

FROM ROCKSTAR RESEARCHER TO SELFLESS MENTOR: A DAUGHTER'S PERSPECTIVE

Carlos Castillo-Chavez's tenure at Cornell University with Simon Levine, also marks the beginning of my life as his daughter. I was nine months old when I arrived to Ithaca, and my recollections of my father in elementary school and middle school were of him furiously writing equations at his desk, or outside on the chalk board in our shed, or on napkins, notepads or anything he could get his hands on at restaurants; but more likely than not, away. When I was young, my father was becoming the researcher that today makes him a three-time Presidential honoree, a member of Barak Obama's Presidential Committee on the National Medal of Science, and of course, the purpose of this volume.¹ Even in those early days, he was away a lot – either traveling to conferences or increasingly as an invited lecturer, or at the office. Of course, I was still (and am) a daddy's little girl, bonded forever by a shared obsession with the same movies (*The Godfather*, *My Name is Nobody*, *The Man from Snowy River*); the same TV shows (*Law & Order*); and all things sports related, but I also knew that my father was a very busy man and his time was limited. So I would watch him work, often with my own little extra homework he would give me to keep me entertained, check him on the clock and let him know that I would take over his job when I was old enough.

Those were the early days when my father was making his name. But I can still remember when life changed for us all in the Castillo family. It was in 1996 and the phenomenon that did so was The Mathematical and Theoretical Biology Institute (MTBI).² I was only 12 at the time, but the energy and excitement as my dad planned that first summer institute is unforgettable. Originally established by Carlos Castillo-Chavez at Cornell University, the intensive summer research experience for undergraduates, MTBI is designed to provide the best quality support and research based education to individuals from nonselective universities that are underrepresented in the mathematical sciences. Since 1996, my father has thrown himself wholeheartedly into this and other similar programs with the goal of increasing the number of U.S. educated students, particularly members of underrepresented minority groups and women pursuing advanced degrees in the mathematical sciences through mentorship, cooperative learning and leadership training. But for those who have been through or are familiar with the program recently or even 10 years ago, have no idea what that first summer was like. If the workload and assignments are vigorous now, count your blessings – because they were paired down after the first couple of years. That summer, if my mother or I wanted to find my father (or my brother, a first year participant and now another Latino PhD in the sciences), we had to be at the MTBI housing where he threw himself, 24-hours around the clock into making that first summer a success and creating a program that is still

¹For a brief summary of his awards visit “Carlos Castillo-Chavez – Short Bibliography.” Mathematical, Computational & Modeling Sciences Center. 9 Nov. 2011. Web. 13 Nov. 2012., <http://mcmcs.asu.edu/carlos-castillo-chavez80>

²For more information on MTBI visit, <http://mtbi.asu.edu/>

unparalleled in its success and longevity. That year, 1996, marked the moment when his perspective irrevocably changed forever. He decided that advancing the careers of minorities and women was more important than continuing to advance his own already remarkable and distinguished career. As he once commented, “No matter how many papers you publish, you have to realize that your contributions to knowledge are really minimal. But changing the life of a young person is something very visible. What could be more rewarding than that?”³

Still, the first part of his path, from Mexico City to renowned scientist was never clear-cut. Carlos Castillo-Chavez was born in 1952 in Mexico City. His mother, my grandmother, Estela Chávez Cárdenas, only finished the fourth grade, yet both she and his father, Carlos Castillo Cruz, initiated and fed a passion for education. While Estela stayed busy raising four children all born about a year apart, his father completed physics and engineering degrees while holding a full-time job to support the family.

My father was always a good student in elementary school, and even in secondary school, always excelled at mathematics. However, his life changed along with the lives of many other young Mexicans in 1968. That year Mexico City hosted the Summer Olympics and student demonstrations swept the city and like many young people, my father attended many of them. The demonstration culminated in what became known as the Tlatelolco Plaza massacre on Oct. 2, 1968 when the government shot a number of students. My father had planned to be at that demonstration that day and though he avoided possible death or arrest, as a result he became more involved in politics, theater, music, and less attentive to his study, disillusioned by what he had witnessed in his country.⁴

