

Audiology: A STEM Profession

Audiology is a STEM discipline that requires education in and application of science and technology as a part of its academic foundation and professional practice. Graduate audiology programs also engage students in “research, innovation and development of new technologies using engineering, physical sciences and computer science”¹ that aligns with relevant definition of a STEM field used by the Classification of Instructional Programs (CIP) taxonomy. Audiologists are licensed in all fifty states and the District of Columbia. Ensuring the public health, safety and welfare in the practice of audiology in virtually all states requires a clinical doctorate degree, a supervised clinical practicum and the passage of a national examination.

The Department of Labor Occupational Information Network (O* Net) and the United States Military Occupational Specialties (MOS) recognize audiology as a STEM profession. At this time, the Department of Homeland Security (DHS) does not recognize audiology on its STEM Designated Degree Program List. DHS STEM designation would help the country meet the growing need for these professionals due to the rapidly increasing numbers of residents with hearing loss and related disorders. An estimated 48 million Americans currently experience hearing loss to some degree² and the number of Americans with hearing loss is expected to increase by 30 million in the next four decades.³

Definition of Audiology in Classification of Instructional Programs (CIP)

The Classification of Instructional Programs (CIP) provides a taxonomic scheme that supports the accurate tracking and reporting of fields of study and program completions. The CIP was originally developed by the U.S. Department of Education’s National Center for Education Statistics (NCES).

➤ Current Audiology CIP Code: 51.0202:

*A program that prepares individuals to diagnose and treat hearing loss and other disorders involving the ear, advise patients on the means to use their remaining hearing and select and fit hearing aids and other devices. **Includes instruction in acoustics, anatomy and physiology of hearing, hearing measurement, auditory pathology, middle and inner ear analysis, rehabilitation therapies and assistive technologies, and pediatric and other special applications.***

From an examination of the current CIP Code for audiology, it is evident that the current description clearly recognizes the necessary education in science and technology necessary to qualify for STEM designation. However, the current numeric CIP Code assigned to audiology does not reflect this.

¹ 8 CFR 214.2(f)(10)(ii)(C)(2)(i)

² Hearing Loss Association of America. Hearing Loss Facts and Statistics. Found on the internet at https://www.hearingloss.org/wp-content/uploads/HLAA_HearingLoss_Facts_Statistics.pdf.

³ Goman, Adele M., et al. Addressing Estimated Hearing Loss in Adults in 2060. JAMA – Otolaryngology Head & Neck Surgery. July 2017. Found on the internet at <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5824202/>

Department of Labor (O*Net) Designation of Audiology as a STEM Discipline

An audiologist (29-1181.00) is recognized as a STEM professional by the Occupational Information Network (O*Net), the nation's primary source of occupational information.

“Occupations are listed that require education in science, technology, engineering, and mathematics (STEM) disciplines.”⁴ O*Net and its listing of STEM disciplines is maintained by the United States Department of Labor. In addition, O*Net provides that the occupation type for an audiologist is “research, development, design and practitioners.”

United States Military Designation of Audiology as a STEM Discipline

An audiologist (72C) is recognized as a STEM professional by the Military Occupational Specialties (MOS) system and provides that “for credentials, the STEM icon indicates credentials related to occupations in science, technology, engineering, and mathematics (STEM).”⁵

State Government/Licensure Definitions of Audiologist or “Practice of Audiology”

Each state has its own definition of “practice of audiology” or “audiologist,” however, most are similar to that found in these two illustrative examples that demonstrate the scientific nature of the profession and the inherent focus on research.

