

Women of the American Otological Society

*Jennifer C. Alyono, *Robert K. Jackler, and †Sujana S. Chandrasekhar

*Otolaryngology–Head & Neck Surgery, Stanford University School of Medicine, Stanford, California; and †New York Otology, Zucker School of Medicine at Hofstra-Northwell, Past President American Academy of Otolaryngology-Head and Neck Surgery, New York, New York

Objective: To describe the history of women in the American Otological Society (AOS).

Methods: Biographies of the early women of the AOS were compiled through review of the AOS transactions, their published scholarship, newspaper articles, and memorials. Interviews were conducted with the only two women to have led the society and also with former colleagues and family members of pioneering AOS women members who are no longer with us. The evolving gender composition of the society over time was researched from AOS membership lists and compared with data on surgical workforce composition from multiple sources such as the Association of American Medical Colleges, Accreditation Council for Graduate Medical Education, American Medical Association, and the American Academy of Otolaryngology—Head and Neck Surgery.

Results: Although American women specialized in otology as far back as 1895, the first woman to be invited to join the AOS as Associate member in 1961 was Dorothy Wolff, PhD. The first female full member was otologic surgeon LaVonne

Bergstrom, M.D., who was elected in 1977, 109 years after the foundation of the Society. As of 2017, only two women have served as AOS President. The first was Aina Julianna Gulya, M.D., who took office during the 133rd year in 2001. At the time of the sesquicentennial (2017), 7.5% of AOS members are women including three of eight who serve on the AOS Council. This compares with 15.8% of women among the otolaryngology workforce and a growing 10.9% representation among those who have earned subcertification in neurotology.

Conclusion: Gender disparities remain in the AOS, but both participation and scholarly contributions by women in otology have grown substantially since the society's inception 150 years ago, and particularly in the 21st century. Increasing the presence of women in leadership provides role models and mentorship for the future. **Key Words:** American Otological Society—Female surgeon—History of otology—Women.

Otol Neurotol 39:S69–S80, 2018.

In honor of the American Otological Society's (AOS's) 150th anniversary, this article recollects the stories of the earliest women members, and tracks the progress of women in the society. Unlike the American Medical Association (AMA), which was founded in 1847 and admitted women by 1909, and the American College of Surgeons, which both was founded and admitted women in 1913, the AOS remained an all-male institution for nearly a century. In recent times, it has accepted and occasionally promoted female members, paralleling the slow increase in women across numerous surgical subspecialties. We found it interesting to trace the stories of pioneering women in the AOS and otology as a field, reflecting on where we are today, and how we got there.

METHODS

Primary sources for this article include the meeting minutes and Transactions of the American Otological Society, publications written by or about AOS women, obituaries from the medical literature, and newspaper articles. Contemporaneous journal articles as well as archives from the Drexel University Legacy Center (available at <http://archives.drexelmed.edu/>), which houses collections from the historical Women's Medical College of Pennsylvania, were used to detail Dr. Musson's life.

The authors are also grateful to the friends and family of AOS women who provided remembrances and photographs, including: Dr. Dennis Trune (colleague of Dr. Catherine Smith), Suzanne Linde (niece of Dr. Catherine Smith), Dr. Elliot Abemayor (student of Dr. LaVonne Bergstrom and of Dr. Ruth Gussen), Timothy and Leticia Johnson (nephew and sister of Dr. LaVonne Bergstrom, respectively), and Jim Gussen (son of Dr. Ruth Gussen). Interviews were conducted with the two women who have had the honor of serving as AOS President: Dr. Aina Julianna Gulya (2001) and Dr. Debara Lyn Tucci (2016).

Statistics regarding the gender composition of the society were tabulated from historical AOS membership lists. Information about medical student, otolaryngology trainee, and current physician gender distributions were compiled from resources from the Association of American Medical Colleges,

Address correspondence and reprint requests to Jennifer C. Alyono, M.D., M.S., Otolaryngology—Head and Neck Surgery, Stanford University School of Medicine, 801 Welch Road, Stanford, CA 94305; E-mail: jalyono@stanford.edu

The authors disclose no conflicts of interest.

DOI: 10.1097/MAO.0000000000001707

the Accreditation Council for Graduate Medical Education, the AMA, the American Board of Otolaryngology, and US Department of Education National Center for Education Statistics. The American Academy of Otolaryngology-Head and Neck Surgery (AAO-HNS) provided current membership statistics.

Attitudes Toward Women Entering Medicine During the 19th and Early 20th Century America

In the late 19th century, women were often relegated to working at women's or children's hospitals, or as medical assistants. The few who did complete medical training faced significant hardship and were often looked down upon. Dr. Eduard Hofrath, Professor of Surgery in Vienna, published a monograph that reflected many views from that time: "Medical practice requires power of thought and the capacity for work. Few male students unite both gifts, and how much fewer, the Professor asserts, the female students, in whom thought is so inextricably mixed with emotion (1)."

The earliest formally trained American female physicians, such as Dr. Elizabeth Blackwell, attended otherwise exclusively male medical schools (2). Blackwell was rejected from 20 medical schools before acceptance to one in New York, Geneva Medical College, which allowed her entrance after a vote by the students (3). It was not until the mid-1800s that the first medical schools for women were founded: the New England Female Medical College in 1848, and the Woman's Medical College (WMC) of Pennsylvania in 1850 (4,5). Many prominent American medical schools were reluctant to admit women. In 1893, Johns Hopkins included three women in its first medical school class, but only because of financial need: in donating the \$500,000 requisite to open the school, four of the original University trustees' daughters—Martha Carey Thomas, Mary Elizabeth Garrett, Elizabeth King, and Mary Gwinn—stipulated that qualified women must be admitted (6). Harvard Medical School did not admit women until 1945 (7). Jefferson Medical College (now known as Sidney Kimmel Medical College) had its first class with women only in 1961 (8).

The Corporation of Harvard College and its Professors in the Medical Department almost admitted their first woman in 1850; however, the students petitioned the faculty:

Resolved, That no woman of true delicacy would be willing, in the presence of men, to listen to the discussion of the subjects that necessarily come under the consideration of the student of medicine.

Resolved, That we are not opposed to allowing woman her rights, but do protest against her appearing in places where her presence is calculated to destroy our respect for the modesty and delicacy of her sex (9)."

First American Female Professor of Otolaryngology: Dr. Emma Elizabeth Musson (1861–1913)

A handful of women specialized in otology nearly a century before the first female AOS inductee. Dr. Emma Elizabeth Musson was recognized as the nation's first female Professor of Otolaryngology in her memorial published in the *Journal of the American Medical Association* (see Fig. 1) (10). Born in Coburg, Canada, she graduated with honors from the WMC in 1883. After a general internship, she spent several years study in the anatomy and physiology labs before her appointment as Clinical Professor of Laryngology and Rhinology in 1893. In 1895, she succeeded Dr. Charles H. Burnett (AOS President 1884–1885) as Professor



FIG. 1. First female Professor of Otolaryngology. Dr. Emma Musson became the first female Professor of Otolaryngology in 1895, serving at the Woman's Medical College of Pennsylvania. Photo courtesy of Drexel University Legacy Center.

of Otolaryngology, and subsequently resigned her other two posts, indicating her dedication to otology (11).