After graduating from high school, Carlos Castillo-Chavez began working full-time and took several math classes at the National Polytechnic Institute as well as classes at the National Institute of Fine Arts and Theatre, both in Mexico City. At 19, he entered an acting contest, but didn't win. Not being one of the top contestants caused him to change his focus from acting to school. He came to the United States in 1974, where he worked a number of odd jobs including a brief stint as a material handler at a cheese factory in Wisconsin. “Fortunately, the cheese factory was an eye opener,” he said. “I saw some people that had been there 20 or 30 years, and I knew that I had to do something else. I decided I had to go to college. So I went to the University of Wisconsin-Stevens Point.”⁵

Initially unsure of what to study, my father, graduated in just two years in 1976 with dual degrees in mathematics and Spanish literature. This always amazes me, because so early on in a new country he already overcame so many barriers to success – language, a new country, and being just one of just two Latinos on the entire campus – yet was never deterred to stop. I remember him telling me for

³Hughes, Carol. “Regents’ Professor: Carlos Castillo-Chavez. Carlos Castillo-Chavez mixes mathematics research with mentoring and social change?” Arizona State University News. 23 March 2006. Web. 13 Nov. 2012., http://www.asu.edu/news/stories/200603/20060323_regents_chavez.htm

⁴To read more about my father’s childhood in his own words, see Castillo-Chavez, Carlos. “Adventures of a Mathematical Biologist.” *Diversity Issues*. 12 Dec. 2003. Web. 13 Nov. 2012., http://sciencecareers.sciencemag.org/career_magazine/previous_issues/articles/2003_12_12/noDOI.14540208274690480062

⁵Hoogveen, Paul. “Award Winning Dr. Carlos Castillo-Chávez Going at It Full Steam.” *Hispanic Outlook Magazine*. 12 March 2012. Web. 13 Nov. 2012., <http://digital.turn-page.com/i/58072/13>

example, after kids picked on me in elementary school, how he had to deal with several people actually asking him, to his face, why Mexicans were lazy. At another point, \$400 dollars almost kept him from graduating, until he was able to obtain an urgent financial package at the behest of the chancellor, Lee Dreyfus. Clearly, the intellectual curiosity that would take him so far was apparent, even during his college years. Instead of letting prejudice bring him down, it drove him to prove that he was fully capable in spite of whatever people might think of Mexicans.

Next, Carlos Castillo-Chavez earned his master's degree in mathematics at the University of Wisconsin-Milwaukee, but again, his road was not so simple. Despite wanting to pursue an education in mathematics and applying to many graduate schools (one being the University of Wisconsin, Madison), he was not accepted because of a weak math background at the time. Later, in the middle of his Ph.D. program, he quit after a serious disagreement with his advisor, who questioned the validity of offering special treatment to Hispanics, African-Americans and Native Americans and then blocked him from changing advisors. Undaunted he moved on to the University of Wisconsin-Madison a year later and completed his Ph.D. in mathematics in 1984 (also now with two small children, my brother and me, just about to be born).

After teaching for a year at the University of Tulsa in Oklahoma, he accepted a postdoctoral position in the Section of Ecology and Systematics and the Center for Applied Mathematics at Cornell University in 1985. Under the mentorship of Simon Levin, he began making a name for himself working on HIV and influenza research. He introduced the concepts of crises in influenza epidemics and HIV and wrote more than 20 papers in just a few short years. Not surprisingly, he became incredibly sought after, applying to several academic positions around the country and receiving several offers, including one from the Harvard School of Public Health and two from Cornell. He accepted the offer to join the Cornell biometrics department in 1988 and was promoted to associate professor in 1991 and to a full professorship in 1997.

Over his 10 year tenure at Cornell in the departments of Biological Statistics and Computational Biology (BSCB; formerly known as Biometrics) and Theoretical and Applied Mechanics (TAM), Castillo-Chavez became one of the most prominent mathematicians in the country. He was a member in 1988 of the modeling group for the National "Effort to Model AIDS Epidemiology" and a member of the "Forum in the National Interest: World Leadership in Basic Science Mathematics and Engineering." Both groups wrote reports for the President's Office of Science and Technology Policy.⁶ As an expert in epidemiological modeling, his work led to new insights on how behavior patterns affect the spread of disease. During the 2003 SARS epidemic in Toronto, for example, he developed a model that accurately predicted the number of cases and estimated how many more people would have been infected had public health authorities not taken measures to control the outbreak.⁷

