
BIOGRAPHICAL SKETCH

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NAME: René H. Gifford

eRA COMMONS USER NAME (credential, e.g., agency login): rgifford

POSITION TITLE: Professor

EDUCATION/TRAINING (*Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.*)

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
Arizona State University, Tempe, AZ	B.S.	1995	Speech and Hearing
Vanderbilt University, Nashville, TN	M.S.	1997	Hearing and Speech
Arizona State University, Tempe, AZ	Ph.D.	2003	Psychoacoustics
Arizona State University, Tempe, AZ	Postdoctoral Fellowship	2006	Speech perception, cochlear implant signal processing

A. Personal Statement

I am a hearing scientist; however, I began my professional career 20 years ago as a clinical audiologist and have maintained an active clinical practice over the past 12 years as I see the complex and difficult-to-manage patients in the Cochlear Implant (CI) Audiology clinic at the Vanderbilt Bill Wilkerson Center. My line of research focuses on the study of basic auditory function, spatial hearing, and speech perception for individuals utilizing electric and acoustic stimulation with cochlear implants and hearing aids. Ultimately my goal is to improve outcomes for adults and children with cochlear implants affording each recipient the opportunity to achieve his/her maximum potential for communication and auditory perception. As both a scientist and a practicing audiologist working in an academic medical environment, I have first-hand knowledge of the clinical problems associated with hearing loss, cochlear implants, and the need for evidence-based recommendations for intervention. We hold the scientific and clinical potential to revolutionize clinical cochlear implant intervention taking a precision medicine approach to electrode selection, ear selection, expectations management, CI programming, and ultimately optimization of outcomes.

B. Positions and Honors

Positions and Employment

2002-2003 NIH Pre-doctoral Fellow (F31), Psychoacoustics Laboratory, Arizona State University
2004-2006 NIH Post-doctoral Fellow (F32), Cochlear Implant Research Laboratory, Arizona State University
2006-2010 Director, Cochlear Implant Program, Mayo Clinic Rochester
2008-2010 Assistant Professor, Mayo Clinic College of Medicine
2011- Director, Cochlear Implant Program, Vanderbilt Bill Wilkerson Center
2011-2014 Assistant Professor, Vanderbilt University, Department of Hearing and Speech Sciences, Department of Otolaryngology
2012- Member, Vanderbilt Kennedy Center for Research on Education and Human Development
2014- Associate Professor, Vanderbilt University, Department of Hearing and Speech Sciences, Department of Otolaryngology
2014- Tier I Training Faculty, Vanderbilt Brain Institute

Honors

- 1995 Summa Cum Laude, undergraduate graduation Arizona State University
- 1991-1995 Arizona State Regents Scholarship, all four years of undergraduate study
- 1997 Jay W. Sanders "Honors in Audiology" Award, Vanderbilt University
- 2003 Mentored Student Poster Award. American Auditory Society. The effect of age on nonlinear cochlear processing.
- 2004 Mentored Student Poster Award. American Auditory Society. Speech recognition in a modulated background and the relation to recovery from forward masking: comparison of younger and older threshold-matched listeners
- 2005-2007 NIH Loan Repayment Program Grant: Combined electric and acoustic hearing
- 2007 The Best of 2007 "Most thought provoking" research article awarded for "Gifford et al., (2007). Auditory function and speech understanding in listeners who qualify for EAS surgery. *Ear Hear*, 28(2), 114S-118S," The Hearing Journal, 2007.
- 2008 The Best of 2008 "Great for the Clinician" research article awarded for "Gifford et al. (2008). Speech Recognition Materials and Ceiling Effects: Considerations for Cochlear Implant Programs, *Audiol Neurotol*, 13, 193-205," The Hearing Journal, 2008.
- 2008 The Best of 2008 "Most thought provoking" research article awarded for "Gifford et al. (2008). Hearing preservation surgery: Psychophysical estimates of cochlear damage in recipients of a short electrode array, *J Acoust Soc Am*, 124, 2164-2173." The Hearing Journal, 2008.
- 2009 The Best of 2009 "Most thought provoking" research article (Co-author) awarded for "Dorman et al. (2009). Word recognition following implantation of conventional and 10 mm Hybrid electrodes. *Audiol Neurotol*, 14:181-189." The Hearing Journal, 2009.
- 2015 Louis M. DiCarlo Award for Recent Clinical Achievement, American Speech-Language-Hearing Association (ASHA)
- 2015 Selected as 1 of 18 VUMC featured StoryCorps interviews with Ally Sisler-Dinwiddie, AuD for *Voices of the NIH community*. Interview recording archived at the American Folklife Center at the Library of Congress.
- 2016 Featured scientist, National Public Radio, Science Friday: *Breakthrough: Portraits of Women in Science—Hearing a Whole New World*, aired live September 9, 2016. Video documentary and recorded live broadcast available at <http://www.sciencefriday.com/segments/breakthrough-hearing-a-whole-new-world/>
- 2017 Vanderbilt University Chancellor's Award for Research; The Chancellor's Award recognizes excellence on the part of faculty for published research, scholarship, or creative expression.

