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Acoustical Society Of America Helmholtz-Rayleigh Interdisciplinary Silver Medal In Physical Acoustics, Biomedical Acoustics, And Engineering Acoustics: Armen Sarvazyan

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ACOUSTICAL SOCIETY OF AMERICA
HELMHOLTZ-RAYLEIGH INTERDISCIPLINARY
SILVER MEDAL
in
Physical Acoustics, Biomedical Acoustics, and Engineering Acoustics

Armen Sarvazyan
2016

The Silver Medal is presented to individuals, without age limitation, for contributions to the advancement of science, engineering, or human welfare through the application of acoustic principles, or through research accomplishment in acoustics.

PREVIOUS RECIPIENTS

Helmholtz-Rayleigh Interdisciplinary Silver Medal

Gerhard M. Sessler	1997	Mathias Fink	2006
David E. Weston	1998	Edwin L. Carstensen	2007
Jens P. Blauert	1999	James V. Candy	2008
Lawrence A. Crum	2000	Ronald A. Roy	2010
William M. Hartmann	2001	James E. Barger	2011
Arthur B. Baggeroer	2002	Timothy J. Leighton	2013
David Lubman	2004	Mark F. Hamilton	2014
Gilles A. Daigle	2005	Henry Cox	2015

Interdisciplinary Silver Medal

Eugen J. Skudrzyk	1983
Wesley L. Nyborg	1990
W. Dixon Ward	1991
Victor C. Anderson	1992
Steven L. Garrett	1993

CITATION FOR ARMEN SARVAZYAN

. . . for contributions to ultrasound imaging and its applications

SALT LAKE CITY, UTAH • 25 MAY 2016

Armen Sarvazyan has lived an interesting life. Born in Yerevan, Armenia, which was part of the USSR, and attended the prestigious Moscow State University where he earned a B.S. in Physics in 1962 and an M.S. in Biophysics in 1964. He was also an active visual artist–sculpting, and drawing. As a graduate student and researcher at the Pushchino Research Center of the USSR Academy of Sciences, Armen earned his Ph.D. in 1969 but also founded and was first president of the Pushchino Arts and Crafts Center "Koryaga." His artistic and scientific efforts embraced the same purpose: to understand and honor nature, while finding creative solutions to human problems. As such, Armen eventually became one of the world's foremost inventors, with over 100 patents and 200 peer-reviewed scientific publications, and the "godfather" of the field of ultrasound elastography.

Armen rose quickly from junior scientist, to senior scientist, to head of the Biophysical Acoustics Laboratory in the Institute of Theoretical and Experimental Biophysics, Russian Academy of Sciences in Pushchino, Russia. There he supervised the work of over 20 Ph.D. students and taught courses in physics, acoustics, and biomedical systems. He even served a stint on a Soviet commission to investigate paranormal phenomena, which yielded many interesting experiences including meeting people with astounding mental capabilities and encountering unusual physical phenomena such as ball lightning. Armen notes that "everything interesting that we investigated was not repeatable; everything repeatable was not interesting."

At that time, travel outside of the USSR by Soviet scientists was nearly impossible. Instead, scientists would come to visit Pushchino; among the US acousticians hosted by Armen were Floyd Dunn, Frank Fry, Wes Nyborg, Kit Hill, Mack Breazeale, Bill O'Brien, Roy Williams, and Christy Holland, as well as leading biomedical acoustics researchers from Eastern Europe. These visitors inspired Armen's investigations of, for example, nonlinear acoustics, which led to papers on the molecular mechanisms of acoustic nonlinearity and techniques to measure them precisely. Similarly, Armen first became acquainted with the acoustic radiation force as a possible ultrasound bioeffect in discussions with Leonid Gavrilov and Frank Fry.

