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Evolution of Otology and Neurotology Education in the United States

Bruce J. Gantz

University of Iowa Hospital, Iowa City, Iowa

A brief history of the evolution of Otology and Neurotology training in the United States is presented. The development of the Neurotology Fellowship accreditation process by the Accreditation Council on Graduate Education and the certification of neurotology fellows by the American Board of Otolaryngology is outlined. **Key Words:** Neurotology certification—Neurotology training.

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Otology/Neurotology training evolved dramatically over the past 150 years. Today, there are rigorous oversight, standardization of content, and minimum numbers of cases that must be accomplished by trainees. For many years, this was not the case. The American Otological Society (AOS) and the American Neurotology Society (ANS) were instrumental in bringing about these changes. A review of the events that precipitated this transformation is presented. The present educational model has involved medical education oversight organizations at the highest levels including the American Board of Otolaryngology (ABOto), American Council for Graduate Medical Education (ACGME), ACGME Residency Review Committee for Otolaryngology (RRC Oto), and the AOS Council and Executive Committee of the ANS (1).

EARLY TRAINING IN OTOLOGY

Early specialty training in the United States before World War I was unregulated and the centers that evolved specialty training engaged practitioners that traveled to Europe to study with individuals in major centers, such as Edinburgh, Paris, and Vienna (2). In the early 1900s, Robert Flexner was commissioned by the Carnegie Foundation to study American medical education because of the lack of oversite, irregular methods, and lack of standards. The Flexner Report examined medical education, but did not mention subspecialty or graduate education (3). Many of the current medical education practices of today stemmed from this review and its suggestions. Evolving specialty training was apprenticeship-based training in large metropolitan hospitals. The standardizing of otolaryngology training was discussed in a report in the *Journal of the American Medical Association* in 1913 (4). The report was written by a Committee for the Laryngological, Rhinological and Otological Society, and consisted of a survey of 31 institutions in 20 states to determine the length of training, course of instruction, and the proper balance of medical and surgical topics. They discussed undergraduate and graduate curriculum, and how to standardize training at the graduate level and whether a PhD should be offered. It was suggested that other important societies such as the American Laryngological Society, the American Otological Society, and the Academy of Ophthalmology and Otolaryngology select representatives to finalize these standards.

The first hospitals in the United States to recognize the specialty of Otology included New York Eye and Ear (1820), Massachusetts Eye and Ear (1827), University of Pennsylvania (1870), and Johns Hopkins (1914). It is interesting that the University of Iowa College of Medicine had a lecturer in Ophthalmology and Otology (1902) and the University of Michigan Department of Otolaryngology recognized Otology in 1904. There were most likely others in this era that had a focus on otological disease. One of the first otologists in the United States was George Shambaugh, Sr. who graduated from medical school at the University of Pennsylvania. He then spent 2 years studying in Berlin and Vienna. Following this specialized training, he was appointed an instructor of anatomy at the University of Chicago in the Department of Otology at Rush Medical College (5).

Between World War I and World War II specialty training became more regulated and principally occurred in academic medical centers (2). In 1938, Julius Lempert published his strategy for the management of otosclerosis

Address correspondence and reprint requests to Bruce J. Gantz, M.D., University of Iowa Hospital, Iowa City, IA;
E-mail: bruce-gantz@uiowa.edu
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with a single-stage fenestration procedure (6). The success of this surgical strategy required specialized training by Dr. Lempert. Otolaryngologists were encouraged to travel to study with Dr. Lempert (6). A shift back to apprenticeship training outside of hospitals and colleges of medicine became a standard. Some eventual leaders of the AOS were fortunate to be able to study and observe Dr. Lempert in the 1930s and 1940s including George Shambaugh Jr., Howard House, and Claire Kos. These individuals became some of the first group of specialists to primarily focus their practices on ear disease after World War II. Howard House must be recognized as the champion of otologic apprenticeship training experiences. He was an early benefactor of the apprenticeship training experience in 1938 when he spent a year traveling in Europe and the United States where he was able to observe the great otologists of his time including Holmgren, Cawthorne, Giles, Mosher, and Lempert. He was one of the few surgeons to learn the technique of single-stage fenestration surgery from Dr. Lempert.

