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Announcements

American Hearing Research Foundation to Celebrate 50th Anniversary on November 8, 2006

The American Hearing Research Foundation will be celebrating its 50th anniversary on Wednesday, November 8, 2006. The Foundation has provided information to the public and patients on hearing and balance-related disorders, and has funded more than 154 research projects in these fields since 1956. The AHRF continues to fund eight to 12 research projects each year, with an average grant of $20,000.

"The 50th anniversary will be a celebration of the Foundation's ongoing support of research focusing on hearing and balance disorders," says Marvin T. Keeling, board member and chairman of the public relations committee of the American Hearing Research Foundation for 23 years. "Our support to researchers over the past 50 years has helped scientists and physicians better understand the biology and mechanics behind hearing loss, and has impacted some of the most cutting-edge technologies, including the cochlear implant." Keeling says he looks forward to the Foundation supporting future research projects including genomic mapping, which may be able to uncover the genetic underpinnings of some types of hearing loss.

The foundation will be holding a special gala event to celebrate its 50th anniversary at Northwestern Memorial Hospital. Speakers at the event will include Peter Dallos, Ph.D., the John Evans Professor of Speech, Communication Sciences and Disorders, and Professor of Neurobiology and Physiology at Northwestern University and a world-renowned expert on the biophysics and neurobiology of the inner ear; and Timothy Hain, M.D., Professor of Neurology, Otolaryngology, and Physical Therapy/Human Movement Science, Northwestern University Medical School. Dr. Hain is a leading expert on balance disorders and dizziness.

Current Projects

Researchers at New York University School of Medicine Investigate the Use of Nasal Stem Cells to Replace Damaged Hair Cells in the Cochlea

Nasal stem cells, called olfactory neural stem cells (ONSCs), help give rise to new olfactory cells in the nose. These sensors let us detect the distinct aroma of a rose or the odors emitted by different foods, die off and are regenerated regularly. The olfactory neural stem cells in mammals are totipotent—they can give rise to any kind of cell found in the body. The fact that stem cells can differeniate into any cell type in the body, from skin to muscle cells, has made them a very appealing target of research studies assessing their therapeutic potential. Everything from regenerating nerve tissue in spinal injuries to replacing cells that produce insulin in diabetics is being investigated. Because ONSCs can be harvested from living adults, and not embryos, they are free of the ethical dilemmas involved using embryonic stem cells. Importantly, the use of one's own cells for a therapeutic procedure would preclude the debilitating effects of graft rejection by the recipient's immune system.

Anand N. Mhatre, Ph.D., Assistant Professor of Otolaryngology and Physiology & Neuroscience,
Anil K. Lalwani, MD, Professor of Otolaryngology and Physiology & Neuroscience, New York Univeristy School of Medicine

AMERICAN HEARING
RESEARCH FOUNDATION

Volume 38, Number 2,
Fall, 2006

Transneuronal Analysis of the Auditory Reflex Pathways

The major sound-triggered reflex pathways–the middle-ear muscle (MEM) and medial olivocochlear (MOC)–begin as sound presented to the inner ear (cochlea). This information is sent to an area in the brain called the cochlear nucleus (CN) via the auditory nerve. Unknown interneurons within the CN form the next portion of the reflex pathway and project to another region of the brain where motoneurons specific for the MEMs are located. These MEM motoneurons send signals to the muscles in the ear, resulting in middle ear muscle contraction. The muscles stiffen the ossicles (hearing bones) and dampen sound reaching the inner ear. The MEM reflex protects the cochlea from intense sounds, minimizing self-generated noise, and reduces the impact of background noise on speech understanding. The MOC reflex pathway mirrors the MEM reflex, except that the targets of this reflex are the outer hair cells of the cochlea. The functions of the MOC reflex pathway complement the MEM reflex to reduce the masking effects of background noise, protect the cochlea from intense sound, and increase the dynamic range of the auditory nerve.

Transneuronal analysis using a weakened pseudorabies virus (PRV) is an exciting technique for mapping brain circuits. PRV preferentially travels along nerves and has been shown to be a safe and effective way to map brain circuits. We will use PRV to find and describe the interneurons in the rat and guinea pig that comprise these auditory reflex pathways, and correlate these findings with our physiologic studies of these two important feedback systems.

