to Wisconsin in 1974 where I held a few non-academic jobs – including a job at a cheese factory – before returning to school. I enrolled at the University of Wisconsin-Stevens Point (UWSP) in 1975, where I majored in Spanish literature and mathematics, earning my bachelor's degree in 1976. I completed a master's degree in pure mathematics in 1977 at the University of Wisconsin-Milwaukee, and in 1984 I completed a PhD in applied mathematics at the University of Wisconsin-Madison." [Dissertation: "Linear and Nonlinear Deterministic Character-Dependent Models with Time Delay in Population Dynamics." Advisor: Fred Brauer.] He continues: "I taught for a year at the University of Tulsa in Oklahoma (1984–85) before accepting a position as a postdoctoral student in the Department of Ecology and Evolutionary Biology at Cornell University...from 1985 to 1988" (`https://www.sacnas.org/sacnas-biography-project`). He shared that "The Ford Foundation Postdoctoral Fellowship came in 1987 and it allowed me to stay one more year at Cornell University working under the supervision of Simon A. Levin. The fellowship came at a critical time. Despite offers elsewhere, I remained at Cornell through 2003 reaching the rank of full professor before I moved to Arizona State University." The reader will find the list of Castillo-Chavez's many doctoral students at `https://genealogy.math.ndsu.nodak.edu/id.php?id=9934`. As a recipient of a fellowship and then a leader of the community of Ford Fellows, his contributions are legendary. Named a SIAM Fellow in 2010, his citation reads: "For contributions to the mathematical modeling of infectious diseases and for leadership as a mentor and teacher." In 2013, Castillo-Chavez was named to the Inaugural Class of Fellows of the AMS.

Figure 8. Mark Gotay.

Mark Gotay, who is Mexican-American, was one of two Ford Postdocs in mathematics in 1988. He grew up in greater Cincinnati, Ohio. A mathematical physicist, his academic training was in Physics and Mathematics. He obtained a BS in 1973 from Duke University, and an MS in 1975 and PhD in 1979 from University of Maryland. [Dissertation: "Presymplectic Manifolds,

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[3]*NIH now allows more than one person to lead a funded project.*

Geometric Constraint Theory and the Dirac–Bergmann Theory of Constraints." Advisor: Robert Gowdy.] He explained that because of his specialization in General Relativity, the Department of Mathematics at the University of Calgary, Alberta, Canada was a natural academic fit for him immediately after graduation. He returned to the United States at the US Naval Academy in 1984. It was while he was on the faculty there, that he was awarded a senior fellowship from 1988–1989, which took him to the Mathematical Sciences Research Institute (MSRI) in Berkeley, CA. Like several of the Ford awardees, this permitted him to work deeply in his field. He worked with Alan Weinstein and Jerrold Marsden. He says it was a year of intellectual life that is shown very clearly in several works, two of which I cite here [14] and [15].

The author of this survey, **Isom Herron**, an African-American, was fortunate to also be a Senior Ford Postdoc in Mathematics in 1988. Born in St. Louis, MO, I started my schooling in Chicago, IL, before my family moved to Kingston, Jamaica, where I completed high school. My higher education was at MIT in Applied Mathematics completing my SB in 1967, and at Johns Hopkins in Mechanics, receiving my PhD in 1973. [Dissertation: "A Fluid Dynamical Theory for the Motion of a Particle Undergoing Centrifugation." Advisor 1: Stephen Davis. Advisor 2: Francis Bretherton.][4] After a postdoctoral year in Applied Mathematics at Caltech under the supervision of Philip Saffman, I began the first half of my academic career at Howard University in Washington, DC, having been recruited by James Donaldson. (I was an easy recruit.) Among my colleagues during those early years was James Curry, who would later receive his Ford Postdoc. While at Howard, I did my Ford Postdoc at the University of Maryland (UMD) in the Institute for Physical Science and Technology (IPST), with Alan Faller. Among the other active people I interacted with at UMD was Chris Jones, who later moved to the University of North Carolina. I can truly say that the Ford Fellowship propelled my career forward. Within three years, I had spent one year visiting MIT and joined the faculty at Rensselaer Polytechnic Institute in 1992, from whence I retired at the end of 2020.