➤ **FLORIDA** [*Fla.Stat.Sec.468.1125(6)(a)*]

*“Practice of audiology” means the application of principles, methods, and procedures for the prevention, identification, evaluation, consultation, habilitation, rehabilitation, instruction, treatment, and **research**, relative to hearing and the disorders of hearing, and to related language and speech disorders. “Disorders” are defined to include any and all conditions, whether of organic or nonorganic origin, peripheral or central, that impede the normal process of human communication, including, but not limited to, disorders of auditory sensitivity, acuity, function, or processing, or damage to the integrity of the physiological system.*

(b) Any audiologist who has complied with the provisions of this part may:

- 1. Offer, render, plan, direct, conduct, consult, or supervise services to individuals or groups of individuals who have or are suspected of having disorders of hearing, including prevention, identification, evaluation, treatment, consultation, habilitation, rehabilitation, instruction, and research.*
- 2. Participate in hearing conservation, evaluation of noise environment, and noise control.*
- 3. Conduct and interpret tests of vestibular function and nystagmus, electrophysiologic auditory-evoked potentials, central auditory function, and calibration of measurement equipment used for such purposes.*
- 4. Habilitate and rehabilitate, including, but not limited to, hearing aid evaluation, prescription, preparation, fitting and dispensing, assistive listening device selection and orientation, auditory training, aural habilitation, aural rehabilitation, speech conservation, and speechreading.*
- 5. Fabricate earmolds.*
- 6. Evaluate tinnitus.*

⁴ [All STEM Occupations \(onetonline.org\)](http://onetonline.org)

⁵ [Army COOL - COOL Overview - Resource Icons \(osd.mil\)](http://osd.mil)

7. Include speech and language screening, limited to a pass/fail determination for identifying individuals with disorders of communication.⁶

➤ **GEORGIA** [O.C.G.A. 43-44.3]

*The practice of audiology" means the application of principles, methods, and procedures of identification of hearing loss, measurement, testing, evaluation, case management, prediction, prevention, consultation, counseling, instruction, and **research** related to hearing, hearing disorders, and auditory and vestibular function and dysfunction; intervention as related to such principles, methods, and procedures; interpretation of the results of such principles, methods, and procedures; the evaluation, recommendations, fitting, and dispensing of hearing aids, frequency modulation technologies, and other assistive devices designed to ameliorate the effects of a hearing disorder; the programming of cochlear implants and other implantable devices; and the planning, directing, conducting, and participating in hearing conservation programs and programs of habilitation, rehabilitation, and intervention for disorders of hearing, auditory function and processing, and vestibular function, including but not limited to auditory training, speechreading, and vestibular rehabilitation, which vestibular function and rehabilitation the audiologist is qualified to perform by virtue of education, training, and experience.⁷*

Relevant STEM Coursework Included in Graduate Course of Study in Audiology

Audiologists are trained and tested on a core set of coursework that falls firmly within the STEM disciplines. At this time, the clinical doctorate (AuD) is the entry-level degree required for state licensure and generally consists of at least three full years of post-graduate coursework and the completion of a clinical practicum. In addition, most states also require and the passage of a national examination (Praxis).

Graduate audiology degree programs (AuD) may have some variability in design but meet curriculum and experiential requirements set forth in the Accreditation Commission for Audiology Education (ACAE)⁸ and the Council on Academic Accreditation in Audiology and Speech Language Pathology (CAA).⁹ These standards include core requirements for STEM knowledge and competencies. The following STEM coursework required by one graduate AuD program is representative of that required by other academic programs.

A.T. Still University offers a Doctor of Audiology course of study that requires 165 semester credit hours for graduation. **Out of that total number, 58.5 credit hours are required in STEM coursework¹⁰.**

AUDE 5110 Human Anatomy and Neuroanatomy (4 credit hours)

AUDE 5120 Infection Control and Cerumen Management (1.5 credit hours)

AUDE 5140 Auditory Science (4 credit hours)

AUDE 5220 Anatomy and Physiology of the Auditory-Vestibular system (3 credit hours)

AUDE 5310 Embryology and Genetic Conditions (3 credit hours)

⁶ [Chapter 468 Section 1125 - 2021 Florida Statutes - The Florida Senate \(flsenate.gov\)](#)

⁷ [Georgia Code Title 43. Professions and Businesses § 43-44-3 | FindLaw](#)

⁸ [ACAE-Standards-5.11NEW-WEB-2.pdf \(acaeccred.org\)](#)

⁹ [Standards for Accreditation \(asha.org\)](#)