Howard House took this experience to the next level by expanding his practice to include specialized training in ear disease within his private practice. Howard opened The LA Foundation of Otology in 1946 and by 1959 the Otologic Medical Group (OMG) included Howard and his brother William (Bill), James Sheehy, and Fredrick Linthicum. The OMG offered courses on management of ear disease to those in practice as well as those in other academic training programs in the United States and international visitors. They were quite innovative and developed the observer tube for the microscope that greatly enhanced the students' ability to understand the intricacies of microsurgery. They also pioneered teaching films to improve training. This was a very exciting time in otology as Bill House and his team were developing pioneering approaches to the skull base that eventually became the new subspecialty of Neurotology. Bill's passion to improve outcomes for acoustic tumor management led to the development of the translabyrinthine and middle cranial fossa access for the removal of vestibular schwannoma. In 1960, the House Group began offering a 1-year fellowship in clinical otology and neurotology. In 1974, the clinical group became Ear Research Institute and in 1981 the House Ear Institute. The group held national and international conferences on the latest management of ear-related disorders. Another feature of the House Ear Institute was the large temporal bone pathology collection that Fred Linthicum amassed over the years. Some of the early trainees of the House group were John Shea, Jack Pulec, Michael Glasscock, Samuel Kinney, Malcom Graham, and Charlie Leutje. At the same time, other otologists visited Los Angeles and spent 2 to 4 weeks with Bill. They then returned to their programs and began to perform neurotologic procedures. Some of these individuals include Brian McCabe, Herb Silverstein, Bill Montgomery, Rod Perkins, and Noel Cohen. The excitement surrounding neurotology expanded the field and increased the development of more training programs. Herb Silverstein, Jack Pulec, Michael Glasscock, Noel Cohen, Brian McCabe, Rod Perkins, Fred Owens, Malcolm Graham, and Don Kamerer all developed their own neurotology fellowship programs. It is interesting to note that many of the present leaders in our specialty today turned again to Europe in the 1980s and 1990s to train with Ugo Fisch in Zurich, Switzerland.

By 1990 the growth of training became exponential with the eventual development of 31 known neurotology training programs, most outside academic institutions. The training was of variable length from 3 to 12 months duration. Some individuals only participated in a 3-month observational fellowship and then began a Neurotology practice. There was no oversight of the type of training or experience that the trainees were required to complete. This became an issue within the Executive Committee of the ANS, the AOS Council, and the American Board of Otolaryngology (ABOto). The ANS Executive Council considered the development of a process to regulate training programs and certifying trainees; however after the investigation of the process, it became apparent that the costs involved to regulate training, including time and expense, were overwhelming. The ABOto had similar concerns with regard to the explosion of fellowship training programs throughout Otolaryngology. Byron Bailey, then President of the ABOto, wrote an article on this subject, stating that there were over 150 Otolaryngology subspecialty fellowship programs in the United States (7). Most programs were not associated with ACGME residency programs, and the quality and curriculum of this training was unregulated. Standardization of subspecialty training was lacking throughout Otolaryngology–Head and Neck Surgery compared with most all other specialties of medicine.

ORGANIZATIONAL STRUCTURE OF THE ACGME AND ABMS

It is important to understand the complexities of the two national organizations responsible for standardization of training, accreditation of training programs, and certification of trainees. They are confusing, but explanation clarifies the reasoning for the regulations that have been established.