Jaime Hernandez was the only fellow in mathematics in 1989. He was the first person from Puerto Rico to receive the award in mathematics. He completed his BS in Mathematics (with a minor in Biology) at University of Puerto Rico, San Juan, PR, in 1983, and obtained his PhD in Biomathematics at North Carolina State University, Raleigh, NC in 1988. [Dissertation: "Testing for genetic disequilibria." Advisor: Bruce S. Weir.] Hernandez was a Postdoctoral Fellow Researcher and Instructor at Louisiana

[4]*Sadly, both of my advisors passed away in 2021, during the composition of this article.*

State University Medical Center, Department of Biometry and Genetics in New Orleans, LA from June 1988 to August 1991, while holding the Ford award. He then joined the Mathematics Department at Dillard University in New Orleans, where he stayed until 2000, the last five years of which he was chair of the department. While at this historically black university, he mentored students through the Louisiana Alliance for Minority Participation (LAMP) program, many of whom went on to get a PhD degree. Since 2000, he has been at Houston Community College System, Houston, TX as Professor of Mathematics.

Since 1990, the number of Ford Postdoctoral Fellowships awarded to mathematical scientists has declined dramatically. Comments about this will be made later. The more recent awardees are profiled next.

Awardees Since 1990

Figure 9. Jim Bryan.

I was pleased to be able to interview **Jim Bryan**, a Mexican-American and a 1997 Fellow. He is a native of Los Alamos, NM. Currently Professor of Mathematics at the University of British Columbia, he says his specialities are: "Algebraic geometry, topology, and geometry, especially related to physics. Moduli spaces, Gromov-Witten and Donaldson Thomas theory." His academic degrees are a BS from Stanford University in 1989 and a PhD from Harvard University in 1994. [Dissertation: "Symplectic Geometry and the Relative Donaldson Invariants Of the Conjugate Projective Plane." Advisor: Clifford Taubes.] Exemplifying some of the changes in the postdoctoral landscape, Bryan had the distinction of being a Presidential Postdoctoral Fellow from 1994 to 1996 at the University of California, Irvine and from 1996 to 1997 at the MSRI in Berkeley, CA. Bryan said that he heard from Rob Kirby at Berkeley that a position as a Ford Postdoctoral Fellow was available from 1997 to 1998, so he had an additional year in the Bay area. He explained that it was while he was a Ford Fellow that he began some of his most significant research. "I would say that maybe my most significant work is the proof of the Yau-Zaslow conjecture [16]. It is a little difficult to explain to a general audience. The conjecture came from the physics of string theory and relates (surprisingly) enumerative algebraic geometry and number theory.

Specifically, the result says that the number of rational curves on a genus g $K3$ surface is the gth coefficient in the Fourier expansion of a certain modular form (the reciprocal of the unique modular cusp form of weight 12)." Named a Fellow of the AMS in 2017, Bryan received the citation: "For contributions to algebraic geometry and service to the mathematical community."

David Cruz-Uribe, a Mexican-American researcher and administrative leader, was the sole recipient in mathematics, the next year, 1998. As he describes it: "the Ford program, was a big impact…on my career. A game changer, literally." Cruz-Uribe is a native of Green Bay, Wisconsin. He completed an AB in Mathematics from University of Chicago in 1985, and a PhD in mathematics from University of California, Berkeley in 1993. [Dissertation: "Piecewise monotonic doubling measures." Advisor: Donald Sarason.] As part of the newer paradigm for postdoctoral work, Cruz-Uribe was a Research Assistant Professor at Purdue University from 1993 to 1996, where Christoph Neugebauer was the postdoctoral advisor. Becoming an Assistant Professor at Trinity College, Hartford, CT from 1996 to 2002, the Ford Fellowship allowed Cruz-Uribe to spend significant time at the Autonomous University of Madrid, where he worked with Carlos Pérez. One example is their joint work on Calderón-Zygmund operators [17]. He also mentioned that he was encouraged by Cora Sadosky to embark on a large translation work [18]. He stayed at Trinity until 2015, rising to full professor there. Currently, he is Professor and Department Chair at the University of Alabama, Tuscaloosa. He explains that "My research is in harmonic analysis. I am particularly interested in the study of the classical operators of harmonic analysis—maximal operators, the Hilbert transform and other singular integrals, Riesz potentials/fractional integrals—on weighted and variable exponent Lebesgue spaces." His work on diversity at the University of Alabama is also significant: of their 43 PhD students, 12 are Black/African-American and 18 are women. The department won the Dean's Award for Diversity in 2019 because of their recruiting efforts.

After 1998, it was fourteen years before another Ford Postdoctoral Award in the mathematical sciences would occur. **Daniel Hernández**, a Mexican-American scholar,

Figure 10. David Cruz-Uribe.

received it in 2012. A native of El Paso, TX, he received his early education there. He completed his BS in Mathematics at Boston University in 2005, and his PhD in Mathematics in 2011 at University of Michigan. [Dissertation: "F-purity of hypersurfaces." Advisor: Karen Smith.] Currently, he is an associate professor at the University of Kansas (KU). He says about himself: "I arrived at KU in January 2016. Prior to that, in reverse chronological order, I was an NSF Postdoctoral Research Fellow at the University of Michigan, an NSF Postdoctoral Research Fellow at the University of Utah, a Postdoctoral Fellow at MSRI in the Commutative Algebra Program, and a Dunham Jackson Assistant Professor at the University of Minnesota." He mentioned that during his Ford Fellowship year he was greatly inspired by Gennady Lyubeznik which led to ongoing collaborative research work [19].

