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Development of a novel pharmaceutical to prevent noise-induced hearing loss

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Western BrainsCAN
Transforming brain research.

Project **Summary**

KNOWLEDGE MOBILIZATION & IMPACT

Development of a novel pharmaceutical to prevent noise-induced hearing loss

Background

Hearing loss is the fastest growing chronic health condition facing Canadians. Age-related hearing loss is common but another leading cause of hearing loss worldwide is excessive exposure to loud noise.

Hearing loss has huge implications on our ability to communicate effectively and there is clear evidence that it increases the risk for developing dementia, including Alzheimer's disease, and accelerates age-related cognitive decline.

The Problem

When exposed to excessive sound, the sensory hair cells in the cochlea (the inner ear) aren't damaged immediately but instead the damage progresses over the hours and days following the exposure as the cells undergo oxidative stress.

Oxidative stress is an imbalance between free radicals and antioxidants in the body. Free radicals are oxygen-containing molecules that react with other molecules in the body and release electrons, known as oxidation. When functioning correctly, oxidation is a normal process and free radicals can help fight pathogens, for example. Antioxidants can react with free radicals and receive the electrons, reducing the reactivity of the free radicals, without themselves becoming unstable.

The body can use this oxidation process, securing benefit from free radicals' reactivity to avoid infections and then balancing with antioxidants to avoid unwanted cell damage. But when the balance of free radicals and antioxidants is out of control, the free radicals can start to damage other cells in the body.

Despite understanding that it is this oxidative stress that is killing the sensory cells in the ear during the period shortly after the noise trauma, research has not yet found a pharmaceutical that can safely and effectively reduce or prevent it. This goal, to find a pharmaceutical that can be administered after exposure to loud noise that reduces or avoids hearing loss, has been the subject of decades of research, but without success.

Normally found in the cochlear cells, an antioxidant called 'catalase' plays a crucial role in protecting against oxidative stress. Research has already shown that therapeutically increasing, or at least maintaining, catalase levels following exposure to loud noise is highly desirable. A major challenge is targeting the cells undergoing oxidative stress with catalase.

The Project

To limit the damage caused by noise-induced oxidative stress, we intend to determine the most effective way to deliver a customized version of catalase to the vulnerable sensory hair cells in the cochlea. We will conduct experiments to explore how best to 'package' and deliver catalase to the subject.

Subsequent projects can then explore how effective it is at addressing oxidative stress and how localized the delivery has been.

Western Researchers

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Funding Program

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