

## Tmprss3 deficiency does not affect auditory neuron differentiation: Implications for cochlear implantation

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**Background and Hypothesis:** TMPRSS3 variants are one of the most common genetic causes of hearing loss in children and adults undergoing cochlear implantation (CI). Controversy exists regarding the success of CI in patients with TMPRSS3-mediated hearing loss as a prior immunolabeling study localized TMPRSS3 to the spiral ganglion (SGN) neurons. Type I SGNs transmit sound information to the CNS, while Type II SGNs are thought to play a role in amplification. Sensory hair cells (HC) that synapse on the SGN appear normal at birth but rapidly degenerate at the onset of hearing (postnatal day 12) in Tmprss3-mutant mice implicating an extrinsic process in HC death. During development, the precise pattern of SGN subtypes requires spontaneous firing of HCs prior to the onset of hearing. We hypothesize that Tmprss3 does not impact HC mechanotransduction or SGN subtype patterning.

**Project Methods:** Cryosections of control and Tmprss3 mutant (Tmprss3<sup>Y2560X</sup>)

Y260X) mice at P11 and P21 were immunolabeled with antibodies specific for SGN subtypes and all neurons. Cell counts were analyzed including two-tailed unpaired t test with significance of  $p < 0.05$  ( $n=3$  for each condition). Whole mount cochlea from P7 mice were used to test HC mechanotransduction using FM1-43 uptake assay. Tmprss3 gene expression was determined using hybridization chain reaction.

**Results:** There was no difference in subtype patterning at P11 or P21 except Tmprss3 mice had less Type II SGNs at P21. Tmprss3 is not expressed in Type I SGNs and has limited expression in Type II SGNs. FM1-43 uptake was unaffected in Tmprss3-mutant mice.

**Conclusion/Potential Impact:** SGN patterning is normal in Tmprss3-mutant mice suggesting that TMPRSS3 plays no physiologic role in the spontaneous firing or mechanotransduction of HCs. The limited expression of Tmprss3 within SGNs and normal SGN patterning supports CI as an effective treatment option for patients with TMPRSS3-mediated hearing loss.



### Claude Smith Black, MD, Award for Outstanding Work in Research

Jasmine Verena Moawad is a third-year medical student, who is currently interested in otolaryngology.

"My most important takeaway from summer research was the ability to gain exposure to my field of interest. I grew up seeing cochlear implantation from the patient perspective, so I really enjoyed the opportunity to learn more about inner ear physiology and cochlear implantation from the laboratory side."

## A Mixed Methods Analysis of Patient Utilization and Trust of Emergency Medical Services (EMS)

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**Background:** Little is known regarding patients' decisions to come to the emergency department (ED) via emergency medical services (EMS) versus privately owned vehicle (POV) and no studies have investigated patients' trust of the EMS system as it varies by race.

**Methods:** Patients who came to one urban, academic ED were given a mixed methods survey at bedside. Qualitative data identified patient reasoning for utilization of EMS versus POV. Quantitative data included patient demographics, medical and social history, and two validated scales to assess trust and perceived empathy of EMS providers (the Group-Based Medical Mistrust Scale and the Jefferson Scale of Patient Perception of Physician Empathy). Descriptive statistics showed characteristics of patients who came in via EMS versus POV and an unpaired t-test described the difference in EMS trust as it varied by race.

**Results:** Qualitative: Patients who came via EMS reported lack of access to a POV, inability to drive, and the inability to move secondary to the chief presenting medical complaint. Patients who came in via POV based their selection on speed, high cost of EMS transport, the ability to drive themselves safely, or lack of perceived emergency.

Quantitative: 9/23 (39.1%) patients utilized EMS transport and 14/23 (60.9%) utilized POV. 56.5% of patients were Black and 39.1% were White. Of those who came in by EMS, only 5/9 (55.5%) felt they had an immediate threat to life, organ or body function. The Group-Based Medical Mistrust Scale indicated that Black patients had less trust in the EMS system than White patients ( $p=0.04$ ), while the Jefferson Scale of Patient Perception of Physician Empathy demonstrated no significant difference ( $p=0.60$ ).

**Conclusion and Potential Impact:** Hopefully, this data will inform policy makers attempting to make the emergency care system accessible to all patients and provide appropriate non-emergent options for optimal medical care.



### General Excellence Award

Alex LaShell is a third-year medical student, who is currently interested in emergency medicine and intensive care. She enjoys the acuity of care and breadth of patients offered in these settings.

"My most important takeaway from this research has been learning more about qualitative studies, especially in the area of health equity. I like to understand the thought processes people have and this type of study is a really interesting way to understand the 'bigger picture' of patient perspective and how it impacts their care."