

Stanford



Alan G. Cheng

Associate Professor of Otolaryngology - Head and Neck Surgery (Pediatrics) and, by courtesy, of Pediatrics

Otolaryngology - Head & Neck Surgery Divisions

CLINICAL OFFICES

- **Stanford Ear Institute**

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ACADEMIC CONTACT INFORMATION

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Bio

BIO

Dr. Alan Cheng received his B.S. in Biomedical Engineering at the Johns Hopkins University, graduating Phi Beta Kappa and Tau Beta Pi. He then received his M.D. degree from the Albert Einstein College of Medicine and graduated with distinction in research in otobiology. Dr. Cheng pursued his residency training in Department of Otolaryngology-Head and Neck Surgery at University of Washington. During residency, he undertook a two-year NIH-sponsored research fellowship investigating mechanisms of hair cell degeneration. After residency he sought fellowship training in pediatric otolaryngology in Children's Hospital Boston, Harvard Medical School.

Alan Cheng joined the Department of Otolaryngology-Head and Neck Surgery at Stanford University as a surgeon-scientist in 2007. His clinical practice based at the Stanford Ear Institute and Lucile Packard Children's Hospital focuses on otologic diseases including congenital hearing loss and cochlear implantation, and chronic ear diseases in the pediatric population. In parallel, his research program focuses on inner ear hair cell development and regeneration. He has received funding from NIH, Department of Defense, the American Otological Society, and California Institute for Regenerative Medicine for this research endeavor.

CLINICAL FOCUS

- Otolaryngology
- Hearing loss
- Cholesteotoma
- Pediatric sinus disease
- Pediatric head and neck tumors

ACADEMIC APPOINTMENTS

- Associate Professor, Otolaryngology - Head & Neck Surgery Divisions
- Associate Professor (By courtesy), Pediatrics - Operations
- Member, Bio-X
- Member, Maternal & Child Health Research Institute (MCHRI)
- Member, Stanford Cancer Institute

- Member, Wu Tsai Neurosciences Institute

ADMINISTRATIVE APPOINTMENTS

- Director, Stanford clinician-scientist training program, (2016- present)

HONORS AND AWARDS

- Association for Research in Otolaryngology Resident Travel Award, Association for Research in Otolaryngology (2001, 2002, 2005)
- Shiley Resident Research Award, American Academy of Otolaryngology-Head and Neck Surgery Foundation (2001)
- Percy Memorial Research Award, American Academy of Otolaryngology-Head and Neck Surgery Foundation (2008)
- American Otological Society Clinician-Scientist Award, American Otological Society (2008)
- Triological Society Career Development Award, Triological Society (2009)
- Herbert Silverstein Otolaryngology-Neurotology Award, American Academy of Otolaryngology-Head and Neck Surgery (2010)
- Akiko Yamazaki and Jerry Yang Faculty Scholar, Child Health Research Institute at Stanford (2011)
- Bass Society of Pediatric Scholars, Stanford Children's Health (2012)
- American Academy of Otolaryngology-HNS Foundation Honor award, American Academy of Otolaryngology-HNS Foundation (2013)
- Geraldine Dietz Fox Young Investigator Award, National Organization of Hearing Research/Johns Hopkins University (2015)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Chair, American Society of Pediatric Otolaryngologist Research Committee (2014 - 2016)
- Member, Hearing committee, American Academy of Otolaryngology-Head and Neck Surgery (2014 - 2017)
- Member, Association of Research in Otolaryngology Program Committee (2013 - present)
- Member, Provost's Advisory Committee on Postdoctoral Affairs (2012 - present)
- Member, Pediatric Education Committee, American Academy of Otolaryngology-Head and Neck Surgery (2014 - present)
- Member, CORE Grant study section, American Academy of Otolaryngology-HNS (2008 - present)

PROFESSIONAL EDUCATION

- Internship: University of Washington Medical Center (2000) WA
- Fellowship: Children's Hospital Boston (2007) MA
- Board Certification: Otolaryngology, American Board of Otolaryngology (2007)
- Residency, University of Washington , Otolaryngology-HNS (2006)
- M.D., Albert Einstein , Medicine (1999)
- B.S., Johns Hopkins , Biomedical Engineering (1995)