Accreditation of training programs in the United States is under the umbrella of the ACGME, which is sponsored by the American Medical Association, the American College of Surgeons, the American Association of Medical Colleges, the American Hospital Association, and the American Board of Medical Specialties (ABMS), among others. The ACGME oversees Residency Review Committees (RRCs) for the various disciplines within medicine. The RRC for Otolaryngology is made up of appointees from the American Medical Association, the American College of Surgeons, and the ABOto. The RRC oversees the quality of graduate medical education in the United States, establishes national standards for graduate medical education (GME), and monitors and upgrades educational programs. When training program

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requirements are expanded, or changed, all ACGME member RRCs, as well as the parent organizations, must approve the changes. Any change of established requirements is evaluated based on needs within the specialty and also the impact it might have on other specialties. A training impact statement must also be developed and circulated to all constituents of this group. As one might expect, expansion of requirements into the domain of another specialty is met with resistance and political maneuvering. This process is time consuming, as you will see.

The ABMS is the over-arching organization for 26 medical specialty boards within the United States. The ABMS provides information to the public, the medical profession, the government, and its members regarding issues of specialization and certification. The ABOto is the second-oldest ABMS board; it has been certifying individuals since 1924. The ABOto is dedicated to ensuring that graduates of ACGME accredited programs have passed a certifying examination that validates their training. The ABOto has the ability to issue a general certificate as well as subspecialty certificates of added qualification (CAQ) in Neurotology, Pediatric Otolaryngology, and Plastic Surgery within the Head and Neck. The subspecialty certification process is similar to the ACGME process in that all of the other 25 boards evaluate the documents justifying subspecialty certification and comment on the overlap with their certificates and scope of practice. A majority of specialty boards must vote to accept any change in the type of certificates issued by an individual board.

Establishment of the Neurotology training guidelines and development of a certification process for trainees required parallel efforts within the ACGME and ABMS. The ABOto initiated the process of establishing the subspecialty within the ABMS with a request for a Certificate of Added Qualifications in Otology/Neurotology in 1986.

ACGME ACCREDITATION PROCESS

The training requirements and standards for training for Otology/Neurotology were completed by the RRC for Otolaryngology for the distribution to the ACGME constituents in 1992. These requirements were constructed in cooperation with the Executive Committee of the ANS, AOS Council, and ABOto. Maxwell Abramson, then a member of the Otolaryngology-Head and Neck Surgery RRC, organized the initial draft of the training requirements in the mid 1980s in anticipation of the ABMS approval of the CAQ. Bruce Gantz, an RRC Otolaryngology member following Dr. Abramson's untimely death, finalized the training requirements in collaboration with the ANS Executive Committee. Several issues regarding the length of training and where training took place had to be resolved before submission of the training documents to the ACGME in 1992. The issue of where the training occurred was a very important issue. The ACGME required all subspecialty training programs to be affiliated with established ACGME specialty residency programs. Programs could not exist in freestanding private practice settings. However, it was acceptable if the practice had a teaching affiliation with an ACGME approved program. The length of training also had to be standardized. The leadership of the ABOto at the time felt strongly that all subspecialty fellowships needed to be 2 years in duration. The administrative staff of the ACGME also supported 2 years of training and intimated that a 2-year program would more likely pass the ACGME Executive Committee. The 2-year training concept was met with some resistance within the specialty, as a 1-year training program was the norm. The leaders of the ANS, Charles Leutje and Samuel Kinney, members of the executive council, and a neurotology subspecialty committee consisting of Derald Brackmann, Michael Glasscock, Robert Jackler, Herman Jenkins, and Bruce Gantz supported the 2-year training period. Another roadblock was encountered when the training requirements were criticized by the Neurosurgery, Neurology, and Rehabilitation Medicine RRCs. This required compromising language stating that when an operation was planned to enter the dura, a neurosurgical consultation should be obtained. The language was not thought to impact the practice of neurotology, as practice was a local issue, not national. The language was thought to be acceptable by the AOS and ANS. This issue had also been raised by Neurosurgery at the ABMS at the level, but the proposed language was found to be acceptable by the ABMS Board of Directors. The ACGME Council on Medical Education recommended approval of the requirement document in March 1993. Next an impact document was prepared that again required approval by the entire ACGME constituency. Unfortunately, during this time period there was national pressure on the ACGME to reduce sub specialization within medicine, and a moratorium was placed on expansion of subspecialization. The ACGME was requiring at least 40 sites of training before an application would be considered. Because of this change, all otolaryngology subspecialty applications were withdrawn as it was believed that 40 training sites should not be established for our specialty. Fortunately, the 40-site moratorium was lifted and the subspecialty training programs were re-initiated in late 1994. The final process for approval required presentation of the requirements to the ACGME Executive Committee. Both Pediatric Otolaryngology and Neurotology went through the process together. Robert (Bob) Miller represented Pediatric Otolaryngology and Bruce Gantz presented the requirements for Neurotology. Dr. Miller presented pediatric requirements first. The pediatric requirements included a provision to include up to 1 year of research during the training experience. This was a red flag for the ACGME executive committee. They explained that not more than 6 months of research training could be included in a 2-year subspecialty-training program. It was a Health Care Financing Authority regulation that GME training expenses could not incorporate more than 6 months of research per 2-year