¹⁰ [Entry Level Doctor of Audiology Degree \(AuD\) | A.T. Still University \(atsu.edu\)](#)

AUDE 5330 Acoustics of Speech (1 credit hour)
AUDE 5410 Acquired Auditory-Vestibular Disorders (3 credit hours)
AUDE 5450 Amplification I (3 credit hours)
AUDE 5460 Otoacoustic Emissions (2 credit hours)
AUDE 6120 Pharmacology and Ototoxicity (2.5 credit hours)
AUDE 6150 Amplification II (3 credit hours)
AUDE 6220 Tinnitus, Hyperacusis and Misophonia: Evaluation and Treatment (2.5 credit hours)
AUDE 6240 Auditory Processing Disorders (3 credit hours)
AUDE 6260 Auditory Evoked Responses and Neurodiagnostics I (3 credit hours)
ASHS 6300 Research Methods and Design (3 credit hours)
AUDE 6370 Vestibular Assessment and Treatment I (3 credit hours)
ASHS 6400 Methods of Data Analysis (3 credit hours)
AUDE 6450 Amplification III (Implantable Devices) (3 credit hours)
AUDE 6460 Auditory Evoked Responses and Neurodiagnostics II (3 credit hours)
AUDE 7150 Amplification IV: Hearing Assistive Technology (2 credit hours)
AUDE 7170 Vestibular Assessment and Treatment II (3 credit hours)

Research

Audiology degree programs prepare students with knowledge of the fundamentals of research and research design. numerous university audiology programs have received grant funding or are working in partnership with federal agencies or other entities, including the National Institutes of Health (NIH), the Patient-Centered Outcomes Research Institute (PCORI), and the U.S. Department of Defense (DoD). Below find just a few examples of ongoing research programs in university Aud programs.

University of Pittsburgh: Healthy Engagement thru Auditory Research Core (HEAR Core)

Dr. Catherine Palmer has been the director of the University of Pittsburgh Auditory Processing Laboratory recently renamed HEAR Core in the School of Health and Rehabilitation Sciences for the past 30 years and mentors PhD students and AuD students who are focused on the effect of untreated and treated hearing loss on older adults in terms of auditory adaptation and healthy aging. Our recent work has focused on effort as a meaningful measure of hearing and treatment. Our work has been funded through VA Merit Review grants, the Department of Defense, the National Alzheimer's Disease Association, the University of Pittsburgh Aging Institute, and numerous Foundation Awards. Currently, the lab is focused on HearCARE: Hearing for Communication and Resident Engagement funded by the Patient-Centered Outcomes Research Institute (PCORI).¹¹

[Link to PCORI description](#)

Vanderbilt University: Research Center in the Department of Hearing and Speech Sciences

This University maintains multiple research laboratories in the area of audiology and hearing including laboratory research devoted to hearing aids, cochlear implants, auditory physiology and auditory neuroscience. "The research efforts of these labs are funded by diverse sources of

¹¹ [HEAR Core | University of Pittsburgh School of Health and Rehabilitation Sciences](#)

funding, including the National Institutes of Health, the United States Department of Education, and the Institute of Education Sciences.”¹²

Johns Hopkins University: Lauer Lab

As a part of the Center for Hearing and Balance at Johns Hopkins, the Lauer Lab studies the functional and anatomical consequences of various forms of acquired hearing loss and the efferent pathways providing brain-controlled modulation of activity in the ear. This work is funded by the National Institute on Deafness and Communication Disorders (NIH), the American Hearing Research Foundation and the National Organization for Hearing Research.¹³

Conclusion

The evidence herein supports the nomination of audiology for the inclusion on the DHS STEM Designated Degree Program List. As noted, the Department of Labor and the US Military recognize audiology as a STEM discipline, state audiology licensure laws distinguish the scientific nature of the profession, and AuD academic programs require significant STEM and STEM-related coursework. In addition, robust audiology research is ongoing at universities funded by scientific-related entities such as NIH, PCORI and the Department of Defense (DoD).

¹² [Research Lab | Hearing and Speech Sciences | Vanderbilt University](#)

¹³ [Our Research — Lauer Lab](#)