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

The overarching goal of our research group is to restore/protect auditory function. The irreversible loss of mechanosensitive hair cells in the cochlea causes permanent hearing loss. Mammals lack the ability to spontaneously regenerate hair cells and restore hearing. Wnt signaling is a recurrent theme playing crucial roles in the development of multicellular organisms as well as tissue and cellular homeostasis including the maintenance of stem/progenitor cells. To understand how to regenerate the inner ear, our group has been studying Wnt-responsive progenitor cells in the mammalian cochlea. We take in vitro and in vivo approaches to study the behavior of these putative progenitor cells both during development and after damage in the mature animal. In particular, we are interested in how cell fate decision is made when these progenitor cells differentiate and how Wnt signaling (and other signals) directly and indirectly affects their decision. Techniques include genetic and pharmacologic manipulations, flow cytometry, cell and organotypic cultures, and confocal and time-lapse imaging, single cell and whole animal physiological testing.

A second direction of our laboratory is to understand how the aminoglycoside antibiotics enter the inner ear. These commonly prescribed antibiotics selectively damage inner ear hair cells leading to hearing loss. We are interested in understanding how it enters the blood-labyrinth barrier and its subsequent transport into hair cells. One main focus is to re-design aminoglycosides to preclude their entry into the inner ear.

Teaching

STANFORD ADVISEES

Med Scholar Project Advisor

Paras Minhas, Zahra Sayyid

Postdoctoral Faculty Sponsor

Ksenia Aaron, Taha Jan, Tina Munjal, Mary O'Sullivan, Jason Qian, Haiying Sun

Postdoctoral Research Mentor

Tina Munjal, Haiying Sun

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Neurosciences (Phd Program)
- Pediatric Otolaryngology (Fellowship Program)

Publications

PUBLICATIONS

- **beta-Catenin is required for radial cell patterning and identity in the developing mouse cochlea.** *Proceedings of the National Academy of Sciences of the United States of America*
Jansson, L., Ebeid, M., Shen, J. W., Mokhtari, T. E., Quiruz, L. A., Ornitz, D. M., Huh, S., Cheng, A. G.
2019
- **Atoh1 Directs Regeneration and Functional Recovery of the Mature Mouse Vestibular System.** *Cell reports*
Sayyid, Z. N., Wang, T., Chen, L., Jones, S. M., Cheng, A. G.
2019; 28 (2): 312
- **Uncoordinated maturation of developing and regenerating postnatal mammalian vestibular hair cells.** *PLoS biology*
Wang, T., Niwa, M., Sayyid, Z. N., Hosseini, D. K., Pham, N., Jones, S. M., Ricci, A. J., Cheng, A. G.
2019; 17 (7): e3000326
- **Direct cellular reprogramming and inner ear regeneration.** *Expert opinion on biological therapy*
Atkinson, P. J., Kim, G. S., Cheng, A. G.
2018
- **Aminoglycoside ribosome interactions reveal novel conformational states at ambient temperature** *NUCLEIC ACIDS RESEARCH*
O'Sullivan, M. E., Poitevin, F., Sierra, R. G., Gati, C., Dao, E., Rao, Y., Aksit, F., Ciftci, H., Corsepilus, N., Greenhouse, R., Hayes, B., Hunter, M. S., Liang, et al
2018; 46 (18): 9793–9804
- **Aminoglycoside ribosome interactions reveal novel conformational states at ambient temperature.** *Nucleic acids research*
O'Sullivan, M. E., Poitevin, F., Sierra, R. G., Gati, C., Dao, E. H., Rao, Y., Aksit, F., Ciftci, H., Corsepilus, N., Greenhouse, R., Hayes, B., Hunter, M. S., Liang, et al
2018
- **Molecular therapy for genetic and degenerative vestibular disorders.** *Current opinion in otolaryngology & head and neck surgery*
Sayyid, Z. N., Kim, G. S., Cheng, A. G.
2018