⁶For more on his time at Cornell see Grace-Kobas, Linda. "Cornell's Castillo-Chavez receives Presidential honor. Efforts in mentoring underrepresented groups in math and science are recognized at White House ceremony on Sept. 11." Cornell News. 11 Sept. 1997. Web. 13 Nov. 2012. http://www.news.cornell.edu/releases/Sept97/Castillo-Chavez_honor.lgk.html

⁷See Gerardo Chowell, P.W. Fenimore, Carlos Castillo-Chavez, M.A. Castillo-Garsow. "SARS outbreaks in Ontario, Hong Kong, and Singapore: the role of diagnosis and isolation as control mechanism." *Journal of Theoretical Biology*. 224 (2003) 1-8. June 2003.

My father has worked on a lot of other projects, but what I think has distinguished him is his commitment to research that matters – research that can and has been applied effectively by the US government and health officials around the world to effectively stop the spread of infectious diseases. As you will see from this volume, he has studied the role of epidemiological factors, vaccination, public transportation and social structure on the transmission dynamics of tuberculosis and its control; the impact of life-history vector dynamics on dengue epidemics (Mexico and Peru); the identification of time response scales and their importance in the control of foot and mouth disease outbreaks (Uruguay); the study of the role of population structure and control (vaccination, isolation, quarantine and others) on the transmission dynamics of rotavirus, pneumonia and rubella; and the study of the impact of increasing levels of pathogens' resistance to antimicrobials generated by nosocomial infections. Castillo-Chavez and collaborators have carried out theoretical work that highlights the role of disease dispersal as a key enhancing mechanism of ecological diversity. Most recently, his research efforts have focused on problems at the interface of homeland security and disease invasions (natural or deliberate) and on the development of models for the dynamics of "social diseases" that involve some form of addiction like alcohol consumption or ecstasy use, with an emphasis on specific groups like college populations. And that is why he has been so well funded and lauded. He not only has an incredible record of research with more than 200 publications, 13 books or edited volumes, but also, it is a body of work that has real world impact.

For as long as I can remember, my father, through example, taught me to take pride in my Mexican heritage. Early on, he dedicated himself to proving what Mexicans could do. And it didn't take him very long. By 1992, Castillo-Chavez received his first of three White House Awards as one of 30 scientists and engineers to receive the first Presidential Faculty Fellowship. Carrying a \$500,000 NSF grant over five years, the award recognized excellence both in research and in "teaching future generations of students to extend and apply human knowledge." That year he was also honored by Mexico City's Council, as well as his home district, and elementary, secondary and high school, where he told his audience, "We Mexicans are as capable as anyone from any other country . . . Do not limit your dreams." I was 8 at the time and utterly enthralled by my father. It was like being with a celebrity.⁸

I was pretty young then, but I remember the first White House Award, and I remember going to Mexico and witnessing how emotional it was for my father to see how his achievements and hard work could inspire others. And that's when I believe the seed for MTBI was planted. Around that time he became the chairman and later co-chair between 1991-1996 for Cornell's committee on affirmative action, leading to the creation of at least four minority faculty positions, and indirectly influencing the creation of several more. He also became involved with SACNAS at this time, as president of the North East chapter from 1992-1995, and then as a member of the board of directors from 1995-1996. I believe seeing the difference

⁸For a more comprehensive list of his publications see his CV online at <https://webapp4.asu.edu/myprofile/cv.do?eid=566521> and ASU's Research catalog online at http://www.experts.scival.com/asu/expertPubs.asp?n=Carlos+Castillo-Chavez&u_id=35

⁹Grace-Kobas, Linda. "Carlos Castillo-Chavez receives award at White House ceremony." *Cornell Chronicle*. Front Page. 18. Sept. 1997. Web. 13 Nov. 2012., <http://www.news.cornell.edu/chronicle/97/9.18.97/Castillo-Chavez.html>

he could make inspired him to do more – and if you know my father, you know he can’t and won’t do anything halfway.

