



**AMERICAN  
OTOLOGICAL  
SOCIETY**



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**“A Study of the "Third Window" Phenomenon using Inner-ear Pressure Measurements”  
FELLOWSHIP GRANT 2015**

**Amount Awarded by AOS: \$40,000**

**Ongoing Funding: Hearing Research Inc. UCSF**

**PUBLICATIONS:**

Guan XY, Cheng YS, Galaiya D, Rosowski JR, Lee DJ, Nakajima HH. *Bone conduction hyperacusis induced by superior canal dehiscence in human – the underlying mechanism*. Submitted May 2020 to Scientific Reports. Sci Rep. 2020 Oct 6;10(1):16564. doi: 10.1038/s41598-020-73565-4. PMID: 33024221.

Cheng YS, Raufer S, Guan XY, Lee DJ, Halpin CH, Nakajima HH. *Superior canal dehiscence similarly affects cochlear pressure in temporal bones and audiograms in patients*. Ear Hear. 2019 2020 Jul/Aug;41(4):804-810.

Guan XY, Cheng YS, Galaiya D, Nakajima HH. *The Effect of Round Window Reinforcement on Human Hearing*. AIP Conference Proceedings. 2018 May; 1965(1):150004.

Cheng YS, Kozin ED, Remenschneider AK, Nakajima HH, Lee DJ. *Characteristics of wax occlusion in the surgical repair of superior canal dehiscence in human temporal bone specimens*. Otol Neurotol. 2016 Jan;37(1):83-8.

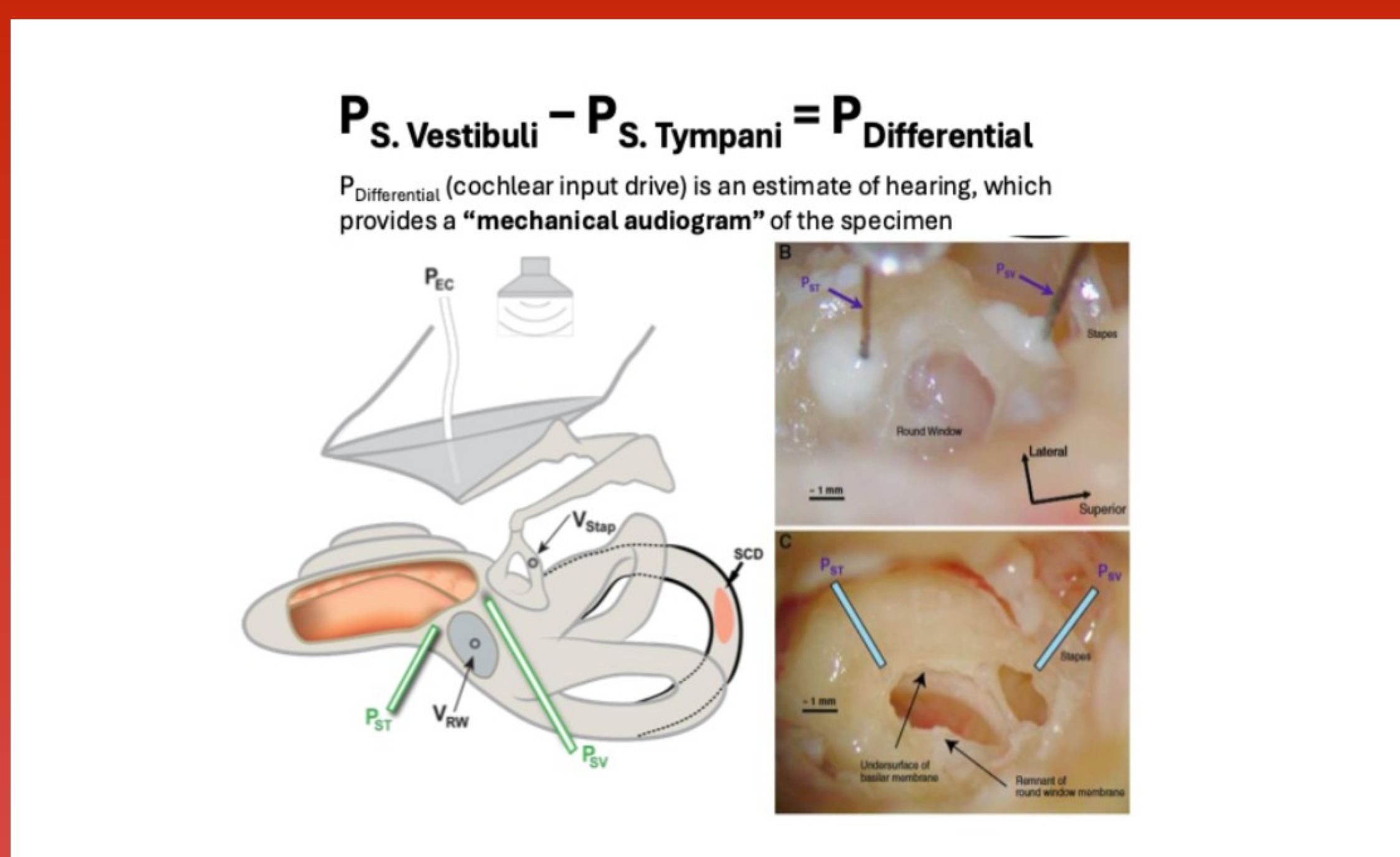
Noij KS, Duarte MJ, Wong K, Cheng YS, Masud S, Herrmann BS, Curtin HD, Kanumuri VV, Guinan JJ Jr, Kozin ED, Tarabichi O, Jung DH, Lee DJ, Rauch SD. *Toward Optimizing Cervical Vestibular Evoked Myogenic Potentials (cVEMP): Combining Air-Bone Gap and cVEMP Thresholds to Improve Diagnosis of Superior Canal Dehiscence*. Otol Neurotol. 2018 Feb;39(2):212-220.

