Ototoxic Drug Levels in Cochlear Tissues: Validating Machine Segmentation of Drug Uptake in Individual Cells Types of the Cochlea in Confocal Images

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Aminoglycosides are antibiotics that are often used to treat patients suffering from severe bacterial infections yet they induce irreversible hearing loss. The mechanisms by which these drugs enter the cochlea are poorly understood. They cross the blood-labyrinth barrier (BLB) of the cochlea and enter hair cells to cause hair cell death. The BLB is composed of tight junction-coupled endothelial cells lining the capillaries running through the cochlea, particularly in the stria vascularis and spiral ligament in the lateral wall of the cochlea.Segmentation analysis is used to note drug uptake of confocal images. Different forms of segmentation are performed to better the understanding of drug uptake. The original image is a raw image of blood vessels in the stria vascularis of a mouse injected with DTR (Dipheria Toxin Receptor). DTR is a receptor that binds to dipheria toxin and once the two bind together they induced hair cell death, resulting in deafness. Different forms of segmentation were used to clearly note tissue. Manual segmentation is performed to remove blood vessels so cells bodies of only the intermediate cells are visible. Machine segmentation uses an algorithm to detect edges of the blood vessels and remove them from analysis. The descriptive statistics for both forms of segmentation were found and compared. Manual segmentation is a time-consuming process so I wanted to automate the process by testing an algorithm that could potentially segment faster in order to isolate the cytoplasm of a single cell layer. I discovered that the differences between machine and manual segmentation were not significant yet their similarities were extremely relative. This means that instead of manually segmenting images, machine segmentation can be done.

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