Blog and Newsletter Article

Seeing the Symphony – AME Professor Tackles Hearing Loss

Sarah Warren

Rethinking Hearing Loss

University faculty and researchers generally garner recognition for their work in the form of awards, research grants, and attention within academic circles and industry insiders. But AME professor Rong Gan, Ph.D., gets an even higher honor – fan mail.

When articles about Gan's research on solutions for hearing loss are published in newspapers and magazines, letters pour in like clockwork from across the country. Usually from someone concerned about an elderly parent, nearly every letter reads something like this*: I read about your research. I will drive my father or mother from any distance to see you. Please work me into your schedule.*

With research like Gan's, the fan mail is no surprise. Her research measures sound and vibration transmission through the ear and is transforming hearing technology.

Gan began her career as a traditional mechanical engineer, working in car manufacturing for years. It was that foundation that instilled in her the fundamentals of mechanical engineering, specifically those related to movement, because as her research proves, mechanical principles of movement are essential to the hearing process.

Gan transplanted her mechanical engineering experience into the realm of biomedical engineering when the father of biomedical engineering, Y.C. Fung, asked her to study under him through Michael Yen at the University of Memphis and earn her doctorate degree. Gan was intrigued by the prospect of helping people through the same discipline that helped her design cars.

Harnessing the Mechanics of Hearing

Years, post-doctoral research appointments and millions of dollars in grants later, Gan is a preeminent biomedical engineer with knowledge that includes pulmonary circulation and the respiratory system. Today, she and her team at the University of Oklahoma and the Hough Ear Institute in Oklahoma City research what was for years the great mystery of hearing – the symphonic relationship between sound's movement through the ear and the inner ear's subsequent movement with sound frequencies, which, working in harmony together, actually creates hearing.

Gan developed a groundbreaking computer modeling program that creates 3-D computational models of the human ear for sound transmission. The program led to a new understanding of auditory frequencies, ear movement and functionality. The developments allowed her and her fellow researchers to literally view hearing and harness the mechanics of the ear. Gan and her team are preparing to license the software so other researchers can benefit from it.

This leap forward by Gan and her team led to developing hearing technology that does not simply amplify noise, but works in harmony with the movement of the ear and sound frequencies. The totally implantable hearing system (TIHS) is completely invisible from the outer ear, and it overcomes the drawbacks of traditional hearing technology like unsatisfactory sound quality,

undesired sound distortion, blocking of the external ear canal and acoustic feedback. The project has not been without difficulties. The team continuously works to overcome three distinct project challenges:

1. Minimizing patient risk by developing a system that can be surgically implanted with minimal disruption to the nerves around the ear while also being the right size for the inner ear, and that has a lifetime of usefulness so it never has to be removed.
2. Ensuring the cost/benefit ratio is comparable to traditional digital hearing aids
3. Enhancing the device's efficiency so it can be used for both mild and profound hearing loss.

TIHS is still in the early phases. While the team makes progress daily, the TIHS is not yet close to receiving approval from the Federal Drug Administration, and is not ready for product testing. Gan faithfully responds to every email from those anxious to be in a TIHS trial with this information.

Hearing the Rest of the Story

While Gan's research is the stuff of dreams for many who suffer from hearing loss, her personal history is closer to the stuff of legend.

Gan was born and raised in China. Her father, Yi Gan, left China as a young man to study in the West. He received both a bachelor's and a master's degree in mechanical engineering from the University of Cambridge and studied at military academies in the United States and the United Kingdom.

When World War II broke out, he returned to China and was appointed a major general. He was instrumental in protecting China's borders from Japan, and by the war's end, was a national hero.

In 1949 the war was long over and General Gan settled in for quiet life in higher education, but China's Cultural Revolution and its anti-intellectual views deterred those plans. Because of his Western education, General Gan was deemed an enemy of the people. Along with 550,000 others, General Gan was given the distinction of being a *Rightest,* which meant the government considered him at risk of having pro-capitalism, anti-communism views.

General Gan was imprisoned from 1955-1956, and from 1969-1976.

"The suffering," Gan said when sharing the dates of her father's imprisonment. "He suffered so much."

During many of the years he was imprisoned, Gan and her family had no idea where her father had been taken, if he was still alive, and if he would return.

General Gan did return. When the Cultural Revolution ended in the mid 70's, he was released. He resumed his quiet life in academia as a university vice president.

In 2010, at the age of 97, General Gan died. After the dramatic twists of fate throughout his life, he died a national hero. Gan returned to her homeland to organize her father's state funeral.

General Gan's legacy and love for education lives on in both America and China. After the Cultural Revolution, Gan and her siblings all came to the United States to finish their educations. Today,

Gan's daughter, nephews and niece are all current or future professors. General Gan and his late wife left their estate to an organization that helps educate poor children in China's rural villages

Rong Gan, like every faculty member at the School of Aerospace and Mechanical Engineering, brings a unique background and personal perspective to her research and teaching. For Gan that involves a family legacy that embraces and even sacrifices for education, and the need to make a difference in the lives of people.

As the fan mail suggests, Gan, like her father, is already a hero to many.

For a more detailed view of the TIHS, please view an article Gan wrote for *Medical Design*: http://medicaldesign.com/engineering-prototyping/research-development/implantable-hearing-system-0411/index.html