Musson was known for her devotion to her craft and to her students. Dr. A. Helena Goodwin wrote, "She spent hours in study, hours in the dissecting room, her clinics were her laboratory, her surgical methods were developed under keen criticism. . . . Among the students at the College her work was a sacred duty to her. . . and through weariness and weakness often, but with cheerful courage, she gave them of her all (12)."

"She was one of those quiet, hardworking, modest woman [*sic*] whose entire pleasure lies in doing. . . . Dr. Clarence J. Blake [AOS President 1877–1878], the leading Boston aurist, and other physicians sent her many patients. . . She had reached the age of 52 years, and had won the respect of all the men of her profession, and clearly demonstrated what lies in the power of women. There was no aggressiveness about her, no undue desire for fame, no self-seeking effort, no forging ahead to reach the limelight; but she seemed to be consumed with a yearning to serve, and serve she did to the very last," wrote Sallie Wistar, a regular author in the local newspaper (13).

Dr. Musson was a member of the AMA and Medical Society of the State of Pennsylvania. She held leadership positions in the Philadelphia Clinical Society and Philadelphia County Medical Society. She presented and wrote numerous articles, covering topics from "The Deaf Child," (14) to "Anomalies of Lateral Sinus, Mastoid Emissary Veins and Internal Jugular Veins," (15) to "Labyrinthine Deafness" (16) to "The Endoscopic Treatment of Bronchiectasis" (17). She was known to

have operated on children as young as 6 months (18), and performed surgery up until the week before she died: “Just 1 week before she died, already feeling most ill, she performed a radical mastoid operation on a patient, who is recovering while she lies dead.” (13)

Musson was not known to have married or have children. After her passing from pneumonia in December 1913, an operating room dedicated to surgeries of the ear, nose, and throat was named in her honor at the WMC (10). The WMC alumnae association also established the Emma E. Musson Scholarship in Otolaryngology for \$700 (nearly \$17,000 in today’s dollar) (19). Even though she was one of but a few American surgeons to hold the title of Professor of Otolaryngology, was a productive otological scholar, and was well known to AOS Presidents Blake and Burnett, Musson never became a member of the AOS. This was not likely a circumstance of her choosing, but rather reflected the bias of her time.

Biographies of the Pioneer Women in the AOS and Their Contributions to Otolaryngology

1961: First Associate Member—Dorothy Wolff, PhD (1895–1980)

Dr. Dorothy Wolff was the first woman admitted into the AOS, albeit as an Associate Member (see Fig. 2A). Noted temporal bone anatomist and pathologist, she instructed scores of budding otologists through her work at the Lempert Institute of Endaural Surgery, a private hospital and research institution in New York City. Born in Pueblo, Colorado in 1895, Wolff was reared in Pennsylvania. She completed her undergraduate studies at Smith College, and her master’s degree at the University of Michigan. She conducted temporal bone research for her PhD thesis at Washington University, St. Louis under the direction of Dr. L.W. Dean (AOS President 1932). She also had an honorary doctorate of science from the University of North Carolina.

Wolff worked at the Johns Hopkins temporal bone laboratory before accepting a position at the Lempert Institute. There she gave lectures on ear histopathology to all those learning the fenestration operation from Dr. Julius Lempert. In 1955, she moved to the Manhattan Eye, Ear, and Throat Hospital where she continued her research on otosclerosis, at times in partnership with otologist Dr. Richard Belluci (AOS President 1981). In a memorial he wrote for her, Belluci was effusive in his praise: “Dr. Wolff became a very important figure in American otology... Her scientific expertise was widely acknowledged and her research was well received as it was

always honest and well done. Above all she will be remembered for her kindness to her students, her eagerness to provide tutelage, and the demonstration of her tireless enthusiasm which was inspiring to all who knew her.” (20)

In his 1978 Guest of Honor speech, Dr. Howard House (AOS President 1966) remarked that his “first exposure to basic research was provided in 1938, by Dr. Dorothy Wolff... It was there that I saw my first microscopic section of a human temporal bone.” (21) In her 1961 AOS nomination, Dr. Philip Meltzer (AOS President 1950) confirmed her widespread renown: “I would like to present Dr. Dorothy Wolff, whom you all know, and who needs no further introduction or words from me.”

She and Dr. Lempert were awarded a gold medal by the AMA for their teaching exhibit on the fenestration operation. Wolff wrote and coauthored numerous textbooks on the anatomy of the temporal bone, including *Microscopic Anatomy of the Temporal Bone: A Photographic Survey* (22), *Surgical and Microscopic Anatomy of the Temporal Bone* with Belluci and Dr. Andrew Eggston (23), and *Histopathology of the Ear, Nose, and Throat* with Eggston (24).

Wolff passed away in January 1980 at the age of 84. Belluci wrote of her, “In the course of the many years devoted to study and teaching of ear anatomy and pathology, she received great respect and became close friends with many otologists in this country and abroad. Her friendly, cheerful, and energetic personality won her great admiration and inspired all who knew her to higher achievement.” (20)

1962: Second Associate Member—Catherine Smith, Ph.D. (1914–2005)

Dr. Catherine Agnes Smith was a renowned inner ear researcher, known especially for her expertise in electron microscopy and cochlear electrophysiology (see Fig. 2B). She was born in 1914 in St. Louis, Missouri to S.P. Smith, a grocer, and his wife Rosa.

She originally aspired to be a social worker, but during a home visit with a fellow student, she was told she missed much of the conversation, and might be suffering from hearing loss. Smith was recommended to see an otolaryngologist, and consulted with Dr. Max Goldstein (AOS President 1928 and founder of the journal *Laryngoscope* 1896), who diagnosed otosclerosis. At the time, around 1933, surgery was not recommended due to the risk of lethal infection. Goldstein counseled that she might consider a career that relied less on communication. As her best grades were in science, he



FIG. 2. Pioneering Associate Members. A, Dorothy Wolff, Ph.D., was the first female associate member, joining in 1961. B, Catherine Smith, Ph.D., was the second female associate member, and joined in 1962. C, Pathologist Ruth Gussen, M.D., was the third female associate member, and joined in 1977.



FIG. 3. American Otological Society group photograph from the 1971 annual meeting held in San Francisco. Dr. Catherine Smith (associate member) was the only woman. (Seated in the fourth row.) This image well illustrates the lack of gender and ethnic diversity typical of the Society a few years after its centennial. (Photo courtesy of Dr. Dennis Trune.)

recommended she become a laboratory technician, which she did following her graduation from college from Washington University in St. Louis in 1935.

After World War II and the development of antibiotics, Smith consulted with Dr. Theodore Walsh (AOS President 1964, Otolaryngology Chair at Washington University St. Louis, and Laryngoscope editor). She underwent a unilateral one-step fenestration operation, which significantly improved her hearing. She subsequently completed her Master of Science (1948) and Ph.D. (1951) in anatomy at Washington University St. Louis, working in the Department of Otolaryngology. After her graduation she joined the faculty there, as well as at the Central Institute for the Deaf, researching cochlear electrophysiology. In addition to her pioneering work on the anatomy of the inner ear, she was the first to discover and describe the electrolytic characteristics of the endolymph: that its ionic composition resembled that of intracellular fluid, and not of interstitial fluid or cerebrospinal fluid (25).

