

Mother and son both were elected to National Academy of Sciences

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It is a continual amazement to me and something I think I will never get used to when in the course of research for Historically Speaking some of the most unusual facts emerge. Often it is about the unique people of Oak Ridge, this story researched and written by Carolyn Krause is certainly no exception. You are going to enjoy this treat from Carolyn.

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Like mother, like son. In May 2016, Krishna (Kris) Niyogi, who grew up in Oak Ridge, was elected to the National Academy of Sciences (NAS). Eighteen years earlier, in 1998, his mother, an Oak Ridger for 44 years, was also elected to the academy.

Election to the academy is considered one of the highest honors that can be bestowed on an American scientist or engineer. Some consider it second only to winning a Nobel prize. According to a NAS spokesperson, Niyogi and others were elected "in recognition of their distinguished and continuing achievements in original research."

Niyogi is one of the two sons of Salil Niyogi and Audrey Stevens Niyogi, who both died in 2010, nine months apart. His parents both were distinguished biochemists in the Biology Division of Oak Ridge National Laboratory. His father was also well known in the local soccer community as a player, coach, soccer "dad" and referee; in 2003 he was inducted into the Oak Ridge Sports Hall of Fame. Kris, a midfielder, was co-captain of the Oak Ridge High School soccer team that won the state championship in 1982.

Although few people at ORNL knew her or about her, his mother made the news in May 1998, with the announcement of her election to the National Academy of Sciences. Ironically, the news came a few months after she and other group members were told they would lose their jobs before Oct. 1, 1998, as a result of lack of funding. However, ORNL was able to get additional federal funds to save her job until she retired.

Kris Niyogi wrote in a Feb. 9, 2017 email: "I vividly remember that day in May 1998 because my wife and I happened to be in Oak Ridge visiting my parents, and I answered the phone when the NAS called my mom. I started working at UC-Berkeley the previous year, and I joked that it would be the only time that I would ever get to answer a call from the NAS. Sure enough, I missed the phone call last year and got the news by email!"

Kris wears three hats. He is an investigator at the Howard Hughes Medical Institute; a biologist faculty scientist in the molecular biophysics and integrated bioimaging division at the Department of Energy's Lawrence Berkeley National Laboratory, and a professor in the department of plant and microbial biology at the University of California at Berkeley.

He discovered the genetic mechanisms by which green plants cope with receiving excessive sunlight. He found that plants have a line of defense (nonphotochemical quenching, or NPQ) that enables them to release the extra light energy as heat. In 2001 Niyogi received the Melvin Calvin Award in recognition of his outstanding contributions to the understanding of mechanisms of "photoprotection" in plants and algae.

"My long-term research goals," Niyogi wrote on his website, "are to understand how photosynthetic energy conversion works, how it is regulated and how it might be improved to help meet the world's needs for food and fuel."

Niyogi teaches courses on the biology of algae and on plant and microbial photosynthesis. He and his graduate students conduct research on algae.

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According to his website, "Aquatic microalgae (phytoplankton) are responsible for approximately half of the net primary production of organic matter on Earth, and they have recently re-emerged as potential next-generation feedstocks for biofuels." On August 18, 2009, Niyogi appeared in the showing on PBS of the NOVA film on algae fuel.

He holds a B.A. degree in biology from Johns Hopkins University and a Ph.D. degree in biology from the Massachusetts Institute of Technology. He also performed research at the Carnegie Institution.

Audrey Stevens grew up on a farm in Nebraska during the Depression. She had an older brother, who became an organic chemist, and a twin sister. In the 1950s she earned a B.S. degree in chemistry from Iowa State University and a Ph.D. in biochemistry from Case Western Reserve University in Cleveland.

As a postdoctoral researcher at the National Institutes of Health, she independently demonstrated, as did other researchers, the synthesis of RNA in *E. coli* bacterial cells by an enzyme (type of protein) called RNA polymerase (RNAP). RNA, or ribonucleic acid, is a nucleic acid present in all living cells. It serves as a messenger because it carries instructions from DNA for controlling the synthesis of proteins. The discovery of RNAP was worthy of a Nobel prize.

According to the Wikipedia entry on "RNA polymerase," RNAP was discovered independently by Charles Loe, Audrey Stevens and Jerard Hurwitz in 1960. By this time, one half of the 1959 Nobel Prize in medicine had been awarded to Severo Ochoa for the discovery of what was believed to be RNAP, but instead turned out to be polynucleotide phosphorylase. The 2006 Nobel Prize in chemistry was awarded to Roger Kornberg for creating detailed molecular images of RNA polymerase during various stages of the transcription process."

Audrey became a professor at St. Louis University, where she met Salil Kumar Niyogi. Salil grew up in Bassein, Burma and Calcutta, India, in the midst of World War II and the struggle for Indian independence. He received a B.Sc. degree in chemistry from Presidency College and an M.Sc. degree in applied chemistry from Calcutta University. He moved to the U.S. in 1958 to attend Northwestern University, where he received his Ph.D. in biochemistry.

At St. Louis and the University of Maryland Medical School, where Audrey and Salil moved in 1963, they worked together on the enzyme RNA polymerase. Salil assumed a position at Johns Hopkins University. The two were married and moved in 1966 to ORNL's Biology Division.

Salil conducted research on the basic biochemistry of cells. His work was recognized by honors from the Department of Energy and the American Association for the Advancement of Science.

In 1972 Audrey isolated a type of protein from *E. coli* cells infected with a certain bacteriophage – a virus that invades a bacterium so the virus can reproduce inside it. She discovered this protein hinders the action of the RNA polymerase. The protein was named the "Audrey Stevens' inhibitor." She later found that lithium might inhibit one of the enzymes that degrade messenger RNA.

Audrey worked half time for 17 years because she felt the need to be home for the Niyogis' two sons, Kris and Dave (who later earned a Ph.D. in environmental sciences from the University of Colorado). As they were growing up, she convinced them of the value of hard work.

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Because of her intense devotion to her scientific pursuits, she was better known in the international scientific community than in her hometown. According to Munger's 1998 article, when the announcement was made about her election to NAS, "Stevens received congratulatory calls and cards from scientists around the globe, many of whom thought the honor was overdue."

Fred Hartman, former director of the Biology Division, told Munger: "What drives her is a sheer quest for knowledge -- not fame, not glory, not money. It's extraordinary if you consider the rather meager support she has received over the years. Ninety-nine percent of what she has accomplished has come with her own two hands as she worked alone for extraordinarily long hours. She is extremely dedicated, motivated and intelligent. She asks the right question at the right time and shows great perseverance."

As does Kris Niyogi.

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Just WOW! What a great story from the heart of what truly makes Oak Ridge SPECIAL! Our people! Thanks, Carolyn for yet another amazing find in our heritage!



Kris Niyogi, an Oak Ridge High School graduate and co-captain of the ORHS soccer team that won the state championship in 1982, was elected to the National Academy of Sciences in 2016, 18 years after his mother's election to the NAS. He works for the university and national lab in Berkeley, Calif.

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Audrey Stevens Niyogi, a co-discoverer of RNA polymerase, was elected to the National Academy of Sciences in 1998. Her son Kris was elected to the NAS in 2016. (Photo courtesy of ORNL)



Fred Hartman was a former director of ORNL's Biology Division and former head of the protein engineering group in which Salil and Audrey Stevens Niyogi performed research (Photo courtesy of ORNL)

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Salil Niyogi was well known as a biochemist in ORNL's Biology Division and as a local soccer player, coach and referee. He was elected to the Oak Ridge Sports Hall of Fame. (Photo courtesy of ORNL)