

CURRICULUM VITAE

Name: Clifford R. Hume, M.D. Ph.D.

Address:

Department of Otolaryngology-Head and Neck Surgery
Virginia Merrill Bloedel Hearing Research Center
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Seattle, WA 98195

Education:

INSTITUTION AND LOCATION	DEGREE (if applicable)	YEAR(s)	FIELD OF STUDY
Carleton College, Northfield MN	B.A. (1983)	1979-1983	Biology, Science Policy
Cornell University, New York NY	Ph.D. (1989)	1983-1988	Molecular Immunology
Columbia University, New York NY	Post doctoral fellow	1988-1993	Developmental Neuroscience
Cornell University, New York NY	M.D. (1996)	1992-1996	Medicine
University of Washington, Seattle WA	Internship	1996-1997	General Surgery
University of Washington, Seattle WA	Residency	1997-2002	Otolaryngology

Postgraduate Training:

1988-1993. Postdoctoral research fellow, Columbia University, College of Physicians and Surgeons, Department of Physiology Cellular Biophysics, Center for Neurobiology and Behavior, NYC, NY. Mentor: J. Dodd, Ph.D.
1996-1997. Intern, Department of Surgery University of Washington, Seattle, WA.
1997-2002. Resident, Department of Otolaryngology-Head and Neck Surgery University of Washington, Seattle, WA.

Faculty Positions Held:

2002-2008 Assistant Professor, Otolaryngology-Head and Neck Surgery, University of Washington, Seattle, WA.
2002- Member, Virginia Merrill Bloedel Hearing Research Center, University of Washington, Seattle, WA.
2004- Faculty, Interdepartmental Program in Neurobiology and Behavior, University of Washington, Seattle, WA.
2006- Research Affiliate, Center on Human Development and Disability, UW, Seattle, WA.
2006- Research Affiliate, Institute for Stem Cell and Regenerative Medicine, UW, Seattle, WA.
2008- Associate Professor, Otolaryngology-Head and Neck Surgery, University of Washington, Seattle, WA.

Hospital Positions Held:

2002- Attending Physician, Department of Otolaryngology-Head and Neck Surgery, University of Washington Medical Center, Seattle, WA.
2002- Attending Physician, Department of Otolaryngology-Head and Neck Surgery, Harborview Medical Center, Seattle, WA.
2002- Staff Physician, Department of Surgery, Division of Otolaryngology-Head and Neck Surgery, Veterans Administration Puget Sound Medical Center, Seattle, WA.

Honors:

1987 Frank L. Horsfall Award, Cornell University, Graduate School of Medical Sciences.
1988 Young Investigator Award, American Society for Histocompatibility and Immunogenetics.
1988-1989 Research Fellow of the Center for Neurobiology and Behavior, Columbia University, NY.
1989-1990 Research Fellow of the Columbia University Comprehensive Cancer Center, Columbia University, NY.
1990-1993 Helen Hay Whitney Foundation Biomedical Research Fellow.
1995-1996 George N. Papanicolaou Fellow in Clinical Anatomy. Department of Cell Biology and Anatomy, Cornell University Medical College.
1996 James Moore Scholarship. Department of Otolaryngology, Cornell University Medical College.
2003 American Neurotology Society/American Academy of Otolaryngology Head and Neck Surgery, Herbert Silverstein Otology/Neurotology Research Award

Board Certification:

2003, 2013 American Board of Otolaryngology

Current Licenses to Practice:

1996- State of Washington, Physician and Surgeon, Active.

Professional Organizations:

1992- American Medical Association
1999- Association for Research in Otolaryngology
1996- American Academy of Otolaryngology-Head and Neck Surgery
2002- Washington State Medical Association
2003- King County Medical Association
2005- Vestibular Disorders Association

Teaching Responsibilities:

2002-pres Biannual lectures in didactic Resident Education Program, Department of Otolaryngology-Head and Neck Surgery, University of Washington. "*Medical and Surgical Management of Vertigo*", "*Temporal Bone Imaging*", "*Cochlear Implantation*", "*Otologic Emergencies*" (annual).
2002-pres Clinical teaching of Otolaryngology residents in medical and surgical otology, 2 days/week. Primary responsibility for otology training of junior and senior residents at the Puget Sound Veterans' Hospital.
2003-pres Annual lectures and demonstration in Resident Temporal Bone Dissection Course, Department of Otolaryngology-Head and Neck Surgery, University of Washington. "*Petrous Exploration*".
2003-pres Annual lectures in Doctor of Audiology Program, Department of Speech and Hearing Sciences, University of Washington. "*Diseases of the Ear and Cerumen Management*"; "*Temporal Bone Imaging*"; "*Molecular Therapy for Hearing Loss*"; "*Cochlear Implant Surgery*"; "*Medical and Surgical Treatment of Dizziness*".