In 1958, Smith received a foreign research travel grant from the National Institutes of Health, and spent 2 years at the Karolinska Institute in Stockholm, Sweden. There she adapted electron microscopy techniques to the study of the ear. She was later recruited to Oregon Health and Science University in 1969 as part of the burgeoning Kresge Hearing Research Laboratory (now known as the Oregon Hearing Research Center).

In 1962, Smith was nominated by Walsh (her surgeon and Chair) to associate membership in the AOS. After the reading of all the nominated candidates for the year, Secretary-Treasurer Dr. James A. Moore (AOS President 1967) announced, "The Council recommends, on the basis of your vote, the election of

these men to membership in our Society." The AOS transactions then records a voice from the gallery interjecting, "And one lady." Moore then confirmed, "And one lady." (see Fig. 3) (26)

In 1975, Smith received the society's highest honor, the AOS Award of Merit. When presented by Dr. John Bordley (AOS President 1971), he said that the Committee's "choice was not made on the awardee's superb research alone... During her career she has inspired countless young doctors to explore the delights of research. She has been a gentle and wise counselor, listening patiently and speaking softly with words of great wisdom to many of us facing perplexing questions in Otolaryngology." Acknowledging that she was the first woman to receive the award, Bordley quipped that all previous recipients had been bald with an average waist size of "52 inches" (27). She was also awarded the Shambaugh Prize by the Collegium Oto-Rhino-Laryngology in 1977, and the Association for Research in Otolaryngology Award of Merit in 1980.

Smith had numerous interests outside of her work, including bird-watching, wild flowers, and travel. She did not marry or have children. She passed away September 27, 2005 in Lake Oswego, Oregon at the age of 91.

1977: First Active Member—LaVonne Bergstrom, M.D. (1928–2001)

Dr. LaVonne Bernadene Bergstrom was an otolaryngologist who took special interest in pediatric disease and genetic malformations (see Figs. 4 and 5). As an otologic surgeon, she became the AOS's first female Active Member in 1977. Born in 1928 in Erskine, Minnesota, she was the oldest of four



FIG. 4. The first female active member of the AOS, LaVonne Bergstrom, was inducted in 1977. Photo courtesy of Timothy Johnson. AOS indicates American Otological Society.

children. She graduated as valedictorian from Wadena, Minnesota High School. At the University of Minnesota she studied journalism before completing her medical degree at the University of Minnesota Medical School in 1953.

Before specializing in otolaryngology, Bergstrom spent several years after internship working as a general practitioner in Embudo, New Mexico (1958–1961), then as Medical Director of the Sangre de Cristo Medical Unit in San Luis, Colorado (1961–1965). Bergstrom served as the single physician in the 1215 square miles that was Costilla County, Colorado, an impoverished, underserved area. Her clinic waiting room was often standing room only. As the only doctor in town, she served multiple unconventional roles: draft board examiner, coroner, and ringside physician at local prize fights. Her schedule was so demanding that she would dictate her notes while driving in her Rambler on her way to the hospital or house calls.

Bergstrom then pursued residency in otolaryngology at the University of Colorado, Denver (1965–1969). Following the completion of her training she joined the faculty there until 1975 when she was recruited to the University of California, Los Angeles (UCLA). With her experience as a family practice doctor, Bergstrom understood the importance of coordinated care and treating families, not just diseases. “Dr. Bergstrom taught you to be a doctor. And by that I mean a healer—she did it in the sense of treating the family. She taught you to understand and appreciate that your nonsurgical intervention can be just as curative, just as empowering, and just as important as doing a neck dissection and curing a patient that way,” said UCLA Professor of Head

and Neck Surgery Dr. Elliot Abemayor, who trained as Bergstrom’s resident. At UCLA she started one of the first unified craniofacial clinics on the west coast. Her experience treating Spanish speaking families in San Luis was an asset: she volunteered with the Hope for Hearing Foundation in Los Angeles, even translating pamphlets for parents of hearing impaired children into Spanish.

In addition to her charitable work, Bergstrom was an academic pioneer. She authored numerous articles and chapters on the otologic manifestations of congenital disorders. Her work at the University of Colorado with rheumatologist Dr. Alan Rosenberg studying a family with autosomal recessive renal insufficiency, ataxia, and sensorineural deafness, was eponymized as the Rosenberg–Bergstrom syndrome (28).

Bergstrom served as vice president of the American Bronchoesophagological Association and president of the American Auditory Society. She won the Fowler Award in 1977 for best Triological Society thesis for her work, “Osteogenesis Imperfecta, Otologic and Maxillofacial Aspects.” (29) That same year she was elected to the AOS, nominated by Dr. Irwin Harris and seconded by Dr. William Hemenway, both also affiliated with UCLA. She became an Emeritus AOS member in 1992. Other professional memberships included the American Academy of Pediatrics, the AAO-HNS, and the American Neurotology Society.

Bergstrom was known not only for her encyclopedic knowledge, but also for her inquisitive nature. Her nephew Timothy Johnson, special collections and rare books curator for the University of Minnesota Libraries, reminisced, “She had an excitement about research and higher education, a natural curiosity with a sense of playful adventure that was contagious.” Bergstrom prioritized spending time with her family despite her busy work life. Known as “Dene” to close friends and family, she loved taking her nephew and friends on camping trips, hiking, biking and “big adventures,” as her sister Leticia Johnson recalled. She had a fine soloist’s singing voice, and always a recommendation for something to read.

Bergstrom retired as Professor from UCLA in 1989. She did not marry or have children. She was diagnosed with Pick’s Disease (frontotemporal lobe dementia), and passed away in January 2001 at the age of 72.

1977: Third Associate Member—Ruth Gussen, M.D. (1925–2003)

Dr. Ruth Gussen was a temporal bone pathologist who joined the AOS in 1977 (see Fig. 2C). Born and raised in New York City, her parents were both Jewish immigrants from Eastern Europe. As a child, she greatly admired her older brother, Raymond Marcus, who went on to become an internist. She attended Cornell University for her undergraduate degree, and also completed medical school there in 1950. She subsequently moved to Los Angeles, California with her husband, Dr. John Gussen, a psychiatrist at the University of Southern California. She was recruited in 1966 by Dr. Victor Goodhill (AOS President 1976) to direct the UCLA Temporal Bone Laboratory, and attained the rank of Professor in the Departments of Pathology and Surgery.