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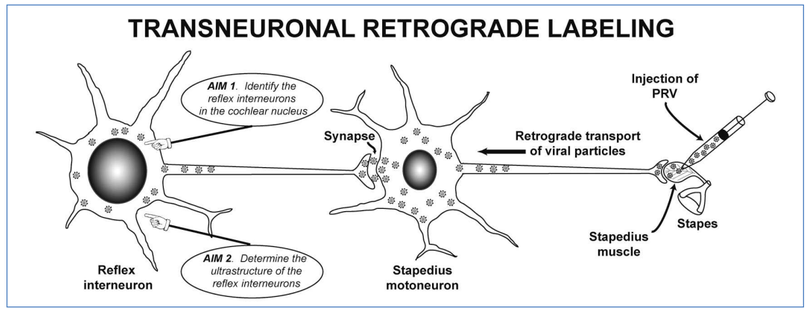

In the pathway shown here, PRV particles are injected into the stapedius muscle, taken up by nerve terminals and transported along the axon to the stapedius motoneuron. The particles replicate, proceed across the synapse, and are transported along the next axon to the cell body of the interneuron of the MEM reflex. The neurons that take up the PRV tracer will be visible using fluorescence microscopy. Analogous experiments will reveal the MOC reflex interneurons when the cochlea is injected with PRV.

Daniel J. Lee, MD, Dept. of Otolaryngology, UMass Memorial Medical Center and the Eaton-Peabody Laboratory, Massachusetts Eye and Ear Infirmary

Vestibular Efferent Innervation: Anatomical and Neurochemical Studies

We have been making slow but steady progress these last three months. We have performed several neuronal tracing experiments to determine the dimensions of efferent fiber terminal fields in the vestibular periphery. Our group is also working on the localization of CGRP receptors, the peripheral target of vestibular efferent fibers, and we hope to submit our work for presentation.

Publications related to this project:
Klapczynski, M., and A. Lysakowski. Concentration of low-abundance, high molecular weight, membrane proteins by repeated loading of tissue homogenate in SDS-PAGE. J.Neurosci. Meth. Submitted.
Cameron, P., M. Klapczynski, R. Gould, J.C. Holt, J.M. Goldberg & A. Lysakowski. Cloning and tissue expression of the nicotinic acetylcholine receptor subunit gene in the turtle. Neuroscience, Submitted.
Meeting presentations: Lysakowski, A. (2006) Organization of efferent pathways to the vestibular organs: origins, targets, and cytochemical subgroups, ARO 29th Midwinter Mtg. Abst., p. 169.
Barrese, J., and A. Lysakowski (2006) Improved method for preparing flattened whole-surface mounts of cristae sensory epithelium for use in the study of peripheral vestibular efferent projections, ARO 29th Midwinter Mtg. Abst., p. 263.

Original Parrish Holiday Card

This Holiday Season Card has been drawn exclusively for the American Hearing Research Foundation.

"May the Spirit of the Holiday Season
be with you throughout the
coming year"
This verse is printed on inside of card

"This card suppports
American Hearing Research Foundation and
was created by The Gray Dove
from an original
design by the late Joseph Parrish."
This message is printed on back of card

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New Board and Research Committee Members

Sumitrajit (Sumit) Dhar

Sumit Dhar is a new member of the AHRF's research committee.

Dhar received his bachelor's degree in audiology and speech language therapy in 1992 from the National Institute for the Hearing Handicapped, University of Mumbai, India. He also served as a clinical audiologist and coordinator at the Speech and Hearing Institute Research Center in India, where he oversaw audiology clinics and schools for the deaf.

Dhar earned his master's degree in audiology in 1995 from Utah State University in Logan, and earned his Ph.D. from Purdue University. After graduating from Purdue, Dhar joined the faculty at Indiana University, Bloomington, as an assistant professor. He is now at the Roxelyn and Richard Pepper Department of Communication Sciences and Disorders at Northwestern University. His research focuses on otoacoustic emissions as they relate to cochlear mechanics.

Wayne Paulson

Wayne Paulson owns Dreamteam, LLC, a health and wellness company, for the past 11 years. Prior, Paulson spent 32 years as chief executive officer or president of several firms involved in construction, and has specialized in site work and material handling.

Paulson received his bachelor's degree from the University of Illinois at Urbana-Champaign in 1964. He was a member of the 1963 Big Ten Champions football team and a member of the 1964 Rose Bowl team. He played professional football for the San Diego Chargers and the St. Louis Cardinals football team before a career-ending back injury.