- **Sox2 haploinsufficiency primes regeneration and Wnt responsiveness in the mouse cochlea** *JOURNAL OF CLINICAL INVESTIGATION*
Atkinson, P. J., Dong, Y., Gu, S., Liu, W., Najarro, E., Udagawa, T., Cheng, A. G.
2018; 128 (4): 1641–56
- **Mind Your Ears: A New Antidote to Aminoglycoside Toxicity?** *JOURNAL OF MEDICINAL CHEMISTRY*
O'Sullivan, M. E., Cheng, A. G.
2018; 61 (1): 81–83
- **Basilar Membrane Vibration After Targeted Removal of the Third Row of OHCs and Deiters Cells**
Xia, A., Udagawa, T., Raphael, P. D., Cheng, A. G., Steele, C. R., Applegate, B. E., Oghalai, J. S., Bergevin, C., Puria, S.
AMER INST PHYSICS.2018
- **Towards the Prevention of Aminoglycoside-Related Hearing Loss** *Frontiers in Cellular Neuroscience*
O'Sullivan, M. E., Perez, A., Lin, R., Ricci, A. J., Cheng, A. G.
2017; 11: 325
- **Towards the Prevention of Aminoglycoside-Related Hearing Loss.** *Frontiers in cellular neuroscience*
O'Sullivan, M. E., Perez, A., Lin, R., Sajjadi, A., Ricci, A. J., Cheng, A. G.
2017; 11: 325
- **Profiling Specific Inner Ear Cell Types Using Cell Sorting Techniques.** *Methods in molecular biology (Clifton, N.J.)*
Jan, T. A., Jansson, L., Atkinson, P. J., Wang, T., Cheng, A. G.
2016; 1427: 431-445
- **Intraoperative acupuncture for posttonsillectomy pain: A randomized, double-blind, placebo-controlled trial** *LARYNGOSCOPE*
Tsao, G. J., Messner, A. H., Seybold, J., Sayyid, Z. N., Cheng, A. G., Golianu, B.
2015; 125 (8): 1972-1978
- **Sensory hair cell development and regeneration: similarities and differences** *DEVELOPMENT*
Atkinson, P. J., Najarro, E. H., Sayyid, Z. N., Cheng, A. G.
2015; 142 (9): 1561-1571
- **Making sense of Wnt signaling-linking hair cell regeneration to development** *FRONTIERS IN CELLULAR NEUROSCIENCE*
Jansson, L., Kim, G. S., Cheng, A. G.
2015; 9
- **Protein-engineered hydrogel encapsulation for 3-d culture of murine cochlea.** *Otology & neurotology*
Chang, D. T., Chai, R., DiMarco, R., Heilshorn, S. C., Cheng, A. G.
2015; 36 (3): 531-538
- **Designer aminoglycosides prevent cochlear hair cell loss and hearing loss.** *journal of clinical investigation*
Huth, M. E., Han, K., Sotoudeh, K., Hsieh, Y., Effertz, T., Vu, A. A., Verhoeven, S., Hsieh, M. H., Greenhouse, R., Cheng, A. G., Ricci, A. J.
2015; 125 (2): 583-592
- **Intraoperative acupuncture for posttonsillectomy pain: A randomized, double-blind, placebo-controlled trial.** *The Laryngoscope*
Tsao, G. J., Messner, A. H., Seybold, J., Sayyid, Z. N., Cheng, A. G., Golianu, B.
2015
- **Lgr5+ cells regenerate hair cells via proliferation and direct transdifferentiation in damaged neonatal mouse utricle.** *Nature communications*
Wang, T., Chai, R., Kim, G. S., Pham, N., Jansson, L., Nguyen, D., Kuo, B., May, L. A., Zuo, J., Cunningham, L. L., Cheng, A. G.
2015; 6: 6613-?
- **Making sense of Wnt signaling-linking hair cell regeneration to development.** *Frontiers in cellular neuroscience*
Jansson, L., Kim, G. S., Cheng, A. G.
2015; 9: 66-?
- **Spontaneous hair cell regeneration in the neonatal mouse cochlea in vivo (vol 141, pg 816, 2014)** *DEVELOPMENT*
Cox, B. C., Chai, R., Lenoir, A., Liu, Z., Zhang, L., Duc-Huy Nguyen, Chalasani, K., Steigelman, K. A., Fang, J., Rubel, E. W., Cheng, A. G., Zuo, J.
2014; 141 (7): 1599