Gussen’s favorite book as a youngster was *Microbe Hunters*—and indeed, she spent a prolific career hunting ear disease on the microscopic level (30). She published on a variety of otologic processes, from otosclerosis to sudden deafness, endolymphatic hydrops to congenital abnormalities. Ever rigorous in her studies, she was quoted as saying, “I enjoyed more working with problems than dealing with people.” (31) One of few



FIG. 5. A, Dr. LaVonne Bergstrom and her dog, Chico, taken at the Sangre de Cristo Medical Unit at San Luis, Colorado, where Dr. Bergstrom served as Medical Director. Photo taken by Mary Ann Gehres, courtesy of Timothy Johnson. B, Dr. Ruth Gussen examining a pathology slide in her office at the University of California, Los Angeles. Photo courtesy of Jim Gussen. C, Dr. A. Julianna Gulya with Dr. Gene Derlacki and Dr. Howard House. Photo courtesy of Dr. Gulya. D, Catherine Smith receiving the award of merit in 1981 from the Association for Research in Otolaryngology, pictured with Hallowell Davis, Harold Schuknecht and Ben Senturia. Photo courtesy of Dr. Dennis Trune. E, Dr. Debara Tucci operating under the microscope. Photo courtesy of Dr. Tucci. F, Dr. Emma Musson. Photo courtesy of Drexel University Legacy Center.

women in the field, and of the even fewer professional women to have had children at the time, Gussen often brought her son, Jim, to her laboratory. Jim recalls being fascinated by her microtome as a child, once finding himself in the back of the room during an autopsy course at only age 10. Abemayor, who first met Gussen when he was a resident, remembers her as “an incredible teacher. She was incredibly generous with her time and with her effort—even as a senior member of the faculty.”

Following her retirement at age 59, she became the president of UCLA’s PLATO society, an organization of retirees who gathered to share their interests in life-long learning. In particular, Gussen was known for imparting her love of reading, opera, and travel. She even combined her interests with a trip to Bayreuth, Germany to see operas from one of her favourite composers, Richard Wagner. She developed many deep friendships, and it was said that she “radiates a natural warmth that reels people into her circle with only a smile as her lure.” (31)

Gussen died in 2003 from cancer.

2001: First AOS President—Aina Julianna Gulya, M.D.

Dr. Aina Julianna Gulya was inducted into the AOS in 1991 as its second female Active Member (see Fig. 6A). She was born in Syracuse, New York in 1953. Gulya’s father, Aladar, had been a thoracic surgeon in Hungary before immigrating to the

United States. He invented several procedures and devices for tuberculosis surgery, which was common in the 1930s before the advent of antibiotic therapy. Gulya’s mother, Sylvia, had worked in rocket circuitry with Wernher von Braun, which prompted Gulya to recall: “Perhaps I got my fine motor manipulation skills from her.”

Gulya completed her undergraduate degree at Yale in 1974 *cum laude*, and her medical degree at the University of Rochester with Distinction in Research in 1978. She initially aspired to be a surgical oncologist, and began internship in general surgery at Beth Israel Hospital in Boston. While there, she gained her first exposure to otolaryngology from trainees from the Massachusetts Eye and Ear Infirmary (MEEI), and was impressed by their joy and love of their craft. She subsequently switched tracks and entered otolaryngology residency at MEEI. At the time, she was the single female resident out of 18, and only the third woman ever to have entered residency at MEEI. She found fascinating the temporal bone histology work of Dr. Harold Schuknecht (AOS President 1977), then Chair of the department. In 1983, she became Dr. Michael Glasscock’s (AOS President 1992) first female otology-neurotology fellow, in Nashville, Tennessee.

Following her fellowship, Gulya and her husband, otolaryngologist Dr. William Rosser Wilson, became founding members of the newly formed Division of Otolaryngology at George Washington University. Gulya later joined the faculty at



FIG. 6. The two women Presidents of the AOS: (A) Dr. A. Julianna Gulya (2001) and (B) Dr. Debara Tucci (2016). AOS indicates American Otological Society.

Georgetown University before becoming the first chief of the National Institute on Deafness and Other Communication Disorders' new Clinical Trials branch in 1996.

Gulya recalls sitting in the audience at the AOS before her induction into the society: "I barely thought I would be a member of the Otological, let alone be the President. It was beyond my wildest dreams. I was delighted." Shortly after she was nominated in 1991, she was inducted into the AOS council in 1994. She then was appointed Editor-Librarian, and rose to President in 2001. During her stewardship of the society, she championed research in the field, and integrated the research fund more closely into the operations of the AOS. Gulya was honored with the Triological Society's Presidential Citation in 1999, the AAO-HNS's Distinguished Service Award in 2001, and the NIH Merit Award in 2004. She served as Associate Editor of *Otology & Neurotology* (previously known as *American Journal of Otology*) and as a member of the executive editorial board of the *Otolaryngology-Head and Neck Surgery*.

Perhaps her best-known publication is *Anatomy of the Temporal Bone with Surgical Implications*, published in three editions between 1986 and 2007 with Schuknecht and Gulya (32). When she initially proposed the idea for this text to Schuknecht, she was told "No, not at all, not a good idea." However, through her own determination and hard work, she put together a pamphlet to teach her fellow residents, organizing the plethora of temporal bone (histo)photomicrographs in the MEEI collection. She went back to Schuknecht, who then agreed to come on board; and her pamphlet would later become a seminal text in otologic training.

Gulya offers advice to the budding otolaryngologist: "The one thing is—and it's really corny but true—it's do what you say, and say what you do. Excuses don't get the job done." She is now enjoying retirement with her husband, step-children, and grandchildren.

2016: Second AOS President—Debara Lyn Tucci, M.D., M.B.A., M.S.

Dr. Debara Lyn Tucci is the fourth female Active Member of the AOS, and the Society's second woman President (see Fig. 6B). Having started her career as a clinical audiologist, she completed medical school at the University of Virginia in 1985, already knowing her goal was to be an otologist. She pursued otolaryngology residency at the University of Virginia and did her fellowship in otology-neurotology at the University of Michigan. Later in her career, she obtained her Master of Business Administration at the Duke University Fuqua School of Business in 2013.

Tucci served on the AOS Research Grants Board of Trustees from 2001 to 2008. She was AOS Editor-Librarian from 2010 to 2012, and AOS Education Director from 2013 to 2015 before rising to President in 2015 to 2016. She was also President of the American Neurotology Society from 2005 to 2006, and President of the Association for Research in Otolaryngology from 2011 to 2012. She has served on the US President's Council, advising on Hearing Devices, and advises the US Food and Drug Administration. She was awarded the AAO-HNS Foundation's prestigious Jerome Goldstein Public Service Award in 2017.

Her Triological Society thesis, "Conductive hearing loss results in a decrease in central auditory system activity in the gerbil," won the Edmund Prince Fowler Award in 1998. She is Professor of Otolaryngology Head and Neck Surgery at Duke University, and continues her leadership as part of the AOS council as Past President. She and her husband, neurologist Kevan VanLandingham, M.D., Ph.D., have three children.

In advising young physicians she notes: "I would advise them to do what they love, and to find a way to devote as much

TABLE 1. Female membership in the American Otological Society

#Women/Total Members	Active or Senior	Emeritus	Associate
2017 (150th yr)	13/174	1/58	5/27
1992 (125th yr)	1/192	1/3	4/38
1967 (100th yr)	0/126	0/1	2/15

time to do that as they want, and to still have time for their family life and personal life. It's a hard thing to do, but I think that people who are happy find a way to balance the two. I've always said "yes," maybe more often than I should of. I think that if you say "yes" to things, that it opens more doors that would not have been open otherwise. Be as involved as you can possibly be. Be as aggressive as you can be in pursuing things that make you happy."