The most recent awardee with an interest in Mathematics is an African-American woman, **Maxine McKinney de Royston**, who received the fellowship in 2015. Her hometown is Minneapolis, MN. She completed her BA in Government from Smith College in 1999, and obtained her PhD in Education from University of California, Berkeley in 2011. [Dissertation: "Teaching to the Spirit: The 'Hidden' Curriculum of African American Education." Advisor: Na'ilah Suad Nasir.] One of her specialties is Mathematics Education, with a focus on the learning experiences of African-American students in mathematics classrooms. She has described her research in this way: "My research is dedicated to examining issues of racial and social inequality and improving the learning experiences and opportunities for students, especially racially non-dominant students." Since 2016 she has been an assistant professor at University of Wisconsin, Madison. Her Ford Postdoc was at the University of Pittsburgh with Richard Milner (now at Vanderbilt University) in the Center for Urban Education. An article which represents the type of research in which she is engaged is her work with Na'ilah Suad Nasir [20]. McKinney de Royston has said that "Nearly everyone who has been schooled in the U.S. in the last few decades has a trauma story about learning math, and the retelling of these stories often results in a proclamation that some people are 'math people' and others aren't. This statement not only

Figure 11. Maxine McKinney de Royston.

reproduces racial and gender stereotypes, it's flat out wrong. We use math every day, often unknowingly and without much thought. You don't have to dream about linear functions and be a math major to count as someone who can do, or likes to do, math."

It is hoped that this survey of the achievements of Ford Postdoctoral Fellows in the mathematical sciences and related fields will be an encouragement for those emerging today to apply to this important program. In my view, the Ford program will continue to raise the prospects for the involvement of minority mathematicians in the future of academia and ongoing research.

The number of Ford Postdoctoral Fellows in mathematics has declined since 1990. I believe this is because of the growth of the availability of competing awards, particularly those from universities and US government agencies and laboratories, some of which may have a higher payout or be for a longer term of appointment. Nevertheless, the Ford Postdoctoral award continues to be among the most prestigious, especially because of the involvement of the National Academy of Sciences and the National Research Council. All of the awardees interviewed acknowledged the positive effect of receiving the award, and those still working actively with graduate students encourage them to apply at the appropriate time. More information about the program for readers who may be interested in applying is posted on the program website: `https://sites .nationalacademies.org/PGA/FordFellowships`.

Appendix: The Year When It Happened: November, 1979

Notices of the AMS (Vol. 26, Num. 7, pp. 466–467):

"*POSTDOCTORAL FELLOWSHIPS FOR MINORITIES*

The National Research Council plans to award approximately 25 Postdoctoral Fellowships for Minorities in a new program designed to provide opportunities for continued education and experience in research to Black Americans, Mexican Americans/Chicanos, Puerto Ricans, and Native Americans. Fellowship recipients will be selected from among scientists, engineers, and humanities scholars who show greatest promise of future achievement in academic research and scholarship in higher education.

"In this national competition supported by the Ford Foundation, citizens of the United States who are members of one of the designated minority groups, who are engaged in college or university teaching, and who hold doctoral degrees may apply for a fellowship award of one year's duration. New doctorate recipients who intend to pursue careers as college or university faculty members will also be considered.

"Awards will be made in the areas of behavioral and social sciences, humanities, engineering sciences, mathematics, physical sciences, life sciences, and for interdisciplinary programs of study. Awards will not be made in professions such as medicine, law, or social work, or in such areas as educational administration, curriculum supervision, or personnel and guidance. Tenure of a fellowship provides post-doctoral research experience at an appropriate non-profit institution of the Fellow's choice, such as a research university, government laboratory, privately-sponsored non-profit institute, or a center for advanced study such as the Center for Advanced Study in the Behavioral Sciences, Palo Alto, California; the Institute for Advanced Study, Princeton, New Jersey; the Institute for Research on Poverty of the University of Wisconsin, Madison, Wisconsin; the Newberry Library, Chicago, Illinois; and the Woodrow Wilson Center for Scholars, Washington, D.C. The deadline date for the submission of applications is February 1, 1980. Further information and application materials may be obtained from the Fellowship Office, National Research Council, 2101 Constitution Avenue, Washington, D.C. 20418. NRC Press Release"

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Credits

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