Jan TA, Cheng YS, Landegger LD, Lin BM, Srikanth P, Niesten ME, Lee DJ. *Relationship between surgically treated superior canal dehiscence syndrome and body mass index*. Otolaryngol Head Neck Surg. 2017 Apr;156(4):722-727.

Barber SR\*, Cheng YS\*, Owoc M, Lin BM, Remenschneider AK, Kozin ED, Lee DJ. *Benign paroxysmal positional vertigo commonly occurs following repair of superior canal dehiscence*. Laryngoscope. 2016 Sep;126(9):2092-7.

**RESEARCH SUMMARY:**

Symptoms in superior semicircular canal dehiscence (SCD) syndrome can be explained by the SCD behaving as a “third window” of the inner ear, which results in leak of volume velocity or sound flow towards the defect. We measured intracochlear sound pressures the scala vestibular, and tympani of fresh human temporal bones and quantified the change in inner ear mechanics when an SCD is present. We used this model to test the influence of SCD size and position, as well as various repair surgical techniques including round window reinforcement.



**OUTCOMES:**

The human temporal bone model provides an excellent model for studying SCD syndrome

Surgical repair of the SCD restores normal inner ear mechanics.

Round window reinforcement does not restore normal inner ear mechanics, but results in small, frequency-specific changes in cochlear drive.

**FURTHER FUNDING HAS ENABLED US TO EXPAND OUR RESEARCH TO:**

The experimental measurements we obtained have helped us refine and create an accurate computational model of the middle and inner ear. This has been valuable in understanding both pathology affecting the mechanics of the ear, but also in advancing knowledge on physiology of hearing.

**LAY SUMMARY OF FINDINGS AND IMPLICATIONS OF THIS RESEARCH:**

Patients can suffer debilitating symptoms from SCD syndrome. We have demonstrated that surgical repair can restore normal mechanics in the human ear.

Other technique may affect symptoms in unexpected ways, but with the human temporal bone model, we can study and quantify these effects.