Research Interests:

Mammalian inner ear embryology: cellular determination and axon guidance in the cochlea
Refining the interface between cochlear implant electrodes and the auditory nerve
Molecular therapeutics of hearing loss and balance disorders
Hybrid cochlear implant/hearing aid devices

Clinical Interests:

Medical and surgical treatment of hearing and balance disorders. Reconstructive middle ear surgery, cochlear implantation.
Humanitarian aid/ENT/otology (Bangkok Thailand 2001, 2009, 2014, 2016, 2017; Dangriga, Belize annually 2007-2015, 2018)

Special Local Responsibilities:

2008 UW/VA Puget Sound- Otolaryngology Division Chief Search Committee.
2005 UW/VA Puget Sound- Head and Neck Surgery Faculty Search Committee.
2004-2014 Department of Otolaryngology-Head and Neck Surgery, UW. Resident application review committee.
2003- 2007 UW Interdisciplinary Cochlear Implantation Group. Coordinator.
2007-pres VA Puget Sound Dizziness and Balance Review Board
2012-2013 UWMC Chief of Audiology Search Committee
2016-pres Department of Otolaryngology-Head and Neck Surgery, Temporal Bone Dissection Course. Director.

Special National Responsibilities:

2004-pres National VA/DOD Cochlear Implant Contracting and Guidelines Workgroup.
2004-pres National VA/DOD Cochlear Implant Advisory Board.
2016-2018 National VA/DOD Auditory Osseointegrated Implant Technical Working Group.
2005- Ad hoc reviewer: *Otology and Neurotology*, *Hearing Research*, *Molecular and Cellular Neuroscience*, *Neuroscience*, *Otolaryngology-Head and Neck Surgery*, *JAMA-Otolaryngology*.
2006 California Institute for Regenerative Medicine (CIRM), Ad Hoc Scientific reviewer.
2008-2011 Association for Research in Otolaryngology, Publications Committee
2010-2016 AAO-HNS Humanitarian Efforts Committee
2011-2016 AAO-HNS CORE Study Section, Otology
2017-2018 AAO-HNS Veterans Affairs Committee

Research Funding:

Current

VM Bloedel Minigrant 7/2017-6/2020

“Vestibular and auditory function in patients with cystic fibrosis.”

This proposal is to evaluation changes in balance function associated with aminoglycoside use in individuals with cystic fibrosis.

Role: Co PI

Past

NSF 1159623

9/2012-8/2016

“Development of PZT Thin Film microactuators for intracochlear applications”. This proposal is directed toward development on an intracochlear PZT device that will deliver acoustic stimulation to the cochlea or function as an intracochlear microphone.

Role: Co-PI

1R01DC012142-01 (J. Bierer)

2/1/2012-1/31/2017

NIH/NIDCD

"Perceptual implications of variable cochlear implant electrode-neuron interfaces". This proposal uses psychophysical measures, computed tomography imaging, and computer modeling to assess how cochlear implant performance relates to affect the function of individual cochlear implant channels.

Role: Co-Investigator (10%)

P30 DC04661 (Rubel)

9/25/2000-8/31/2015

NIH/NIDCD

University of Washington Research Core Center

The major goals of this project are to provide infrastructure support for present research programs and to stimulate new research initiatives between NIDCD-funded researchers.

Role: Investigator

2R01 DC003696-09 (Stone)

4/1/07-3/31/2012

NIH/NIDCD

“Hair Cell Regeneration: Molecular Regulation”

This grant explores the mechanisms regulating avian hair cell regeneration in the auditory epithelium. In particular, it tests the hypothesis that signaling through the Notch receptor maintains progenitor cells in a quiescent state.

Role: Consultant

No number (Consortium, Private Donation)

07/01/2004-01/31/2011

Hearing Regeneration Initiative

This project supports a collaborative effort amongst the laboratories at the Virginia Merrill Bloedel Hearing Research Center toward understanding hair cell regeneration. Specifically, my lab is developing surgical procedures for inner ear delivery of therapeutic reagents including recombinant viruses and stem cells.