Progression of Women in the AOS Over the Last 40 Years (1977–2017)

Female membership has slowly been increasing since the first female Active member was admitted to the AOS in 1977. While only 0.05% (1/192) of Active or Senior members were female at the AOS's 125th anniversary, this has risen to 7.5% (13/174) at its 150th anniversary (see Tables 1 and 2). Meanwhile, in recent years, women have increasingly participated in AOS leadership. As of 2017, three of eight council members are female: Dr. Carol Bauer (Education Director), Dr. Sujana Chandrasekhar (Secretary-Treasurer elect and Past President of the AAO-HNS), and Dr. Tucci (Past President) (see Fig. 6B).

Trends of Women in Otolaryngology—Neurotology Workforce and Training Pipeline

According to the AMA, 34.0% of all practicing physicians in 2015 were women. Their distribution in various specialties has been skewed: women are more likely to practice primary care, and the fields of pediatrics and obstetrics/gynecology have the highest proportions of women (see Fig. 7). In 2015, 15.8% of practicing otolaryngologists were women, with a similar percentage (17.4% in 2017) comprising the membership of the

TABLE 2. Proportions of females in medical, otolaryngological, and otological training and practice

	Women/Total	(Percentage)
Medical school ¹	10,474/21,030	(49.8%)
Otolaryngology residency ²	534/1,472	(36.3%)
Otolaryngology practicing physicians ³	1,485/9,405	(15.8%)
AAO-HNSF US members ⁴	1,712/9,852	(17.4%)
Neurotology subspecialty certification ⁵	34/313	(10.9%)
AOS membership (active, senior, emeritus, associate) ⁶	19/259	(7.3%)
AOS membership (active, senior) ⁶	13/174	(7.5%)

Sources: 1. 2016 Association of American Medical Colleges, 2. 2015 Accreditation Council for Graduate Medical Education, 3. 2015 American Medical Association, 4. 2017 American Academy of Otolaryngology—Head and Neck Surgery, 5. 2016 American Board of Otolaryngology, 6. 2017 American Otological Society.

AAO-HNSF indicates American Academy of Otolaryngology—Head and Neck Surgery; AOS, American Otological Society.

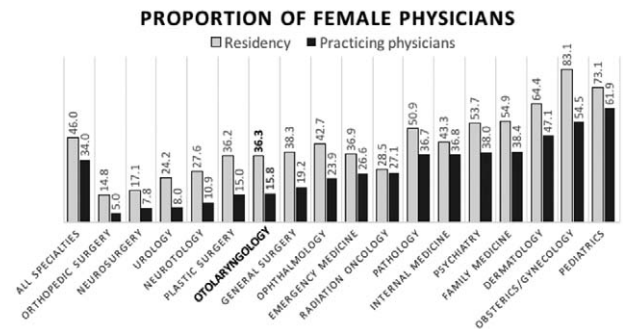


FIG. 7. Proportion of female physicians in residency and clinical practice, by specialty.

AAO-HNS (see Fig. 7, Table 2). In comparison, in 1980, less than 1% of practicing otolaryngologists and 23% of medical graduates were women (33).

An even lower percentage of female otolaryngologists represent those with neurotology subcertification. As of 2017, 34 of 313 diplomats, or 10.9%, were women (see Table 2, Fig. 8A). This proportion has been steadily increasing since the first-year neurotology certificates were granted, in 2004, when it was 2.6%.

Gender parity in neurotology training lags behind that in otolaryngology residency, and far behind what is observed among medical students. As of 2017, 49.8% of all medical students are women (34). The increase in female medical students, especially marked since the 1970s, parallels the rise of women in other professional fields such as law and dentistry, as tracked by the US Department of Education (see Fig. 8B) (35). The proportion of females comprising otolaryngology residents in 2016 was 36.3% (36). Additional data on neurotology and pediatric otolaryngology trainees is available, as these are the only two Accreditation Council for Graduate Medical Education regulated fellowships. Since 2008, the proportion pursuing pediatric fellowship has on average been higher than that in residency. In contrast, the proportion pursuing neurotology training has on average been lower, at 16.7 and 27.6% in 2016 and 2017, respectively (see Fig. 8C) (36).

DISCUSSION

Founded in 1868 by nine men, it took nearly 100 years before the first woman was elected into the AOS. The first women were preeminent researchers in the anatomy and physiology of the ear, and were allowed to join only in a limited capacity as associate members who could neither vote nor propose new members. This is in contrast to the American College of Surgeons, which admitted women in its founding year, in 1913. The first female otological surgeon to be invited as a full member was Dr. LaVonne Bergstrom in 1977 during the Society's 109th year. Dr. A. Julianna Gulya became the first woman to serve as AOS President in 2001, the Society's 133rd year. Although only 7.5% of AOS members are women, during this sesquicentennial year 10.9% of those with subcertification in Neurotology are women, and a more robust 27.6% of neurotology fellows training in 2017 are female.

To help understand the progression of women entering otology, it is of interest to explore the patterns of women

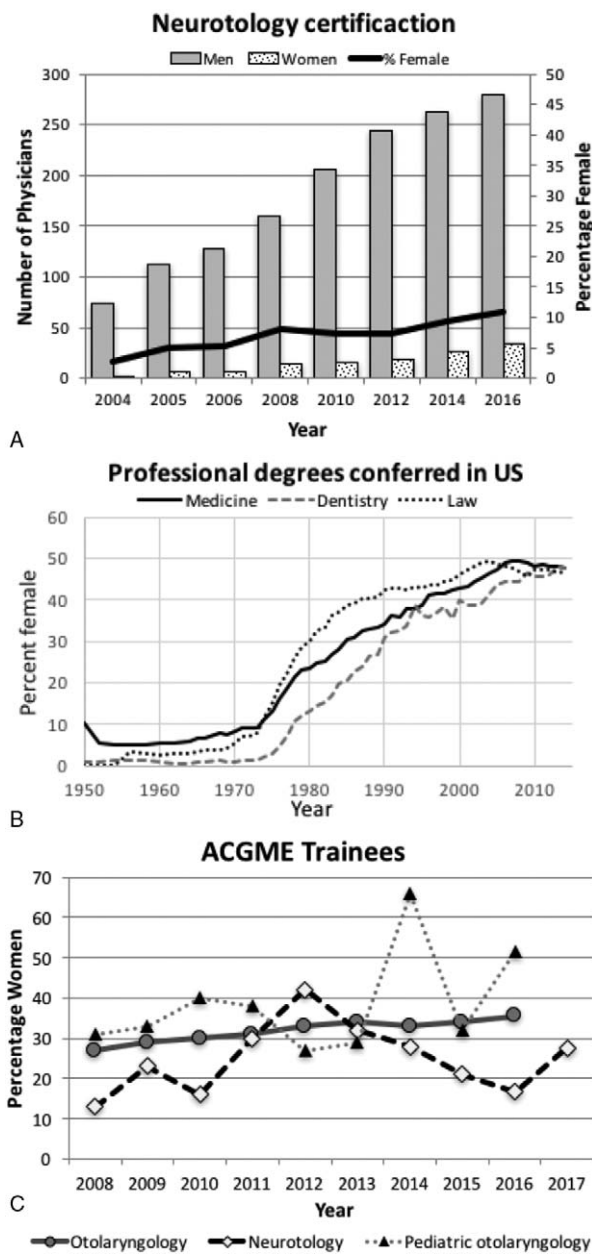


FIG. 8. A, Number of men and women with neurotology sub-certification through the American Board of Otolaryngology. B, Proportion of professional degrees attained by women in the United States over time. C, Proportion of Accreditation Council for Graduate Medical Education (ACGME) otolaryngology trainees over time.