- **Spontaneous hair cell regeneration in the neonatal mouse cochlea in vivo** *DEVELOPMENT*
Cox, B. C., Chai, R., Lenoir, A., Liu, Z., Zhang, L., Nguyen, D., Chalasani, K., Steigelman, K. A., Fang, J., Cheng, A. G., Zuo, J.
2014; 141 (4): 816-829
- **Transient, afferent input-dependent, postnatal niche for neural progenitor cells in the cochlear nucleus (vol 110, pg 14456, 2013)** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Volkenstein, S., Oshima, K., Sinkkonen, S. T., Corrales, C., Most, S. P., Chai, R., Jan, T. A., van Amerongen, R., Cheng, A. G., Heller, S.
2013; 110 (42): 17160
- **Transient, afferent input-dependent, postnatal niche for neural progenitor cells in the cochlear nucleus.** *Proceedings of the National Academy of Sciences of the United States of America*
Volkenstein, S., Oshima, K., Sinkkonen, S. T., Corrales, C. E., Most, S. P., Chai, R., Jan, T. A., Cheng, A. G., Heller, S.
2013; 110 (35): 14456-14461
- **Tympanic border cells are Wnt-responsive and can act as progenitors for postnatal mouse cochlear cells** *DEVELOPMENT*
Jan, T. A., Chai, R., Sayyid, Z. N., van Amerongen, R., Xia, A., Wang, T., Sinkkonen, S. T., Zeng, Y. A., Levin, J. R., Heller, S., Nusse, R., Cheng, A. G.
2013; 140 (6): 1196-1206
- **Integrity and Regeneration of Mechanotransduction Machinery Regulate Aminoglycoside Entry and Sensory Cell Death** *PLOS ONE*
Vu, A. A., Nadaraja, G. S., Huth, M. E., Luk, L., Kim, J., Chai, R., Ricci, A. J., Cheng, A. G.
2013; 8 (1)
- **A simple method for purification of vestibular hair cells and non-sensory cells, and application for proteomic analysis.** *PloS one*
Herget, M., Scheibinger, M., Guo, Z., Jan, T. A., Adams, C. M., Cheng, A. G., Heller, S.
2013; 8 (6)
- **A simple method for purification of vestibular hair cells and non-sensory cells, and application for proteomic analysis.** *PloS one*
Herget, M., Scheibinger, M., Guo, Z., Jan, T. A., Adams, C. M., Cheng, A. G., Heller, S.
2013; 8 (6)
- **Wnt signaling induces proliferation of sensory precursors in the postnatal mouse cochlea** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Chai, R., Kuo, B., Wang, T., Liaw, E. J., Xia, A., Jan, T. A., Liu, Z., Taketo, M. M., Oghalai, J. S., Nusse, R., Zuo, J., Cheng, A. G.
2012; 109 (21): 8167-8172
- **Isolating LacZ-expressing Cells from Mouse Inner Ear Tissues using Flow Cytometry** *JOVE-JOURNAL OF VISUALIZED EXPERIMENTS*
Jan, T. A., Chai, R., Sayyid, Z. N., Cheng, A. G.
2011
- **Dynamic Expression of Lgr5, a Wnt Target Gene, in the Developing and Mature Mouse Cochlea** *JARO-JOURNAL OF THE ASSOCIATION FOR RESEARCH IN OTOLARYNGOLOGY*
Chai, R., Xia, A., Wang, T., Jan, T. A., Hayashi, T., Bermingham-McDonogh, O., Cheng, A. G.
2011; 12 (4): 455-469
- **Functional Hair Cell Mechanotransducer Channels Are Required for Aminoglycoside Ototoxicity** *PLOS ONE*
Alharazneh, A., Luk, L., Huth, M., Monfared, A., Steyger, P. S., Cheng, A. G., Ricci, A. J.
2011; 6 (7)
- **Intrinsic regenerative potential of murine cochlear supporting cells** *Scientific Reports*
Sinkkonen ST, Chai R, Jan, T, Hartman B, Laske R, Gahlen F, Sinkkonen W, Cheng AG, Oshima K, Heller
2011; 1 (26): DOI:10.1038/srep0002
- **Mechanisms of aminoglycoside ototoxicity and targets of hair cell protection.** *International journal of otolaryngology*
Huth, M. E., Ricci, A. J., Cheng, A. G.
2011; 2011: 937861-?
- **Decompression of the Orbital Apex An Alternate Approach to Surgical Excision for Radiographically Benign Orbital Apex Tumors** *ARCHIVES OF OTOLARYNGOLOGY-HEAD & NECK SURGERY*
Almond, M. C., Cheng, A. G., Schiedler, V., Sires, B. S., Most, S. P., Jian-Amadi, A.
2009; 135 (10): 1015-1018