Paulson is extensively involved in public service, educational, and charitable activities; and with the University of Illinois President's Council. He will be serving on the AHRF's media relations committee.

Suzanne Himmel-Pollack

Suzanne Himmel-Pollack, president of the Kiwanis Club of Chicago for seven years, is the first woman president of Kiwanis Chicago.

She's volunteered extensively at Northwestern Memorial Hospital greeting and directing visitors and patients, and has been volunteering in Chicago hospitals since she was 15.

Himmel-Pollack graduated from the School of Business at the University of Wisconsin, Madison; completed graduate work at Roosevelt University in the Lawyer's Assistant Program, and at the University of Chicago in the Interaction Management Program.

She will be serving as the attendance coordinator for the AHRF's 50th anniversary event, to be held on November 8, 2006. She is also a member of the media relations committee.

Robert McKenna

Robert McKenna's business experience has been primarily with Radio Flyer, Inc., manufacturer of the famous red Radio Flyer wagons. He has served as vice president of manufacturing, executive vice president, and chief operations officer for the company from 1973 to 1995.

McKenna received his bachelor's degree in business administration from the University of Notre Dame, Indiana, and attended DePaul University, Chicago for post-graduate law courses.

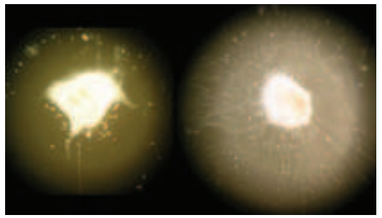
McKenna is a board member of Ada S. McKinley Community Services, Inc., one of Chicago's largest and most effective non-profit social service agencies. McKenna also serves as business advisor to St. John Berchmans Church. McKenna will be on the AHRF's media relations committee.

Sharon Parmet

Sharon Parmet is the new development and communications associate for the AHRF; Parmet will be involved in helping raise funds, and will contribute to the website and newsletter. Parmet has more than seven years experience in communications and media relations, and has worked at the University of Chicago Hospitals, the American Medical Association, and Solucient, a major hospital market research company. Prior to joining the AHRF, Parmet did freelance writing and media relations consulting for companies including StayWell Custom Communications, MWW Group, and Velsicol Chemical Company. Parmet earned her bachelor's degrees in biology and English from Skidmore College, Saratoga Springs, New York; and received her master's degree in scientific journalism from Boston University. Parmet can be reached at: sparmet@american-hearing.org

Wiley Harrison Otologic Research Grant

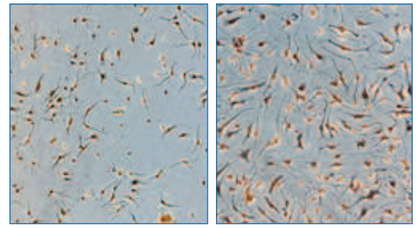
Stimulating Auditory Nerve Growth with Embryonic Factors



Explant cultures from a chick embryo. ODF stimulation causes dramatic neurite outgrowth.

John A. Germiller, M.D., Ph.D., at the Children's Hospital of Philadelphia, and recipient of the AHRF's Wiley Harrison Otologic Research Grant for 2006, is investigating the activity of a substance that is secreted by the inner ear during embryonic development. The substance, a mixture of unknown proteins, is called otocyst-derived factor (ODF) and seems to be responsible for initiating the innervation of the inner ear. Proper innervation (auditory nerve development) of the inner ear is critical to normal hearing, as these nerves relay sound information to the brain, which interprets the sound as words and noises. Dr. Germiller has shown that mouse auditory neurons are stimulated by ODF and grow rapidly in its presence, throughout development and even after birth.

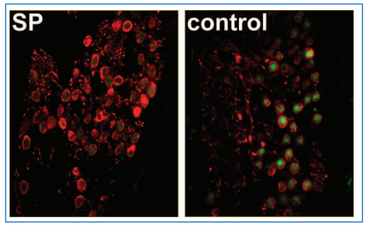
Dr. Germiller and colleagues are examining ODF to try to determine what it is made of, and the specific roles each component plays during embryonic development, "This will help us understand normal auditory nerve development, and may shed important light on clinical disorders such as auditory nerve deficiency." Because the group has seen that neonatal mouse neurons have an even stronger response to ODF than do embryonic neurons, this "may open a door to investigating ODF and its components as potential therapeutic agents in the future, to stimulate the auditory neurons to grow in children and perhaps even adults," writes Dr. Germiller. He is currently investigating whether ODF has an influence on auditory neurons after the neonatal period (in juvenile mice) and on adult mouse tissues. If so, then the components of ODF may hold promise as agents to maintain, or even regenerate, human auditory nerve cells in patients with hearing loss.



