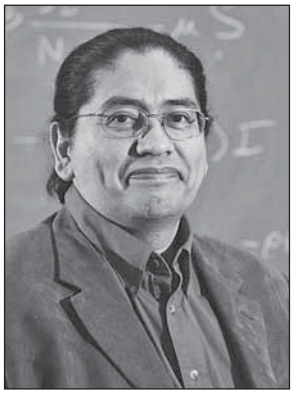
2010 Award for Distinguished Public Service

CARLOS CASTILLO-CHAVEZ received the 2010 Award for Distinguished Public Service at the 116th Annual Meeting of the AMS in San Francisco in January 2010.

Citation

Carlos Castillo-Chavez is a Joaquin Bustoz Jr. Professor of Mathematical Biology and a Regents Professor at Arizona State University. At Arizona State he is the director of the Ph.D. program in applied mathematics in the life and social sciences, executive director of the Arizona State Mathematical, Computational and Modeling Sciences Center, and director of the Institute for Strengthening Understanding of Mathematics and Science (SUMS). The Sciences Center strives to create a dynamic community of quantitative scientists and mathematicians driven to contribute to the solution of problems in the biological, environmental, and social sciences. The SUMS mathematics and science honors program has trained over 2,000 Arizona high school students from economically disadvantaged backgrounds over the past twenty-four years. He is also the founder and director of the Mathematical and Theoretical Biology Institute. This summer program provides sequential research experiences, at the undergraduate and graduate levels, in the field of applied mathematics and its applications to the biological and social sciences for disadvantaged students from across the country. Castillo-Chavez has had a major impact with his efforts and activities in improving the representation in the broad mathematical sciences of the nation's traditionally underrepresented and economically disadvantaged students. He continues his activities in research and education at a very high level and is a most worthy recipient of the AMS Distinguished Public Service Award.



Carlos Castillo-Chavez

Biographical Sketch

Carlos Castillo-Chavez is a Regents Professor and a Joaquin Bustoz Jr. Professor at Arizona State University. Castillo-Chavez's research program is carried out at the interface of the mathematical and natural and social sciences. His research has focused on the role of adaptive social landscapes on disease dynamics and its evolution. Castillo-Chavez and other collaborators' contributions are tied into the study of questions of interest in fields of ecology, epidemiology, evolutionary biology, and homeland security. Their research highlights the relevance and criticality of computational, mathematical, modeling, and statistical approaches in the study of the dynamics and control of addiction, childhood diseases, dengue, foot and mouth disease, HIV, influenza, and tuberculosis at the population level. Their research has also contributed to the study of cross-immunity in the context of influenza and behavior dispersal, and movement on disease evolution.

Carlos Castillo-Chavez has coauthored nearly 200 publications, including the 2001 textbook *Mathematical Models in Population Biology and Epidemiology*. His edited volume (with Tom Banks) 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. The volumes *Mathematical and Statistical Approaches to AIDS Epidemiology* (Springer, 1989), *Mathematical Approaches for Emerging and*

Reemerging Infectious Diseases (An Introduction and Models, Methods, and Theory), 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) highlight some of his interests in the applications of mathematics to the study of emerging and reemerging diseases.

Castillo-Chavez is an external faculty member at the Santa Fe Institute and an adjunct professor at Cornell University. Castillo-Chavez joined Cornell's faculty in 1988, was promoted to associate professor in 1991, and to full professor in 1997. He joined Arizona State University's faculty in 2004. Castillo-Chavez is the founding director of the Mathematical, Computational and Modeling Sciences Center, the graduate field in applied mathematics in the life and social sciences, the executive director of the Mathematical and Theoretical Biology Institute (MTBI) and the Institute for Strengthening the Understanding of Mathematics and Science (SUMS), all at ASU. These institutes provide sequential intense summer experiences from high school to the postdoctoral level. These experiences are aimed at students from economically disadvantaged groups with the goal of increasing their number in the mathematical sciences. SUMS's efforts were recognized with a Presidential Mentorship Award in 2002, and the American Mathematical Society recognized MTBI's program as a "Mathematics Program That Makes a Difference" in 2007.

Castillo-Chavez's efforts to promote diversity in the mathematical sciences at Cornell University culminated in the establishment of the David Blackwell and Richard Tapia Distinguished Lecture Series in 2000, an event that soon was transformed into the David Blackwell and Richard Tapia Award, thanks to the additional efforts of David Eisenbud.

Castillo-Chavez is the recipient of several awards, including a Presidential Faculty Fellowship Award (1992); a Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring (1997); the 2002 Society for the Advancement of Chicanos and Native Americans in Science (SACNAS) Distinguished Scientist Award; the 2003 Richard Tapia Award; and the 2007 AAAS Mentor Award. He held the position of Stanislaw M. Ulam Distinguished Scholar at Los Alamos National Laboratory (CNLS) in 2003; was named honorary professor by China's Xi'an Jiaotong University (2004); and became a fellow of the American Association for the Advancement of Science (AAAS) in 2007.