- **Sensorineural hearing loss in patients with cystic fibrosis** *OTOLARYNGOLOGY-HEAD AND NECK SURGERY*
Cheng, A. G., Johnston, P. R., Luz, J., Uluer, A., Fligor, B., Licameli, G. R., Kenna, M. A., Jones, D. T.
2009; 141 (1): 86-90
- **Airway management in Nager Syndrome** *LARYNGOSCOPE*
Ho, A. S., Aleshi, P., Cohen, S. E., Koltai, P. J., Cheng, A. G.
2009; 119: S179-S179
- **Airway management in Nager Syndrome** *INTERNATIONAL JOURNAL OF PEDIATRIC OTORHINOLARYNGOLOGY*
Ho, A. S., Aleshi, P., Cohen, S. E., Koltai, P. J., Cheng, A. G.
2008; 72 (12): 1885-1888
- **Melanoacanthoma of the external auditory canal: a case report and review of the literature** *AMERICAN JOURNAL OF OTOLARYNGOLOGY*
Cheng, A. G., Deubner, H., Whipple, M. E.
2007; 28 (6): 433-435
- **Cerebrospinal fluid leak in the neck: A rare complication of glomus vagale excision** *OTOLARYNGOLOGY-HEAD AND NECK SURGERY*
Cheng, A. G., Maronian, N. C., Futran, N. D.
2006; 134 (2): 334-335
- **Mechanisms of hair cell death and protection.** *Current opinion in otolaryngology & head and neck surgery*
Cheng, A. G., Cunningham, L. L., Rubel, E. W.
2005; 13 (6): 343-348
- **Auramine orange stain with fluorescence microscopy is a rapid and sensitive technique for the detection of cervical lymphadenitis due to mycobacterial infection using fine needle aspiration cytology: a case series** *OTOLARYNGOLOGY-HEAD AND NECK SURGERY*
Cheng, A. G., Chang, A., Farwell, D. G., Agoff, S. N.
2005; 133 (3): 381-385
- **Neomycin-induced hair cell death and rapid regeneration in the lateral line of zebrafish (Danio rerio)** *JARO-JOURNAL OF THE ASSOCIATION FOR RESEARCH IN OTOLARYNGOLOGY*
Harris, J. A., Cheng, A. G., Cunningham, L. L., MacDonald, G., Raible, D. W., Rubel, E. W.
2003; 4 (2): 219-234
- **Hair cell death in the avian basilar papilla: Characterization of the in vitro model and caspase activation** *JARO-JOURNAL OF THE ASSOCIATION FOR RESEARCH IN OTOLARYNGOLOGY*
Cheng, A. G., Cunningham, L. L., Rubel, E. W.
2003; 4 (1): 91-105
- **Caspase activation in hair cells of the mouse utricle exposed to neomycin** *JOURNAL OF NEUROSCIENCE*
Cunningham, L. L., Cheng, A. G., Rubel, E. W.
2002; 22 (19): 8532-8540
- **Oxidative stress-induced apoptosis of cochlear sensory cells: otoprotective strategies** *INTERNATIONAL JOURNAL OF DEVELOPMENTAL NEUROSCIENCE*
Huang, T., Cheng, A. G., Stupak, H., Liu, W., Kim, A., Staecker, H., LEFEBVRE, P. P., Malgrange, B., Kopke, R., Moonen, G., Van de Water, T. R.
2000; 18 (2-3): 259-270
- **Calpain inhibitors protect auditory sensory cells from hypoxia and neurotrophin-withdrawal induced apoptosis** *BRAIN RESEARCH*
Cheng, A. G., Huang, T., Stracher, A., Kim, A., Liu, W., Malgrange, B., LEFEBVRE, P. P., Schulman, A., Van De Water, T. R.
1999; 850 (1-2): 234-243
- **LATERAL VENTRICULAR EFFACEMENT AS AN ISOLATED SONOGRAPHIC FINDING IN PREMATURE-INFANTS - PREVALENCE AND SIGNIFICANCE** *AMERICAN JOURNAL OF ROENTGENOLOGY*
Patel, M. D., Cheng, A. G., Callen, P. W.
1995; 165 (1): 155-159