Exposure to ODF results in significantly improved survival of auditory neurons, and stimulates the robust outgrowth of long neurites.

Inhibition of JNK signaling to reduce SGN

Spiral ganglion neurons (SGNs) undergo apoptosis after the death of hair cells. SGN survival can be maintained in vivo and in vitro by adding neurotrophic factors or by stimulating neural activity. One important outcome of thia investigation has been our discovery that a proapoptotic signaling pathway involving Jun N-terminal kinase (JNK) and its target, the transcription factor Jun, is activated in vivo in SGNs that are undergoing apoptosis after the loss of hair cells. We hypothesized that (1) inhibition of JNK signaling will reduce SGN death in vitro and in vivo and (2) one or more of the prosurvival intracellular signaling pathways recruited by neural activity will suppress JNK activity. Our goal is to develop a fundamental understanding of exactly how SGNs die and to develop comprehensive strategies to protect SGN survival and function in deaf individuals, particularly in cochlear implant patients in whom SGN degeneration may compromise implant efficacy.



JNK-treated ganglia, and control, or untreated ganglia.

We are currently generating a peptide JNK inhibitor that can be intracochlearly infused and that will have greater specificity and enhanced solubility and so should be more effective in protecting SGN survival. Earlier work from our lab had identified three principal intracellular signaling pathways recruited by depolarization to promote survival, Ca2+/calmodulin-dependent protein kinase II (CaMKII), CaMKIV, and cAMP-dependent protein kinase. We have now shown that, of these, it is specifically CaMKII that links neural activity to suppression of JNK activation. Current work is focusing on identification of the molecular events intervening between CaMKII and JNK and defining the entire pathway.

Steven Green, M.D., Associate Professor of Biological Sciences and Otolaryngolgoy, University of Iowa

Can we identify genes that contribute to age-related hearing loss?

Typical hearing loss occurring with age is called presbycusis. Presbycusis begins with loss of sensitivity to the high pitches, and progresses to the middle and lower pitches that are important for understanding speech.

Although presbycusis is known to have a strong genetic component, the specific genes that cause people to be susceptible to developing presbycusis are still unknown. Dr. Robert Frisina, at Rochester Institute of Technology and others have shown that the hearing ability of maternal relatives (such as mother and child) correlate well. Since mitochondrial (*mt*) DNA is only inherited from the mother's egg, we are investigating whether there is a susceptibility factor in *mt* genes. We have used two different approaches to validate whether or not the *mt* genome is involved.

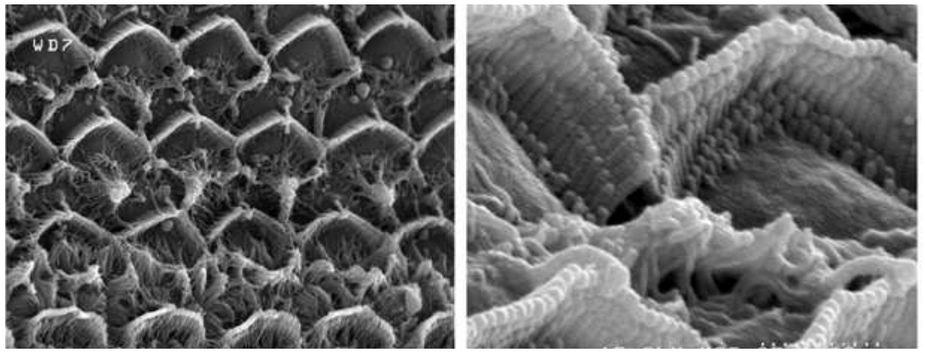
First, we sequenced a portion of the *mt* DNA in each of our subjects, and used the differences between people to draw a relationship tree of their *mt* genetic links. Then we designed a computer software program to determine whether position on the tree correlated with hearing ability. The correlations increased especially for one's ability to hear the high pitches, as would be expected for most cases of presbycusis. A more robust protocol uses genetic differences to group people into nine major European "haplogroup" genetic families (maternal lineages that go back thousands of years). Using this method, we found statistically significant differences. The biggest differences were seen with the right ear, which is known to lose sensitivity faster than the left in presbycusics. With an increased understanding of why certain individuals might be