Grant Review

- 2011-2016 NIH NIDCD, Ad Hoc Reviewer, Communication Disorders Review Committee (CDRC)
- 2012 NIH NIDCD, Ad Hoc Reviewer, Special Emphasis Panel, ZDC1 SRB-R (35)
- 2013 NIH NIDCD, Ad Hoc Reviewer, Special Emphasis Panel, ZDC1 SRB-K (12)
- 2016-2020 NIH NIDCD, Permanent member, Communication Disorders Review Committee (CDRC)

C. Contribution to Science

(1) We have developed a novel way to program cochlear implants using post-operative CT scans to specify the relationship between the cochlear implant (CI) electrode array and the locations of the primary auditory neurons located within the modiolus (i.e. cochlear bony core). To date, we have applied this technique to over 200 adult CI recipients (159 postlingually deafened ears) and 23 pediatric CI recipients (27 ears). After using the new program for at least 1 month, 111 of the 159 reprogrammed CIs (69.8%) and 23 of the 27 pediatric patients (85.2%) chose to keep the new map either due to statistically significant improvement in speech understanding or subjective improvement that was deemed significant enough for them to abandon the maps they had been using for, on average, 4½ years. Select related publications and patent (a-e) are shown below. I have worked as a co-investigator and co-PI on these projects.

- a. Noble JH, Gifford RH*, Hedley-Williams A, Sunderhaus L, Labadie RF, Dawant BM. (2014). Clinical evaluation of an image-guided cochlear implant programming strategy. *Audiol Neurotol*. 19(6):400-11. PMID: 25402603. *co-first author

- b. Noble JH, Labadie RF, Gifford RH, Dawant BM. (2013). Image-guidance enables new methods for customizing cochlear implant stimulation strategies. *IEEE Trans Neural Syst Rehabil Eng.* 21(5):820-9. PMID: 23529109
- c. Noble JH, Gifford RH, Labadie RF, Dawant BM. (2012). Statistical shape model segmentation and frequency mapping of cochlear implant stimulation targets in CT. *Med Imag Comput Assist Interv.* 15 (Pt 2): 421-8. PMID: 23286076
- d. Noble JH, Hedley-Williams A, Sunderhaus L, Dawant B, Labadie RF, Camarata S, Gifford RH. (2016). Image-guided cochlear implant (CI) programming can improve hearing outcomes for pediatric CI recipients. *Otol Neurotol.* 37(2):e63-9. PMID: 26756157
- e. U.S. Patent Serial Number 61/619,824: Methods and systems for customizing cochlear implant stimulation and applications of same

(2) I have worked as the PI on nearly 14-years of NIH-funded research evaluating psychophysical processing related to combined electric and acoustic stimulation (EAS) with cochlear implantation. During my F32 funded postdoctoral fellowship, I defined basic auditory properties of low-frequency acoustic hearing in EAS patients (paper 'f' shown below) which led to additional prospective studies examining i) the efficacy of hearing preservation, ii) the effects of surgical trauma on hearing outcomes for EAS benefit, and iii) the best practices for optimizing EAS outcomes in a clinical environment. Work that my lab has completed over the past decade has documented significant speech understanding benefit for listening in complex environments including diffuse noise, reverberation, and informational masking, significant improvements in auditory localization abilities, retention of binaural hearing cues helpful for spatial hearing and speech understanding in noise, as well as optimization of EAS parameters for clinical applicability.