Role: Investigator

AAO-HNS Resident Research Grant

11/1/2008-06/30/2011

“Expression Profiling of Spiral Ganglion Neurons.”

This project is to analyze gene expression in purified, developing auditory neurons at critical time points in neurite formation.

Role: Mentor for Jennifer Hsia, MD

K08 DC006437 (Hume)

3/1/2004-2/29/2010

NIH/NIDCD

“Afferent Innervation of the Postnatal Cochlea”

This mentored training award supports studies to identify axon guidance cues for auditory neurons and use these to improve cochlear implant function. In NCE.

Role: PI

No number

01/01/2007-12/31/2007

Bloedel Mini-Grant, Virginia Merrill Bloedel Hearing Research Center

“In Situ Targeting of Auditory Axons by Neurotrophin-3.”

This project tests whether the neurotrophin NT-3 is able to induce directed outgrowth of mature auditory neurons in explanted inner ear cultures and when delivered by recombinant adenovirus *in vivo*.

Role: PI (with Jennifer Hsia, MD, Resident)

No Number (Shen, Hume, Cao)

7/2005-6/2006

Royalty Research Fund, University of Washington

"Feasibility Study of Hybrid Cochlear Implants"

This project supported a collaborative effort with Mechanical Engineering and Materials Science to design a hybrid cochlear implant with a PZT piezoelectric acoustic stimulator electrode.

Role: Co-PI

Herbert Silverstein Neurotology Award (Hume)