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period. It was explained that our subspecialty training came at a time when GME training money was not available to our subspecialty residents, as they were beyond the 5-year training period limit for training payment and did not qualify for GME financial support. This challenge was unsuccessful. The final approval of the ACGME Council occurred in June 1995, 4 years after submitting our program requirements.

The first subspecialty residency in Otology/Neurotology to receive ACGME accreditation was the University of Michigan in 1997. The first 10 approved programs included: University of Michigan, University of Iowa, New York University, Ohio State University, University of Virginia, Massachusetts Eye and Ear, Providence Hospital/Michigan Ear Institute, USC/House Ear Clinic, Northwestern University, and University of Miami. In 2017, 20 ACGME Neurotology Training programs are accredited (Table 1). Originally, the ACGME required the term resident for the trainees of accredited programs, but the term fellow has been assigned to differentiate the advanced level of training in these programs. There are specific numbers of index cases that the fellow must participate at the accredited institution and the caseloads, faculty participation, and performance on the certifying examination of fellows is monitored regularly.

ABOto CERTIFICATION PROCESS

Individuals within the ABOto who led the Neurotology process include George Reed, Byron Bailey, Robert Cantrell, Robert Kohut, Zan Schleuning, and all members of the ABOto. This process began in 1986, using the description of the subspecialty that was developed in conjunction with the Executive Committee of the ANS and AOS Council. The ability to issue a CAQ was finally approved by the entire ABMS assembly in September 1992 after much discussion with the American Board of Neurosurgery and the American Board of Neurology. The ABOto decided not to pursue issuing a certificate in Otology/Neurotology until there were a sufficient number of ACGME-approved training programs in the subspecialty, and the subspecialty societies requested that the ABOto proceeded with a Certifying Exam. The Joint Executive Councils of the AOS and ANS asked the ABOto to move forward with the examination process in 2002. A Neurotology subspecialty committee was established by the ABOto consisting of five members of the ABOto and two members each from the ANS and AOS. The ABOto also decided at this time that the subspecialty certificate would be limited to only Neurotology as it was strongly believed by the ABOto Board of directors that the general certificate for Otolaryngology included otology and the subspecialty of Neurotology required an additional training period of 2 years. The ABOto then sent a questionnaire to over 7500 Diplomates who hold ABOto Certificates regarding the subcertification process. The survey established the fact that 65% of those responding (524) believed that the ABOto should proceed with issuing a Neurotology subspecialty certificate, and 23% (182) said they would take the subspecialty examination. Importantly, the Diplomates did not voice an opposition to a certification process for the subspecialty of Otology/Neurotology.