Established in 1996 at Cornell University, the Mathematical and Theoretical Biology Institute (MTBI), quickly gained recognition for its unique aim to increase underrepresented minorities and women in the sciences, as well as to open doors for students from non-selective institutions, like the one he himself attended. As he explains, “I went to a non-selective university where everyone who applies gets in. There are millions of people at these institutions. They didn’t have the same opportunities... but they are as smart and determined as those at Harvard or Cornell.... I wanted to make those students famous.”¹⁰ As a result, Carlos Castillo-Chavez was awarded his second Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring at a White House ceremony on Sept. 11, 1997 where he was among 19 individuals and institutions to win this honor as well as receiving a \$10,000 grant to be used to enhance mentoring activities.¹¹ In addition, in the Ithaca community, he was the director of the Cornell Ithaca Mathematics Enrichment Program, which brought math assistance to minority students at Ithaca High School, many with Vietnamese roots.

But that still wasn’t enough. After two years at the Los Alamos National Laboratories, MTBI moved with Carlos Castillo-Chavez to Arizona State University in 2004. I know it was a very difficult decision for him, because we discussed it, and the move this time wasn’t for his career or for his research. It was a strategic move to reach more students. In his own words, he explains, “I have always been in love with the ASUs of the world. These universities will solve the problems of this country. The small, elite institutions educate a very small population. Those graduates are too few to deal with problems in this country. If we waited for the graduates of Harvard, Yale and Columbia, it may take 50 years to produce enough people to solve our problems.”¹² Mentoring had become his top priority and it showed in his unparalleled results:

- From 1996 to 2011, the MTBI summer program has recruited and enrolled a total of 359 first time undergraduate students, and 85 returning students. Of the regular students, 300 are U.S. citizens or permanent residents, and 221 (74%) are underrepresented minorities. Seventy-one percent enrolled in a graduate or professional school program.
- As of 2011, the program has produced 150 technical reports (<http://mtbi.asu.edu/research/archive>) and generated a large number of referred publications.
- 68 program alumni have successfully completed a Ph.D. Of these students, 69 were U.S. citizens and 54 (79% of the U.S. Ph.D.s.) were underrepresented minority students, with an additional 12 were women from non-minority backgrounds.
- MTBI alumni have earned 78 degrees between May 2005 and February 2012 or slightly over 10 Ph.D.’s per year.

¹⁰Tropiano, Dolores. “ASU Professor Carlos Castillo Chavez.” *Phoenix Magazine*. July 2011. Web. 13 Nov. 2012. <http://www.phoenixmag.com/lifestyle/valley-news/201107/asu-professor-carlos-castillo-chavez/>

¹¹NSF Press Release. “Presidential Awards Honor Mentoring Efforts of 19 Individuals and Institutions.” 11 Sept. 1997. Web. 13 Nov. 2012. <https://www.washington.edu/doit/Award/president.html>

¹²See Tropiano, Dolores.

- MTBI alumni have contributed between 1.6% and 4.3% of Ph.D.'s in applied mathematics to all groups, and (based on the number of applied mathematics jobs targeting mathematical biologists) a rough (most likely low) estimate of approximately 50% of the Ph.D.'s awarded to Latinos/Latinas in mathematical biology since 2005.¹³

Growing up, I was often jealous of my father's students. They saw him much more than I did. So it's not with a twinge of guilt that I admit how angry it used to make me to watch him call in each of his students one by one to see how they were progressing in their work, but couldn't sit down face to face with him and ask me about mine. But now as PhD student myself at Yale, struggling to see the light at the end of the tunnel, I understand how important it is to have someone like him as a mentor. He told me once how sorry he was for being away, but by then I would not accept that apology. By then I had my own experiences with a lack of mentorship and understanding in my creative writing (for example, an advisor who told me there was too much Spanish in my fiction, because that's how Junot Diaz wrote and yet could not name another Latino author) as well as my own attempt at mentorship. One day after attending an event of Academia Hispana, the group that I mentored while completing my master's in English with a Creative Writing concentration at Fordham University, I teased him, because for the first time I understood the importance of his role as a mentor to Latinos and how difficult it was to make any difference. I felt a kinship with him in terms of his passion to change the face of Academia. So I told him: "Papi I understand how important your work is now, I understand why you had to be gone so much."