8/1/2003-7/31/2005

American Neurotologic Society, AAO-HNS

"Hair Cell Induction in the Postnatal Organ of Corti." Role: PI

Bibliography:**Manuscripts**

1. Hume, C. R., Accolla, R. S., and Lee, J. S. (1987). Defective HLA class II expression in a regulatory mutant is partially complemented by activated ras oncogenes. *Proc Natl Acad Sci U S A* *84*, 8603-8607.
2. Hume, C. R., Nocka, K. H., Sorrentino, V., Lee, J. S., and Fleissner, E. (1988). Constitutive c-myc expression enhances the response of murine mast cells to IL-3, but does not eliminate their requirement for growth factors. *Oncogene* *2*, 223-226.
3. Sorrentino, V., McKinney, M. D., Drozdoff, V., Hume, C. R., and Fleissner, E. (1988). Spontaneous or carcinogen-mediated amplification of a mutated ras gene promotes neoplastic transformation. *Oncogene Res* *2*, 189-195.
4. Hume, C. R., and Lee, J. S. (1989). Congenital immunodeficiencies associated with absence of HLA class II antigens on lymphocytes result from distinct mutations in trans-acting factors. *Hum Immunol* *26*, 288-309.
5. Hume, C. R., Shookster, L. A., Collins, N., O'Reilly, R., and Lee, J. S. (1989). Bare lymphocyte syndrome: altered HLA class II expression in B cell lines derived from two patients. *Hum Immunol* *25*, 1-11.
6. Hume, C. R., and Lee, J. S. (1990). Functional analysis of cis-linked regulatory sequences in the HLA DRA promoter by transcription in vitro. *Tissue Antigens* *36*, 108-115.
7. Mattioni, T., Hume, C. R., Konigorski, S., Hayes, P., Osterweil, Z., and Lee, J. S. (1992). A cDNA clone for a novel nuclear protein with DNA binding activity. *Chromosoma* *101*, 618-624.
8. Hume, C. R., and Dodd, J. (1993). Cwnt-8C: a novel Wnt gene with a potential role in primitive streak formation and hindbrain organization. *Development* *119*, 1147-1160.
9. Bannish, G., Hume, C., and Lee, J. S. (1996). Coordinate regulation of HLA class II genes: a novel DNA binding complex. *Mol Immunol* *33*, 407-415.
10. Shah, S., Skromne, I., Hume, C., Kessler, D., Lee, K., Stern, C., and Dodd, J. (1997). Misexpression of chick Vg1 in the marginal zone induces primitive streak formation. *Development* *124*, 5127-5138.
11. Popperl, H., Schmidt, C., Wilson, V., Hume, C. R., Dodd, J., Krumlauf, R., and Beddington, R. S. (1997). Misexpression of Cwnt8C in the mouse induces an ectopic embryonic axis and causes a truncation of the anterior neuroectoderm. *Development* *124*, 2997-3005.
12. Hume, C. R., Kierkegaard, M., Oesterle, E. C. (2003). ErbB Expression: The Mouse Inner Ear and Maturation of the Mitogenic Response to Heregulin. *J Assoc Res Otolaryngol.* *4*, 422-443.
13. Lee, C. C., Shen, I., Hume, C., Gao, G. (2005). A Feasibility Study of PZT Thin-Film Microactuators for Hybrid Cochlear Implants. *Conf Proc IEEE Eng Med Biol Soc* *2(1)*, 1929-1932.
14. Birmingham-McDonogh, O, Oesterle, E.C., Stone, J.S., Hume, C. R., Huynh, H., Hayashi, T. (2006) The expression of Prox1 during mouse cochlear development. *J. Comp. Neurol.* *10;496(2)*, 172-86.
15. Hume, C. R., Bratt, D. L., Oesterle, E. C. (2007). Expression of LHX3 and SOX2 during mouse inner ear development. *Gene Expression Patterns, Mechanisms of Development.* *Mechanisms of Development Aug;7(7):798-807.*
16. Oesterle, E. C., Campbell, S., Taylor, R. R., Forge, A., Hume, C. R. (2008) Sox2 and Jagged1 Expression in Normal and Drug-Damaged Adult Mouse Inner Ear. *J Assoc Res Otolaryngol.* *Mar;9(1):65-89.*
17. Lee, C. C., Hume, C. R., Cao, G. Z., Shen, I. Y. (2008) Temporary Packaging of PZT Thin-Film Microactuators. *Integrated Ferroelectrics*, *101:121-131.*
18. Wise, AK, CR Hume, BO Flynn, YS Jeelall, CL Suhr, BE Sgro, SJ O'Leary, RK Shepherd, and RT Richardson. (2010) Effects of Localized Neurotrophin Gene Expression on Spiral Ganglion Neuron Resprouting in the Deafened Cochlea. *Mol Ther* *18*, no. 6: 1111-1122.
19. Wise, A.K., et al., The effect of deafness duration on neurotrophin gene therapy for spiral ganglion neuron protection, *Hearing Research* (2011), doi:10.1016/j.heares.2011.04.010
20. Lin, V., Golub, J., Nguyen, T. B., Hume, C.R., Oesterle, E. C., Stone, J. S. (2011) Inhibition of notch activity promotes non-mitotic regeneration of hair cells in the adult mouse utricles. *J. Neurosci.* *31(43);15329-15339.*
21. Lewis, RM, CR Hume, and JS Stone. (2012) Atoh1 expression and function during auditory hair cell regeneration in post-hatch chickens. *Hear Res* *289*, no. 1-2: 74-85.
22. Golub, JS, L Tong, TB Ngyuen, CR Hume, RD Palmiter, EW Rubel, and JS Stone. (2012) Hair cell replacement in adult mouse utricles after targeted ablation of hair cells with diphtheria toxin. *Journal of Neuroscience* *32*, no. 43: 15093-15105.
23. Atkinson, PJ, AK Wise, BO Flynn, BA Nayagam, CR Hume, SJ O'Leary, RK Shepherd, and RT Richardson. (2012) Neurotrophin gene therapy for sustained neural preservation after deafness. *PLoS ONE* *7*, no. 12: e52338.
24. Tong, L., Strong, M. K., Kaur, T., Juiz, J. M., Oesterle, E. C., Hume, C., Warchol, M. E., Palmiter, R. D., and Rubel, E. W. (2015). Selective deletion of cochlear hair cells causes rapid age-dependent changes in spiral ganglion and cochlear nucleus neurons. *J. Neurosci.* *35*, 7878-7891.
25. Luo, C., Omelchenko, I., Manson, R., Robbins, C., Oesterle, E. C., Cao, G. Z., Shen, I. Y., and Hume, C. R. (2015). Direct Intracochlear Acoustic Stimulation Using a PZT Microactuator. *Trends Hear* *19*,

26. Liu Y, Luo C, Cao GZ, Hume CR, Shen IY. A Study on Long-Term In Vitro Reliability of Intracochlear Lead-Zirconate-Titanate Microactuators. (2018) ASME. *ASME J of Medical Diagnostics*. 2018;1(3):031005-031005-8. doi:10.1115/1.4040103.