entering surgical fields and the factors influencing their career choices. Contrary to commonly held beliefs, the historical record shows that women held prominent roles as surgeons from ancient times through the middle ages (2). In the 15th century, it was said that a surgeon needed: “the mind of Aesculapius, the eye of an eagle, the heart of a lion, and the hands of a woman.” (37) Nevertheless, in 1540 Henry VIIIth proclaimed that: “no carpenters, smiths, weavers, or women should practice medicine.”

(38) This led to the exclusion of women from the Guild of Surgeons. From colonial times through the early 19th century, few women in America were trained in surgery. With the opening of women’s medical colleges in the mid-19th century, a handful of women entered surgical professions.

Beginning in the last quarter of the 20th century, and continuing into the 21st, as the number of women in medical school classes has approached parity with men, representation of women in surgical fields has steadily risen. Representation among surgical specialties is maldistributed, however, with a greater fraction among obstetrics and gynecology and ophthalmology, and fewer in urology, orthopedics, otolaryngology, cardiothoracic, and neurological surgery (37). The challenges of being accepted as a woman in a male-dominated profession were well articulated by Dr. Jo Buyske, Associate Executive Director of the American Board of Surgery in her 2005 editorial: “Most women surgeons of my era, and certainly those before, have spent our careers being as sexually invisible as possible while attending to the business of learning and practicing surgery. The goal was to be accepted as a surgeon, not a woman surgeon. Now, to be a surgeon and thrown into the spotlight as *women* is blinding. Being asked to write this editorial made me both proud and uneasy. Talking about it with my colleagues, friends and husband (a male surgeon) has been uncomfortable. Are there issues? Is discussing them not just a form of whining? And yet, as I review the literature and ponder my assignment, it is obvious that there are deep and complicated issues that have very real implications for the future of our field.” (39)

Some of the issues that remain include under-representation in surgical specialties such as otolaryngology, which is especially noteworthy in otology-neurotology. Disparities in compensation and academic faculty rank between men and women are certainly factors, and these are, regrettably, prevalent in most medical specialties. Trying to understand the drivers of these differences is important to developing female role models for future generations. In addition, addressing matters traditionally thought of as “women’s issues,” such as cultural and institutional barriers to work-life balance or child care, will benefit both men and women. Examples include availability of parental leave, on-site daycare with hours amenable to a surgeon’s schedule, and flexibility for what Borman in 2007 characterized as: “personal or family serious illness (including complicated pregnancies and neonatal crises), divorce, and death [which are] stressors that defy gender.” (40) Tucci notes, “It’s probably been a culture change for both sexes that parents want to be at their kids’ events after school more, or want to be able to contribute to their kids’ lives in a way that people may not have done in the past.”

Just as one’s personal reasons for choosing a specialty may be myriad, pinpointing the reasons why women disproportionately enter some fields over others is complex. Dr. Jeffrey Flier, former Dean of the Faculty of Medicine at Harvard posited whether lifestyle

considerations might be a contributor: “Over the past 70 years, the previously dominant role of women in child care and family matters has evolved to reflect greater equality, but still differences persist. These ongoing, but highly variable, disparities of external responsibility may explain in part why women physicians gravitate toward fields seen as hospitable to work-family and work-life balance with shorter workweeks, more predictable schedules and greater potential for part-time status.” (7) Work hours alone, however, cannot explain why fewer female medical students pursue otolaryngology. A 2011 study found that over an entire year, otolaryngologists worked an average of only 24 hours more than family practitioners and an average of 85 hours less than medical internists (41). Arguably, the field of otology-neurotology might expect more favorable work/life balance, and thus *more* women than otolaryngology, as there are fewer emergencies and more outpatient procedures, compared with other subspecialties.

Financial compensation for female physicians continues to trail behind that for male counterparts, even in studies that adjust for age, academic rank, specialty, work hours, spousal employment, years of experience, NIH funding, publication count, and total Medicare payments (42,43). Jena et al. (43) found that among physicians at public universities, women earned \$51,315 less than men annually. After multivariate adjustment, this difference persisted, with a difference of \$19,878 (43). While they did not calculate salary differences specifically in otolaryngology, surgical subspecialties demonstrated the largest salary difference of \$76,457, which persisted after multivariate adjustment at \$43,728. In contrast, in radiology, men’s salary only exceeded that of women by \$863. After adjustment, radiology was the only field in which women earned more than men, by \$2,378. Tucci noted that one way to address wage differences is to arm oneself with information. In addition to departmental transparency and having models of compensation that are not subjective, she notes that: “the AAMC publishes information about average salaries for academic and private practice by area of the country. It’s important to have that information, and it’s important to stick up for yourself. It could be if there’s a discrepancy, men are asking for raises and women aren’t. Women have a tendency to undervalue their contribution.”

A key factor which inspires women to enter surgical fields is the availability of women at senior levels to serve as role models and mentors. The ascent of women to senior leadership roles in surgical fields has been notably slow paced. The first woman Chair of the American Board of Surgery was not until 1994 (Patricia Numann, M.D.) and the first woman to lead the AAO-HNS was in 2003 (Jennifer Derebery, M.D.). In the US, regional differences may play a role; the first woman member of the Southern Surgical Society was not inducted until 2011. Presently in otolaryngology many perceive an imbalance between women in residency and junior faculty positions, and those in leadership roles. As noted by Johnson, while there might not be a “glass ceiling” in

otolaryngology, “organizational cultures favor men through mentoring and networking.” (44) In 1980, less than 1% of practicing otolaryngologists were women and virtually none were in senior academic ranks (33). By 2010, women represented 11% of otolaryngologists (13% including residents) and generally had achieved proportionate representation in leadership positions when adjusted for age distribution (45). Nevertheless, without compensating for age to adjust for the higher fraction of women in otolaryngology who are earlier in their careers, representation of women in leadership roles remains relatively low. For example, in 2017, only 2 of the 17 (11.7%) Directors of the American Board of Otolaryngology are women. With 36.3% of women in otolaryngology residency in 2016, engagement of women in leadership development programs and active recruitment of women to specialty leadership roles should be a policy priority for incumbent leaders.