Researchers in ultrasound were concerned with tissue characterization, that is, determining experimental characteristics of human tissue that could aid in diagnosis and therapy. Armen Sarvazyan was among the first to realize that there was significant structural information in the shear properties of soft tissue, and that these properties could be sensitively probed using low-frequency shear waves. At Pushchino in the 1970s and 1980s, Armen developed low-frequency acoustic methods and analytic tools to study the shear properties of soft tissue and correlate shear properties with disease characteristics of many tissue types. This work led directly to the later development of elasticity imaging, or elastography, a multi-billion-dollar branch of biomedical ultrasound that provides detailed diagnostic images from shear wave interactions, for instance, in cancer tumor detection. Virtually every clinical ultrasound imaging machine now includes shear wave imaging capability.

Early shear wave transducers used a piezoelectric crystal that moved parallel to its contact face. Devices and analytical tools pioneered by Armen and colleagues helped to solve the inverse problem of determining the characteristics of deeper objects: the "princess and the pea" problem. But in searching for better ways to move tissue, Armen Sarvzyan was among the first to use acoustic radiation force to generate the low-frequency shear waves. Many researchers thought this would not work because of the small magnitude of the radiation force in tissue, but being an inventor and engineer, Armen developed a method described by his seminal patent in 1997, "Method and device for shear wave elasticity imaging." His 1998 archival paper describing this method, co-authored by colleagues at the University of Michigan, is a thousand-citation classic that opened the field to clinical practice and spawned several companies.

Emigrating to the United States, Armen Sarvazyan first took a position as research professor and head of the Bioacoustics Laboratory in the Chemistry Department at Rutgers University. In 1994, he founded Artann Laboratories, Inc., for which he is still the chief scientific officer. The enormous engineering accomplishments of Artann Labs include over 60 US patents and development of devices to diagnose prostate and breast cancer. At Artann Labs, considerable advances have been made in nonlinear focusing by time-reversal acoustics, ultrasound-assisted drug delivery to brain tumors, assessment of body hydration status, and monitoring of colonoscopy force patterns, among many areas. Other companies, often led by Armen's former students or collaborators, have grown up from the ultrasonic methods and devices that he developed and patented. For example, a company in Israel is commercializing a device for monitoring and analyzing liquid food products such as milk, juices, and other beverages. An Irish company is commercializing a device for monitoring biomolecular structural changes in the pharmaceutical, biotech, polymer, and petrochemical industries. A different ultrasonic device is installed in hundreds of Russian hospitals for determining the molecular composition of blood serum and whole blood that does not require costly reagents and takes minutes instead of hours to complete analysis. US companies have developed technologies based on the use of cylindrical ultrasonic resonators and other devices for monitoring various processes of biochemical and/or pharmaceutical importance such as drug-DNA interactions, thermodynamics of conformational transitions of biopolymers, rapid detection of food borne pathogenic bacteria, and other highly sensitive immunochemical sensors. Armen's engineering accomplishments extend to such diverse fields as the artificial insemination of pigs, manufacturing of golf balls and sausages, land mine detection, and development of non-lethal weapons.

Armen has maintained an ardent connection with the Acoustical Society of America (ASA) over the years, presenting more than 60 talks at ASA meetings with about one-third invited. A Fellow of the ASA, he can be found at most meetings sharing ideas and proposing innovative solutions to difficult problems.

Armen's artistic production never stopped, either, and has been recognized in international art festivals and exhibited in galleries in New York City. Working in media as diverse as wood, stone, concrete, paint, and found objects, Armen has examined the relationships of classic form with a creative (and often humorous) spin. Some of it can be viewed at www.armensarvazyan.net. Whether investigating molecular interactions using carefully designed resonators or creating clever art sculptures, Armen Sarvazyan has helped elucidate nature's beauty and turn it to good purpose for humanity's benefit.

We are pleased to congratulate Armen Sarvazyan for being awarded the ASA Helmholtz-Rayleigh Interdisciplinary Silver Medal in Physical Acoustics, Biomedical Acoustics, and Engineering Acoustics.

E. CARR EVERBACH
LAWRENCE A. CRUM