Reviews/Chapters:

1. Lee, J. S., Cohen, E. B., Hume, C. R., and Sartoris, S. (1986). Organization, polymorphism, and regulation of class II genes of the major histocompatibility complex. *Year Immunol* 2, 205-221.
2. Hume, C. R., and Lee, J. S. (1990). Genetics of HLA class II regulation. *Immunol Res* 9, 93-102.
3. Kuhel, W. I., Hume, C. R., and Selesnick, S. H. (1996). Cancer of the external auditory canal and temporal bone. *Otolaryngol Clin North Am* 29, 827-852.
4. Oesterle, E. C., and Hume, C. R. (1999). Growth factor regulation of the cell cycle in developing and mature inner ear sensory epithelia. *J Neurocytol* 28, 877-887.
5. Stone, J. S., Hume, C. R. (2011) Current Issues in Inner Ear Regeneration. In: *Translational Perspectives in Audiology*. Editors: Tremblay, K., Burkard, R. Plural Publishing.

Complete List of Published Work in MyBibliography:

<http://www.ncbi.nlm.nih.gov/sites/myncbi/clifford.hume.1/bibliography/41143295/public/?sort=date&direction=ascending>

Invention Disclosures/Patents:

Active Incudo-stapedial Prosthetic Joints. (with I. Y. Shen) UWTech Transfer Reference Number 7092D. 8/23/2004.
 Hybrid Cochlear Implants. (with I. Y. Shen) UWTech Transfer Reference Number 4146DL. 1/18/2005.
 Intracochlear Pressure Sensors. (with I. Y. Shen) UWTech Transfer Ref# 45476. 2/1/2011.
 Methods and systems for improving actuator performance by reducing tensile stresses in piezoelectric thin films US 20120245408 A1, Sep 27, 2012

Other Invited Lectures/Courses:

- 2001 Sixth Annual Asian Course in Temporal Bone/ Ear Surgery. Otolaryngology Institute of Thailand, Bangkok, Thailand. Clinical and Didactic Instructor, *Temporal Bone Imaging*. November 2001.
- 2005 "Molecular Therapeutics of Hearing Loss". Washington State Society of Audiology, Annual Meeting. Seattle, WA. June 3, 2005.
- 2005 "Steps Towards Molecular Therapeutics of Hearing Loss." UW Dept. of Otolaryngology-Head and Neck Surgery, Alumni Day. Seattle, WA June 10, 2005.
- 2006 "New tools for the treatment of hearing loss". Hearing Loss Association of America (SHHH). Hearthstone Chapter, Seattle, WA. February 14, 2006.
- 2006 "Hearing Loss: Molecular Therapy". UWTV Inside Access. Production date March 3, 2006.
<http://www.uwvtv.org/programs/displayevent.aspx?rID=4126>
- 2006 "Inner ear development: tools for the treatment of hearing loss". Graduate Program in Neurobiology & Behavior, University of Washington. Seattle, WA. May 22, 2006.
- 2006 "Molecular Therapeutics for Hearing Loss". Institute for Stem Cell and Regenerative Medicine, Conference for Choongwae Pharma. Seattle, WA. July 26, 2006.
- 2009 Fourteenth Annual Asian Course in Temporal Bone/ Ear Surgery. Otolaryngology Institute of Thailand, Rajavithi Hospital, Bangkok, Thailand. Clinical and Didactic Instructor, *Temporal Bone Imaging, Middle Ear Physiology and Anatomy*. November 2009.
- 2014 Nineteenth Annual Asian Course in Temporal Bone/ Ear Surgery. Otolaryngology Institute of Thailand, Rajavithi Hospital, Bangkok, Thailand. Clinical and Didactic Instructor, *Temporal Bone Imaging, Middle Ear Physiology and Anatomy*. November 2014.
- 2016 21st Annual Asian Course in Temporal Bone/ Ear Surgery. Otolaryngology Institute of Thailand, Rajavithi Hospital, Bangkok, Thailand. Clinical and Didactic Instructor, *Temporal Bone Imaging, Middle Ear Physiology and Anatomy*. November 2016.
- 2014-2017 SOAR (Seattle Otology and Rhinology Course). Seattle Science Foundation, Swedish Medical Center. Laboratory instructor and panelist. Course Director: Douglas Backous. (March)
- 2015 "Steps towards hearing regeneration". Hearing Loss Association of America (SHHH). University House Chapter, Seattle, WA. January 18, 2015
- 2015 "Steps towards hearing regeneration" Washington State Academy of Audiology, Washington Audiology Alliance. April 24, 2015

Neurology Menieres 2018, 2011?

2017 Asian temporal bone course

OMFS temporal bone

Cochlear implant UW SHS 2018

Otology series 2018

HLA Burlington

HLA Tacoma