In academia, women have been at a disadvantage in career progression. Among physicians with academic appointments, women are less likely to be promoted to full professorship, even when accounting for age, experience, specialty, and research productivity (46). One reason for this may be that while male and female faculty publish similar numbers of articles over their careers, men have been found to be more productive early on, while women more productive at more senior levels (47). Eloy et al. (48) found this to be true among otolaryngologists: in their study of 20 academic otolaryngology departments, male otolaryngologists had higher research productivity at junior academic ranks, while women were higher at senior ranks, as measured by the *h-index*, calculated from an individual’s number of published articles and citations. A second reason may be relative geographic (im)mobility. Sociological studies of dual-career households suggest that relocation decisions are more often based on a husband’s career than a wife’s (49–53). In corollary, surveys of surgeons show women are more likely than men to report geography and family considerations as primary reasons for choosing a job, or that their spouse’s career was most important in the family (54,55). At the same time, geographic relocation has been found to be positively associated with career advancement in academic medicine (56).

Another factor may be implicit bias, also referred to as unconscious bias. In 2012, Moss-Racusin et al. (57) performed a randomized, double-blind study of 127 science faculty from “research-intensive” universities. Faculty were sent application materials for a laboratory manager position with a randomly assigned male or female name. Despite otherwise identical resumes, faculty rated the male applicant as significantly more “competent,” more “hirable,” and more “deserving of faculty mentoring” than the female applicant. In addition, on average, the male applicant was offered a significantly higher starting salary (\$30,238.10) compared with the female applicant (\$26,507.94). Encouragingly, educational interventions to address unconscious bias can be effective, and can be implemented across

departments, especially in recruitment and promotion committees (58–61). Faculty diversity programs to increase representation of women and under-represented minorities (URMs) have also been beneficial (62). In otolaryngology, Johns Hopkins University published their 10-year experience with a diversity and inclusion program (63). Their multifaceted approach included supporting the pipeline of women and URMs in the form of mentored clerkships with financial support, creation of a climate of diversity and inclusion, recruitment of qualified female and URM faculty, achievement of salary parity based on academic rank, and a faculty mentorship program. As noted by Flier, “There is nothing that a woman in medicine cannot do. It is our responsibility, however, to identify remaining barriers to full gender equality, so that medicine will be an exemplar for all field of human endeavor, as it certainly should be.” (7)

Until 2017, requirements for membership in the AOS included having completed the final level of otological training at least 5 years previous, being nominated and seconded by AOS members in good standing, having a practice primarily limited to otology (and/or neurotology), possessing a sizeable body of meaningful otologic literature to one’s credit, and having attended previous AOS meetings. In 2017, the years of post-training practice were increased to 8 years. Once all of the requirements are met, the Council reviews the membership applications and those passed for membership by the Council are then put up for a vote by the entire AOS membership before they are admitted.

The route to leadership in the AOS involves selection for service on the AOS Council for a number of years, which then leads to President. Council service can be in a number of positions, including Education Director or Secretary-Treasurer. The AOS Award of Merit is granted annually to a particularly deserving member of the society, and reflects their lifetime body of work in Otology including service to the AOS. In the history of the AOS, only one woman (Catherine Smith, Ph.D.) has been awarded this prestigious honor.

Both the processes of entering into membership and moving up into leadership rely on nominations and selections, and can be inherently biased against members of a different group, such as women, underrepresented minorities, or individuals not privileged to have trained under AOS leaders. It requires active recruitment and promotion of these individuals, to allow any society that uses this type of system to progress to better representation of the source group.

While the number of women in otolaryngology is rising, it still lags well behind that of many medical specialties. The proportion of women in the subspecialty of otology-neurotology notably lags behind the mother specialty. The number of women in otology-neurotology is steadily rising, albeit at a measured pace. While disparities remain, it is clear that both the participation in the AOS and scientific contributions of women in otology have steadily increased over the past 40 years. As a senior society, membership in the AOS is generally

awarded only after having a substantial track record of achievement in the field. Because of the reliance on nominations, it is exceptionally important that current AOS members are encouraged to actively pursue women and other URM individuals for membership, speaking roles at meetings, and leadership. With the rising cohort of women obtaining specialized training in neurotology, the membership composition of the AOS should become more balanced in coming years. There is good reason to hope that the increasing number of women being invited to join the AOS will serve as role models and thus further catalyze this rise. It should be acknowledged that the Society has made a laudable effort to engage women into leadership positions with 37.5% (3/8) of the 2017 AOS Council members women. Nevertheless, only with a sustained and purposeful effort to increase gender and ethnic diversity will the Society succeed in its efforts to become more diverse in ways which better reflect the population of patients we serve.

REFERENCES

1. Women healers vs women doctors. *Med Rec* 1895;47:810.
2. Pastena JA. Women in surgery. An ancient tradition. *Arch Surg* 1993;128:622–6.
3. Wirtzfeld DA. The history of women in surgery. *Can J Surg* 2009; 52:317–20.
4. New England Female Medical College. Women Working, 1800–1930. *Harvard University Library Open Collections Program*. Available at: <http://ocp.hul.harvard.edu/ww/nefmc.html>. Accessed August 11, 2017.
5. Peitzman SJ. *A New and Untried Course: Woman’s Medical College and Medical College of Pennsylvania*. New Brunswick, NJ: Rutgers University Press; 2000. xi-5.
6. Women—Or the Female Factor. *About Johns Hopkins Medicine*. Available at: <http://www.hopkinsmedicine.org/about/history/history6.html>. Accessed August 15, 2017.
7. Flier J. Harvard Medical School Dean on the Gains-and Obstacles-to Women in Medicine. *The Wall Street Journal*. Available at: <https://blogs.wsj.com/experts/2015/10/01/harvard-medical-school-dean-on-the-gains-and-obstacles-to-women-in-medicine/>. Accessed October 1, 2015.
8. Novielli K. Women in Medicine & Science. *Sidney Kimmel Medical College*. Available at: <http://www.jefferson.edu/university/skmc/about/women-in-medicine-science.html>. Accessed August 15, 2017.
9. *Report of the Female Medical Education Society*. Boston, MA: Female Medical Education Society; 1851. 15–16.
10. Memorial to Dr. Musson. *JAMA* 1916;66:825.
11. Jones EC. Tribute from the alumnae association of the Woman’s Medical College of Pennsylvania. *The Iatrician* 1914;4.
12. Goodwin AH. Tribute from Dr. Musson’s personal friends. *The Iatrician* 1914;9.
13. Wistar S. Sallie Wistar Says. *Public Ledger* 1913.
14. Musson EE. The Deaf Child. *The Escalopian* 1911;2:1.
15. Musson EE. Anomalies of the lateral sinus, mastoid emissary vein and internal jugular veins. Presented at American Medical Association Section of Laryngology and Otology, Saratoga, June 10–13, 1902.
16. Musson EE. Labyrinthine deafness. Presented at College of Physicians of Philadelphia, Philadelphia, Nov 1908.
17. Musson EE. The endoscopic treatment of bronchiectasis. *Penn Med J* 1914;17:279.
18. Hospital Notes: College Hospital. *The Escalopian* 1910; 2:12.
19. Work of alumnae. *JAMA* 1914;62:2038.
20. Belluci RJ. In memoriam: Dorothy Wolff. *Trans Am Otol Soc* 1980;68:106.