- f. Gifford RH, Dorman MF, Spahr AJ, Bacon SP, Lorens A, Skarzynski H. (2008). Hearing preservation surgery: Psychophysical estimates of cochlear damage in recipients of a short electrode array. *J Acoust Soc Am*, 124:2164-2173. PMID: 19062856
- g. Gifford RH, Dorman MF, Skarzynski H, Lorens A, Polak M, Driscoll CLW, Roland P, Buchman CA. (2013). Cochlear implantation with hearing preservation yields significant benefit for speech recognition in complex listening environments. *Ear Hear*, 34(4):413-25. PMID: 23446225
- h. Gifford RH, Grantham DW, Sheffield SW, Davis TD, Dwyer R, Dorman MF. (2014). Localization and interaural time difference (ITD) thresholds for cochlear implant recipients with preserved acoustic hearing in the implanted ear. *Hear Res*, 312:28-37. PMID: 24607490
- i. Loisel LH, Dorman MF, Yost WA, Cook SJ, Gifford RH. (2016). Using ILD or ITD cues for sound source localization and speech understanding in a complex listening environment by bilateral and hearing-preservation cochlear-implant listeners. *J Speech Lang Hear Res.* 59(4):810-8. PMID: 27411035
- j. Gifford RH, Davis TJ, Sunderhaus LW, Menapace C, Buck B, Crosson J, O'Neill L, Beiter A, Segel P. (2017). Combined electric and acoustic stimulation (EAS) with hearing preservation: effect of cochlear implant low-frequency cutoff on speech understanding and perceived listening difficulty. *Ear Hear.* 2017 Mar 15. Epub ahead of print. PMID: 28301392

(3) As co-I or co-PI on various projects related to test design for assessing speech understanding and non-linguistic assessment of CI outcomes, we have provided clinicians and researchers with a direct translation of research-proven tasks into validated clinical tests. These clinical tests have the potential to guide clinical decision making regarding cochlear implant candidacy, ear selection, and postoperative programming of CI processors. Our validated speech perception measures are now included in the adult and pediatric minimum speech test battery (MSTB) which outlines the best practices protocols for clinical assessment of CI recipients in Audiology practice. Our work with assessment of speech perception in adults and children with cochlear implants as well as our clinical translation of a psychoacoustic measure of spectral resolution has resulted in the development of the AzBio sentence materials (k), BabyBio sentence materials (l), the Quick Spectral Modulation Detection (QSMD) test (m), and the Pediatric Minimum Speech Test Battery (PMSTB) (n).

- k. Spahr AJ, Dorman MF, Litvak LL, Van Wie S, Gifford RH, Loizou PC, Loisel LM, Oakes T, Cook S. (2012). Development and Validation of the AzBio Sentence Lists. *Ear Hear.* 33:112-7. PMID: 21829134
- l. Spahr AJ, Dorman MF, Cook SJ, Loisel L, Hayes C, Hedley-Williams A, Sunderhaus LW, DeJong MD, Gifford RH. (2014). Development and validation of the pediatric AzBio sentence test. *Ear Hear* 35(4):418-22. PMID: 24658601

- m. Gifford RH, Hedley-Williams A, Spahr AJ. (2014). Clinical assessment of spectral modulation detection for adult cochlear implant recipients: a non-language based measure of performance outcomes. *Int J Audiol*. 53(3):159-64. PMID: 24456178
- n. Uhler K, Warner-Czyz A, Gifford RH. (2017). Pediatric Minimum Speech Test Battery (PMSTB). *J Am Acad Audiol*. 28(3): 232-247. PMID: 28277214

(4) I have worked as the PI along with a number of collaborating clinician/scientists in the scientific evaluation of current cochlear implant (CI) candidacy indications. Based on both retrospective and prospective, longitudinal studies, we have concluded that both adult and pediatric labeled indications for implantation are overly restrictive not allowing for potentially hundreds of thousands of individuals who are significantly affected by moderate-to-profound sensory hearing loss to take advantage of the communicative benefits afforded by cochlear implantation. This work has led to 1) two of the three FDA approved CI manufacturers to commence multi-center FDA approved clinical trials to define revised indications for adult CI candidacy and 2) the FDA to convene an Ear, Nose, and Throat Devices Panel Meeting to review current labeled indications for pediatric CI candidacy. Related publications (a-d) are as follows:

- o. Gifford RH, Shallop JK, Peterson AM. (2008). Speech Recognition Materials and Ceiling Effects: Considerations for Cochlear Implant Programs. *Audiol Neurotol*, 13:193-205. PMID: 18212519
- p. Gifford RH, Dorman MF, Shallop JK, Sydlowski, SA. (2010). Evidence for the expansion of adult cochlear implant candidacy. *Ear Hear*, 31:186-94. PMID: 20071994
- q. Gifford RH, Dorman MF, Skarzynski H, Lorens A, Polak M, Driscoll CLW, Roland P, Buchman CA. (2013). Cochlear implantation with hearing preservation yields significant benefit for speech recognition in complex listening environments. *Ear Hear*. 34(4):413-25. PMID: 23446225
- r. Carlson MC, Sladen DP, Haynes DS, Driscoll CLW, DeJong MD, Sunderhaus LW, Hedley-Williams A, Rosenzweig EA, Davis TJ, Gifford RH. (2015). Evidence for the expansion of pediatric cochlear implant candidacy. *Otol Neurotol*. 36(1): 43-50. PMID: 25275867
- s. Sladen DS, Gifford RH, Haynes DS, Kelsall D, Benson A, Lewis K, Zwolan T, Fu, QJ, Gantz B, Gilden J, Westerberg B, Gustin C, White L, Driscoll CL. (2017). Evaluation of a revised indication for determining adult cochlear implant candidacy. *Laryngoscope*. 24 Feb 2017. Epub ahead of print. PMID: 28233910

Complete List of Published Work in MyBibliography (from 78 peer-reviewed publications):

<http://www.ncbi.nlm.nih.gov/sites/myncbi/rene.gifford.1/bibliography/40425043/public/?sort=date&direction=ascending>

D. Research Support

Ongoing Support

R01 DC009404	Gifford (PI)	2009-2020
<u>Title:</u> Cochlear implants: combined electric and binaural acoustic stimulation		
<u>Goal:</u> The goal of this study is to determine the efficacy of binaural hearing preservation for speech recognition in complex listening environments, the spatial resolution in adult cochlear implant recipients, and describe the underlying auditory mechanisms driving this benefit associated with electric and acoustic stimulation (EAS).		
<u>Role:</u> Principal Investigator		
R01 DC13117	Gifford (PI)	2013-2018
<u>Title:</u> Clinical application of spectral envelope perception: cochlear implant evaluation		
<u>Goal:</u> The goal of this project is to conduct a prospective, longitudinal study of acoustic and electric spectral resolution and speech recognition performance in adult cochlear implant (CI) recipients.		
<u>Role:</u> Principal Investigator		
R01 DC014037	Noble (PI)	2014-2019
<u>Title:</u> Image-guided cochlear implant programming techniques		

Goal: The goal of this project is to develop and evaluate new image-guided cochlear implant programming strategies that use objective information acquired from clinical images to determine patient customized frequency, current steering, and current focusing settings that lead to better hearing outcomes.

Role: Co-Investigator

R01 DC014462

Dawant (PI)

2015-2020

Title: Computer-assisted, image-guided programming of cochlear implants

Goal: The goal of this project is to investigate the relationship between electrophysiologic and psychophysical responses to electric stimulation and objective estimates of the electrode-to-neuron interface obtained via pre- and post-operative imaging and to automate our image-guided approach to cochlear implant programming.

Role: Co-Investigator

Completed Support

R21 DC012620

Noble (PI)

2012-2014

Title: Image-based frequency reallocation for optimizing cochlear implant programming

Goal: The goal of this study is to develop and assess the clinical utility of an image-guided approach for determining the position of implanted cochlear implant electrodes relative to stimulation targets [the nerves of the Spiral Ganglion (SG)] for cochlear implant programming assistance.

Role: Co-Investigator

R01 DC010821

Gifford (Co-PI)

2010-2015

Title: Cochlear Implant performance in Realistic Listening Environments

Goal: The goal of this study is to assess speech recognition performance for unilateral and bilateral implant recipients in both standard and simulated realistic test environments, with the goal of creating a decision matrix that links data that can be easily collected in the clinic, e.g., CNC scores in quiet and the amount of residual hearing, with data that cannot be collected in the clinic, i.e., performance data collected with multiple, spatially separated loudspeakers

Role: Co-Principal Investigator (MPI)