Castillo-Chavez received his B.S., M.S., and Ph.D. degrees from the University of Wisconsin at Stevens Point (1974), Milwaukee (1977), and Madison (1984), respectively. Fred Brauer and Simon Levin were, respectively, his Ph.D. and postdoctoral advisors. Both of them continue to be his mentors. Castillo-Chavez has advised seventeen Ph.D. students, including seven U.S. underrepresented minorities (US-URM) and six women. He has served as the mentor of seventeen postdoctoral students, a group that includes two US-URM and five women. He has cosupervised twenty-four master's degree students and mentored dozens of undergraduates each summer since 1996.

As a member of the steering committee of the Committee for the Review of the Evaluation Data on the Effectiveness of NSF-Supported and Commercially Generated Mathematics Curriculum Materials, Castillo-Chavez was a coauthor and contributor to the corresponding NRC report from 2002–2004. He was a member of the Arizona Governor's P–20 Council's Mathematics Alignment Team in 2008–2009. He is currently a member of the scientific mathematical sciences advisory boards at the National Institute for Mathematical and Biological Synthesis (NIMBioS), at the Statistical and Applied Mathematics Sciences Institute (SAMSI), and at the Banff International Research Station (BIRS). In addition, he chairs or cochairs diversity advisory boards at the Mathematical Biosciences Institute (MBI) and at the Society for Industrial and Applied Mathematics (SIAM). He is a member of the National Research Council's Board of Higher Education and Workforce (BHEW).

Castillo-Chavez, a native of Mexico, immigrated in 1974 and is the proud father of a Chicano (Carlos William) and two Chicanas (Gabriela Citlalli and Melissa Ann). Carlos William is about to complete a Ph.D. in mathematics education at Arizona State University under the supervision of Pat Thompson; Melissa is on her way to earning a master's degree in creative writing at Fordham University; and Gabriela is enamored of her sixth-grade mathematics and science classes, volleyball, Shakespeare, and music. His wife, Nohora, a native of Colombia, recently completed a B.S. in mathematics education while raising Gabriela. She plans to join the profession of junior high school mathematics teachers. The Castillo-Chavez children speak Spanish and are infinitely proud of their American, Mexican, and Colombian heritages.

Response

When it comes down to public service, perhaps Martin Luther King said it best: "Life's most urgent question is: what are you doing for others?" I am profoundly moved by the AMS's decision to recognize my epsilon contributions to the mathematical sciences and some of its communities with the 2010 Distinguished Public Service Award. The importance that the AMS places on public service, as demonstrated by the establishment of this award two decades ago, resonates even more in this time of crisis. The importance of providing opportunities and multiple successful pathways to all U.S. aspiring mathematicians must be continuously

carried out, not only to preserve the intellectual capacity that we have but also to broaden and enrich the mathematical community through the systematic inclusion in the wonderful and empowering world of mathematics of Americans who have been traditionally underrepresented.

I became a member of the profession twenty-five years ago after completing a Ph.D. in mathematics under the supervision of Fred Brauer at the University of Wisconsin–Madison. My life in Mexico, a country that I left thirty-five years ago, made me intensely aware of the role of initial conditions in a world full of inequities. Finding ways of combining my love of mathematics, my mathematical training, and my deep desire to increase the opportunities for minorities by reducing the impact of initial conditions has driven my decisions ever since.

The near absence of U.S. minority students in the mathematical sciences is the result perhaps of preconceived notions of who can do mathematics, or the lack of systemic access of these students to advanced mathematics training at the elementary, middle, or high school levels and the pressures of giving back to our communities as soon as possible. The successes of Jaime Escalante at Garfield High School in East Los Angeles (immortalized by the movie *Stand and Deliver*) and the victory of Carl Hayden's Robotics High School Team over MIT in the third annual Marine Advanced Technology Education Center's Remotely Operated Vehicle Competition in 2004 are not miracles but clear evidence of the untapped and immense potential at each and every public and private school in the land. Why do we lose so many?

The Mathematical and Theoretical Biology Institute's (MTBI) summer program encourages students to self-organize into small groups around problems identified as important and relevant by the group members. Soon one finds students working on ways of ameliorating the global impact of HIV or exploring the role that poverty has on the transmission dynamics of tuberculosis. Four Latinas just about to start their senior year in college chose to investigate the role of peer pressure on the dynamics of bulimia in 2001. As a result, the first paper on dynamics of bulimia at the population level was coauthored by them in 2003 (*Journal of Mathematical Psychology* **47** (2003), 515–526). Two of these students/authors completed their Ph.D.s, a third will earn her Ph.D. in May while raising her three children (a group that includes twins), and the fourth has started a Ph.D. in biostatistics.