Researchers Investigate Protein Involved in Sensorineural Deafness

Researchers from Vanderbilt University in Nashville, Tennessee are attempting to uncover the function of a protein thought to be critical for maintaining proper organization of the hair cells in the cochlea. The hair cells help translate sound waves into neural impulses that are in turn recognized as sounds by the brain. Normal hair cells (made up of protein strands, not actual hair) are straight, and are arranged into neat bundles containing up to 100 hairs. When the hairs within the bundles become disorganized, hearing impairment in the form of sensorineural deafness can result.

The researchers, led by Matthew Tyska, Ph.D., assistant professor in the Department of Cell and Developmental Biology at Vanderbilt University, have been studying a protein called *Myo1a* with funding from the American Hearing Research Foundation. In 2003, studies revealed that mutations in the *Myo1a* gene can cause deafness in humans but it's unclear how the protein contributes to causing hearing impairment.

Tyska and colleagues are currently experimenting with specially-bred knockout (KO) mice where *Myo1a* has been eliminated. Their hope is that the *Myo1a KO* mouse will serve as a model system that will help them illustrate the basis of hearing loss in humans with mutations in *Myo1a*.



This is a scanning electron microscope (SEM) image of the hair cells from the cochlea of a normal mouse.

American Hearing Impaired Hockey Association

Year-end Report for AHRF 2006

The American Hearing Impaired Hockey Association hosted its 33rd Stan Mikita Hockey School for the Hearing Impaired, June 10-17, 2006. The annual one-week hockey camp, held at the Seven Bridges Ice Arena, Woodridge, Illinois, was attended by approximately 100 hearing impaired athletes from across the nation. This year there were 25 new players on the roster. Athletes were assigned to one of four teams Freshman (two teams), Junior Varsity and Varsity depending on their age and hockey ability. In addition to daily practice and training sessions, teams played nightly games against Chicago area youth teams.

The Hockey School concluded with a game that featured the AHIHA Varsity team against the Stan Mikita All Star team, which is comprised of current and former Chicago Blackhawks and other hockey professionals.

The XVI Deaflympics will be held in Salt Lake City, Utah on February 1-12, 2007. The American Hearing Impaired Hockey Association hosted tryouts for the USA team during the 33rd Annual Stan Mikita Hockey School for the Hearing Impaired. Open tryouts began on Thursday, June 15 and concluded on Sunday, June 18. Participants surviving the first cut were invited to a training camp in August 2006 for further evaluation. Final selection will be made in Chicago in January 2007.

This will be the fifth time AHIHA has sponsored a team that has participated in the deaf equivalent of the Olympic Games. In previous competitions, Team USA has won one gold medal, one silver medal and two bronze medals. Hopes are high for bringing a gold medal back to the USA. This is the first international competition held in the United States for deaf hockey players in over twenty-five years. In previous international competition, the U.S. team has been successful, winning a gold medal, two silver medals and one bronze medal. In 2003, the U.S. Team won the bronze medal in Sundsvall, Sweden.

In addition to the annual Hockey School, AHIHA offers a number of other programs and services to players and their families throughout the year, such as helping students obtain hearing aids and speech, auditory and language therapy. AHIHA also maintains an extensive counseling service that assists parents and players with problems related to hearing loss.

During the past year, AHIHA also continued its programs that provide counseling for deaf and hard of hearing athletes and their families, educational scholarships for worthy recipients and stipends that help defray the high cost of needed medical equipment or services for deaf and hard of hearing athletes.

Another exciting development within the AHIHA organization is the modernization of their web site, www.ahiha.org. The new, improved web site allows downloading of registration forms, plays a short informational movie about the Stan Mikita Hockey School for the Hearing Impaired and for the first time, AHIHA can accept donations online.

AHIHA is always on the lookout for hearing impaired youngsters interested in playing hockey. If you know anyone who might be interested, contact Cheryl Hager 312 226-5880, or log on at www.ahiha.org.