I'm proud to say, my father, Carlos Castillo Chavez is a force. He is someone who keeps tabs on not just his 17 PhD students and 23 postdoctoral students, but on hundreds of MTBI alumni, following, supporting, and motivating students from undergraduate studies through professorships, in some cases even from high school. Not only is he a mentor, he is a community maker. And like in Ithaca, he continues to be involved in the larger community through his work with high school students in Arizona through The Joaquin Bustoz Math-Science Honors Program, which has now existed more than 26 years.

So at least for me, it came as no surprise that MTBI was recognized by a second president (although this was my father's third trip the White House), this time by President Barack Obama who honored the program with the Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring in 2011. Administered by the National Science Foundation (NSF), the Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring is awarded by the White House to individuals and organizations in recognition of the crucial role that mentoring plays in the academic and personal development of students studying science and engineering – particularly those who belong to groups that are underrepresented in these fields. In addition to being honored at the White House, recipients received awards of \$25,000 from NSF to advance their mentoring efforts.¹⁴

His mentoring efforts have also been recognized with the 2007 AAAS Mentor Award, as the 12th recipient of the American Mathematical Society Distinguished Public Service Award (2010); and well as ASU's Outstanding Doctoral Mentor

¹³To read more about MTBI's astonishing results visit <http://mtbi.asu.edu/about/history>

¹⁴Hughes, Carol. "Obama awards mentoring honor to ASU math program for underrepresented students." ASU News. 15 Nov. 2011. Web. 13 Nov. 2012. https://asunews.asu.edu/20111115_whitehousementoraward

Award. MTBI was also honored as a “Mathematics Program that Makes a Difference” by the American Mathematical Society in 2007.¹⁵

A few years ago, my father remarked to me that as a scientist he could have advanced his research and publications much more if it wasn’t for his focus on mentorship and the increasingly large administrative duties he has taken on at ASU as executive director of not just MTBI, and the Institute for Strengthening Understanding of Mathematics and Sciences SUMS, but also of The Mathematical, Computational and Modeling Sciences Center (MCMSC) and the graduate field in applied mathematics in the life and social sciences or AMLSS which he established at ASU in 2008 and which graduated 7 PhD students in 2011-2012. There is of course in addition to his multiple appointments in the School of Human Evolution and Social Change, The School of Mathematical and Statistical Sciences, the School of Life Sciences, the Center for Population Dynamics, the Environmental Life Sciences Graduate Program, the Center for Social Dynamics and Complexity; not to mention external appointments at Cornell University and the Santa Fe Institute. But that was a choice he doesn’t regret, and by pretty much anyone else’s standard, but his own, his research is at the top of the field.

Today, Carlos Castillo-Chavez is a Regents Professor, a Joaquín Bustoz Jr. Professor of Mathematical Biology, and a Distinguished Sustainability Scientist at Arizona State University. In addition to continuing to publish numerous referred articles, his 2003 edited volume (with Tom Baner) on the use of mathematical models in homeland security published in SIAM’s Frontiers in Applied Mathematics Series (2003) provided the first collection of mathematical studies on bioterrorism. Recently, he also co-edited volumes in the Series Contemporary Mathematics entitled “Mathematical Studies on Human Disease Dynamics: Emerging Paradigms and Challenges” (American Mathematical Society, 2006) and Mathematical and Statistical Estimation Approaches in Epidemiology (Springer-Verlag, 2009) highlighting his interests in the application of mathematics in emerging and re-emerging diseases.¹⁶

And so despite his focus on mentorship, the accolades for research keep coming. A few of these include: the NSCNAS Distinguished Scientist Award (2001); Stanislaw M. Ulam Distinguished Scholar at the Center for Nonlinear Studies (CNLS) at Los Alamos National Laboratory (2003); honorary professor at Xi’an Jiaotong University in China (2004); the Richard Tapia Achievement Award for Scientific Scholarship, Civil Science and Diversity in Computing (2003); election as fellow of the American Association for the Advancement of Science (AAAS), Fellow of the Society for Industrial and Applied Mathematics, fellow of the American College of Epidemiology; membership on the Arizona Governor’s P-20 Council’s Mathematics Alignment Team in 2008-09 as well as three scientific mathematical sciences advisory boards at The National Institute for Mathematical and Biological Synthesis (NIMBioS, 2008-2011), the Statistical and Applied Mathematics Sciences Institute (SAMSI, 2007-2012), and Banff International Research Station (BIRS); membership on the National Research Council’s Board of Higher Education and Workforce or BHEW (2009-); and honorary professor at the School of Public Health, East