The citation that comes with this recognition implicitly acknowledges the contributions of a large number of individuals. William Yslas Velez (University of Arizona) instigated the start of this effort through his letter to the AMS on 24 August 1994 on NSA's policy. The program was put in place with the support of Jim Schatz (NSA), Barbara Deuink (NSA), Don M. Randel (now at the Andrew W. Mellon Foundation), Ted Greenwood (Alfred P. Sloan Foundation), and the National Science Foundation. Countless mathematicians have come to Ithaca or Tempe ready to spend up to eight weeks collaborating with undergraduates on the challenging questions posed by them. Shirley Eva Sanchez, while an undergraduate, asked "What is the impact of alcohol on the brain?" She will soon complete a Ph.D. at the interface of the neurosciences and mathematics. Fred Brauer, Tom Banks, Erika Camacho, Christopher Kribs-Zaleta, Baojun Song, Steve Tennenbaum, and Steve Wirkus have been involved in this program for over a decade. My current research collaborators, former graduate students, and postdocs have always played a central role in comentoring the more than 400 students who have participated in MTBI. Carlos Bustamante, Richard Durrett, Richard Rand, Steve Strogatz, and Roald Hoffmann supported these efforts summer after summer at Cornell. Marilyn Carlson, Sharon Crook, Gerardo Chowell, Marco Janssen, Nicolas Lanchier, Yang Kuang, Alex Mahalov, Svetlana Roudenko, Sergei Suslov, and Pat Thompson have played the equivalent role at ASU. Over 2,200 high school students have been trained during the past twenty-four summers at the Mathematics Science Honors Program, Joaquin Bustoz Jr.'s baby. Joaquin recruited me with the expectation that together we would make an even bigger impact. Unfortunately, he died tragically in a car accident four months before my arrival.

My deans, director Sander van der Leeuw, provost Elizabeth Capaldi, former provost Milton Glick, and president Michael M. Crow have always supported these efforts. The Mathematical, Computational and Modeling Sciences' staff runs these programs year after year facing myriad challenges that somehow get resolved. I thank them all. The mentorship I received and continue to receive from my former academic advisers, Fred Brauer and Simon Levin, has made all the difference in the world.

Meeting President Michael Crow's challenge of providing an excellent education within an environment of inclusion at a scale that is commensurate with the goals and mission of state institutions is essential if we are to meet the workforce challenges of the twenty-first century. The model of the New American University put forward by ASU's President Crow sets the intellectual framework and vision needed to scale up the learning-through-research model developed, implemented, and tested at Cornell University. Our Center's version, through its Mathematics Science Honors Program, integrates a model of mentorship from high school to the postdoctoral level.

My son Carlos William has contributed to the success of these programs for nearly a decade with his computing, modeling, and intellectual

skills, and he has helped articulate the program successes via articles that we coauthored. My daughter Melissa participated in the program and, as a journalism major, coauthored two applied mathematics papers, including a highly cited paper on SARS that appeared in the *Journal of Theoretical Biology* **224** (2003), 1–8. My wife Nohora and daughter Gabriela have accepted and cherished these efforts even though they have limited our family time and made it nearly impossible to take vacations. Special thanks to Nohora, Carlos, Melissa, and Gabi for their support of my efforts, which I hope have made a contribution not only to mathematics but also to the growth of the students-researchers-citizens involved in this program. I want to reiterate my gratitude to the American Mathematical Society not only for this recognition but also for establishing an award that goes to the heart of Dr. King's question. I hope that my work has indeed helped others.

About the Award

The Award for Distinguished Public Service is presented every two years to a research mathematician who has made a distinguished contribution to the mathematics profession during the preceding five years. The purpose of the award is to encourage and recognize those individuals who contribute their time to public service activities in support of mathematics. The award carries a cash prize of US$4,000.

The Award for Distinguished Public Service is made by the AMS Council, acting on the recommendation of a selection committee. For the 2010 award, the members of the selection committee were: Richard A. Askey, C. H. Clemens, Carolyn R. Mahoney, Paul J. Sally, and Richard A. Tapia.

Previous recipients of the award are: Kenneth M. Hoffman (1990), Harvey B. Keynes (1992), I. M. Singer (1993), D. J. Lewis (1995), Kenneth C. Millett (1998), Paul J. Sally Jr. (2000), Margaret H. Wright (2002), Richard Tapia (2004), Roger Howe (2006), and Herbert Clemens (2008).

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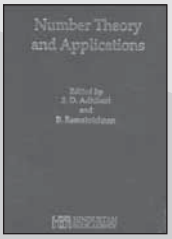

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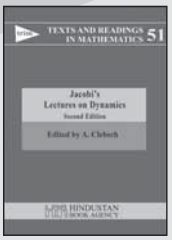

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