21. House HP. Guest of honor: Why? A personal analysis. *Trans Am Otol Soc* 1978;66:19–21.
22. Wolff D. *Microscopic anatomy of the temporal bone: a photographic survey of serial sections of the temporal bone cut in the three routine planes of sectioning human specimens*. Philadelphia, PA: Williams & Wilkins; 1957.
23. Wolff D, Belluci RJ, Eggston A. *Surgical and Microscopic Anatomy of the Temporal Bone*. New York: Hafner Publishing; 1957.
24. Eggston A, Wolff D. *Histopathology of the Ear, Nose and Throat*. Philadelphia, PA: Williams & Wilkins; 1947.
25. Smith CA, Lowry OH, Wu ML. The electrolytes of the labyrinthine fluids. *Laryngoscope* 1954;64:141–53.
26. Business meeting. *Trans Am Otol Soc* 1962;50:337.
27. Bordley JE. Introduction of the Award of Merit recipient. *Trans Am Otol Soc* 1975;63:151.
28. Stedman TL. *Siedman's Medical Eponyms*. Baltimore, MD: Lippincott Williams & Wilkins; 2005. 65.
29. Alumni Notes. *Univ of Minn Med Bulletin* 1977;Summer/Fall:18-9.
30. de Kruif P. *Microbe Hunters*. New York: Mariner Books; 1926.
31. Lee C. She gets a second chance to learn. *UCLA Newsroom*. Available at: <http://newsroom.ucla.edu/stories/990831gets>. Accessed July 15, 2017.
32. Schuknecht HF, Gulya AJ. *Anatomy of the Temporal Bone with Surgical Implications*. Philadelphia, PA: Lea and Febiger; 1986.
33. Fletcher MM. A preliminary report on the woman otolaryngologist. *Am J Otolaryngol* 1980;1:211–2.
34. Number of female medical enrollees reaches 10-year high. *Association of American Medical Colleges*. Available at: <https://news.aamc.org/press-releases/article/applicant-enrollment-2016/>. Accessed Aug 15, 2017.
35. 2015 Digest of education statistics, National Center for Education Statistics. Available at: https://nces.ed.gov/programs/digest/d15/tables/dt15_324.40.asp. Accessed Aug 15, 2017.
36. *Data Resource Book: Academic year*. Chicago, IL: Accreditation Council for Graduate Medical Education; 2016.
37. McLemore EC, Ramamoorthy S, Peterson CY, et al. Women in surgery: bright, sharp, brave, and temperate. *Perm J* 2012;16:54–9.
38. Burrow GN, Burgess NL. The evolution of women as physicians and surgeons. *Ann Thorac Surg* 2001;71:S27–9.
39. Buyske J. Women in surgery: The same, yet different. *Arch Surg* 2005;140:241–4.
40. Borman KR. Gender issues in surgical training: From minority to mainstream. *Am Surg* 2007;73:161–5.
41. Leigh JP, Tancredi D, Jerant A, et al. Annual work hours across physician specialties. *Arch Intern Med* 2011;171:1211–3.
42. Jagsi R, Griffith KA, Stewart A, et al. Gender differences in salary in a recent cohort of early-career physician-researchers. *Acad Med* 2013;88:1689–99.
43. Jena AB, Olenski AR, Blumenthal DM. Sex differences in physician salary in US public medical schools. *JAMA Intern Med* 2016;176:1294–304.
44. Johnson JT. Women in otolaryngology. *J Otolaryngol Head Neck Surg* 2014;43:14.
45. Choi SS, Miller RH. Women otolaryngologist representation in specialty society membership and leadership positions. *Laryngoscope* 2012;122:2428–33.
46. Jena AB, Khullar D, Ho O, et al. Sex differences in academic rank in US medical schools in 2014. *JAMA* 2015;314:1149–58.
47. Reed DA, Enders F, Lindor R, et al. Gender differences in academic productivity and leadership appointments of physicians throughout academic careers. *Acad Med* 2011;86:43–7.
48. Eloy JA, Svider P, Chandrasekhar SS, et al. Gender disparities in scholarly productivity within academic otolaryngology departments. *Otolaryngol Head Neck Surg* 2013;148:215–22.
49. Bielby WT, Bielby DD. Family ties, gender role beliefs, and reluctance to relocate for a better job. *Amer J Sociol* 1992;97:1241–67.
50. Boyle P, Cooke TJ, Halfacree K, et al. A cross-national comparison of the impact of family migration on women's employment status. *Demography* 2001;38:201–13.
51. Cooke T. Family migration and the relative earnings of husbands and wives. *Ann Assoc Am Geograph* 2003;93:338–49.
52. McKinnish T. Spousal mobility and earnings. *Demography* 2008;45:829–49.
53. Markham WT, Pleck JH. Sex and willingness to move for occupational advancement. *Sociol Quart* 1986;27:27.
54. Amoli MA, Flynn JM, Edmonds EW, et al. Gender differences in pediatric orthopaedics: What are the implications for the future workforce? *Clin Orthop Relat Res* 2016;474:1973–8.
55. Grandis JR, Gooding WE, Zamboni BA, et al. The gender gap in a surgical subspecialty: Analysis of career and lifestyle factors. *Arch Otolaryngol Head Neck Surg* 2004;130:695–702.
56. McLean MR, Morahan PS, Dannels SA, et al. Geographic mobility advances careers: Study of the Executive Leadership in Academic Medicine (ELAM) program for women. *Acad Med* 2013;88:1700–6.
57. Moss-Racusin CA, Dovidio JF, Brescoll VL, et al. Science faculty's subtle gender biases favor male students. *Proc Natl Acad Sci U S A* 2012;109:16474–9.
58. Carnes M, Devine PG, Baier Manwell L, et al. The effect of an intervention to break the gender bias habit for faculty at one institution: A cluster randomized, controlled trial. *Acad Med* 2015;90:221–30.
59. Isaac C, Lee B, Carnes M. Interventions that affect gender bias in hiring: A systematic review. *Acad Med* 2009;84:1440–6.
60. Colleges AoAM. The state of women in academic medicine: the pipeline and pathways to leadership 2013-2014. Available at: <https://members.aamc.org/eweb/upload/The State of Women in Academic Medicine 2013-2014 FINAL.pdf> Accessed Aug 15, 2017.
61. Girod S, Fassiotto M, Grewal D, et al. Reducing implicit gender leadership bias in academic medicine with an educational intervention. *Acad Med* 2016;91:1143–50.
62. Valentine HA, Grewal D, Ku MC, et al. The gender gap in academic medicine: Comparing results from a multifaceted intervention for stanford faculty to peer and national cohorts. *Acad Med* 2014;89:904–11.
63. Lin SY, Francis HW, Minor LB, et al. Faculty diversity and inclusion program outcomes at an academic otolaryngology department. *Laryngoscope* 2016;126:352–6.