On April 29, 2002, the ABOto unanimously approved moving forward with the certifying examination for Neurotology. The development of a Neurotology subspecialty qualifying examination was led by Julianna Gulya and included ABOto members Richard Chole, Richard Miyamoto, Harold Pillsbury, and Bruce Gantz. The representatives from the ANS were Newton Coker and Douglas Mattox, and the representatives from the AOS were Charles Leutje and Paul Lambert. The first examination was scheduled for the spring of 2004. The 2-year delay was required to provide adequate notification for the examination. Two pathways were established enabling those in established Neurotology practices to qualify for the examination. The Standard Pathway is for those individuals who have satisfactorily completed an ACGME-approved subspecialty residency. The Alternative Pathway was open to those who did not complete an ACGME-approved program, but who limit at least 60% of their practice to Neurotology, have been in practice for at least 7 years, complete a Peer Associates' Rating Review, and submit a 2-year log of operative experience. To qualify for the Alternative Pathway the individuals needed to demonstrate that their practice involves advanced otology and the full spectrum of neurotology and lateral skull-base surgery. The Alternative Pathway was only open for 7 years after the date of 1st examination. After 2011, qualification for the certifying examination required completion of an ACGME-approved Subspecialty Neurotology Fellowship. Another aspect of the certification process is the maintenance of certification (MOC) that must occur on a 10-year recertification cycle. Originally, the certificate holder was required to pass a proctored recertification examination. The ABOto is presently modifying the MOC recertification and in the future, it is expected that a successful yearly review of specific items will replace a recertification examination. As of this writing in 2017 there are 328 Neurotology Diplomates that are engaged in the MOC process.

The nine examiners involved in the initial examination in 2002 are observed in Figure 1. The two groups of examinees nine in the morning (Fig. 2) and nine in the

TABLE 1. *Fellowship programs 2017*

Baylor College of Medicine	Stanford University
University of Miami	House Ear Clinic/UCLA
Johns Hopkins University	University of Iowa
Louisiana State University	University of Michigan
Massachusetts Eye and Ear	University of Minnesota
University of California (San Diego)	University of Pennsylvania
University of Cincinnati	University of Texas Southwestern
New York University	University of Virginia
Ohio State University Hospital	University of Pittsburgh
Michigan Ear Institute	Vanderbilt University

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FIG. 1. Original examiners: Front Table: Harold Pillsbury, Herman Jenkins, Richard Chole, Richard Miyamoto, Bruce Gantz, Paul Lambert, Newton Coker. Back Table: David Schuller (ABOto President), Gerald Healy (ABOto Executive Director). Inset: Douglas Mattox, Charles Leutje.

FIG. 2. Morning examinees: Jeffery Harris, George Hashisaki, Robert Jackler, Alexander Arts, Steven Cass, Thomas Eby, John Keveton, Thomas Balkany.

afternoon (Fig. 3) are shown. This group of 27 individuals became the core examining team for the first few years that the examination was given. Presently, the examination is held every 2 years.

COMMENT

Neurotology training and certification in 2017 is regulated by organizations that require programs and boards that oversee them to comply with national standards of advanced medical education. This process occurred over an 18-year period between 1986 to 2004 when the ABOto first petitioned the ABMS to issue a subspecialty certificate and the first diplomates became board certified in Neurotology. A number of our former and present leaders from the AOS, ANS, ABOto, ACGME RRC, and ABMS participated along the way. The journey was not without stress, anxiety, and conflict, requiring multiple discussions and compromise by all involved. The outcome of this journey has been the outstanding patient care that has become a standard. One of the most unforeseen advantages of the certification process has been the recognition of the Neurotology subspecialty by our neurosurgical colleagues. Many of our diplomates are joint members of neurosurgical faculties in major academic medical centers and medical schools around the country. Prior to the certification process there was significant resistance by neurosurgery for our subspecialty to be involved in the management of intradural procedures. Today, management of skull base and cerebellopontine angle tumors is seamless between the specialties.

FIG. 3. Afternoon examinees: Myles Pensak, Steven Telian, Debra Tucci, Michael McKenna, Sean McMenonomy, Ashly Wackym, Richard Wiet, Bradley Welling, Peter Weber.

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