¹⁵For a brief summary of his awards visit “Carlos Castillo-Chavez – Short Bibliography.” Mathematical, Computational & Modeling Sciences Center. 9 Nov. 2011. Web. 13 Nov. 2012., <http://mcmcs.asu.edu/carlos-castillo-chavez80>

¹⁶For a more comprehensive list visit “Carlos Castillo-Chavez.” Arizona State University Directory. Web. 13 Nov. 2012. <https://webapp4.asu.edu/directory/person/566521?pa=true>

Tennessee State University. And of course, President Obama appointed Carlos Castillo-Chavez to the President's Committee on the National Medal of Science for the period 2010-2012, SIAM recently honored his lifetime achievement at their 2012 meeting this past summer, and he just joined the Founding Class of Fellows of the American Mathematical Society.¹⁷

So as a MTBI alumna myself, I can truly tell you the program is something special. As a student in MTBI, you are empowered to set the research agenda, an invaluable experience for undergraduates. Even at only 16, the lessons I learned at MTBI – how to collaborate, how to really research deeply, how to create new projects and uncover new discoveries are lessons I think got me into Yale, despite a more creative than academic background. Even though I followed my mother into the humanities, I am thankful for the research experiences with my father at MTBI and beyond, both of which resulted in scientific publications.

My father specializes in daddy's little girls, athletic tomboy Latinas who hang onto his every word. My little sister wins rock climbing and volleyball medals; I won soccer championships and spent my time playing football with boys. We never experimented with make up and spent anytime we could with my father when he was actually home, glued to whatever crime reports, or news show he happened to be watching, even when it was utterly boring for an adolescent girl (Seriously, Golf?). My relationship with my father, like my little sister Gabi's is special, sacred, one my mother, or hers could never aspire to or even try to replicate.

So even when it hurt when he was away, when he gave attention to students that I desperately wanted, looking back now I realize how lucky I am to have Carlos Castillo-Chavez as my father. Not only, as ambitious myself, his example taught me the value of hard work, the importance of community, the significance of mentorship. His dedication to minorities inspires me to uncover unwritten histories of Latina women, to teach Latin writings if I even manage to complete my own studies. He even inspires my poetry, like the piece below published in the *Hispanic Culture Review*.¹⁸ And when a mathematician's work and example can inspire creativity in the humanities – that is one very long reach. *Felicidades Pápa*.

“1968”

by Melissa Castillo-Garsow

Black Americans in Mexico
with raised fists and gold medals
black socks/ black scarf/ long beads
swaves lined with love, not war
drugs dodging& war protests while
10 days earlier hundreds fell
in protest – just miles away when

¹⁷Ibid.

¹⁸Those publications are: 1) S. Baojun, M. Marcin L. Henso, M.A. Castillo-Garsow and C. Castillo-Chavez, “Raves, Clubs, and Ecstasy: The Impact of Peer Pressure.” *Journal of Mathematical Biosciences and Engineering*. Vol. 3, No. 1, pp. 1-18 Jan. 2006; 2) Gerardo Chowell, P.W. Fenimore, Carlos Castillo-Chavez, M.A. Castillo-Garsow. “SARS outbreaks in Ontario, Hong Kong, and Singapore: the role of diagnosis and isolation as control mechanism.” *Journal of Theoretical Biology*. 224 (2003) 1-8. June 2003.

¹⁹“1968.” *Hispanic Culture Review*. Spring 2011. Print.

Black Power ruled the Olympics.
When Black Power ruled the Olympics
he thinks it is a year of change.
My father: 16& a protester
occupies the University
watches friends get beaten
listens to the Doors, and Jimi Hendrix and
loves the Beatles more than anything
porque el cambio viene.

10 days before they raised fists
students, workers, poor, families, barrios,
inspired, unorganized, excited, convinced
of spontaneous revolution so hopeful
they send military radios& weapons
ammunition& riot control
the Pentagon, that is.

No fists, no beads or socks for dead Mexicans,
Imprisoned Salvadoran teachers and
Murdered Brazilian teenagers.
Free love to Sergeant's distortion while
Yale admits women.

Melissa Castillo-Garsow

E-mail address: mcastillo2@gmail.com