CHARACTERIZING TRANSPORT MODEL IN COCHLEAR AQUEDUCT USING CT DATA AND A BAYESIAN INVERSION APPROACH

AMAL ALGHAMDI

Recent studies in rodents and humans show that gene therapy or tracers injected into cerebrospinal fluid (CSF) reach the inner ear. The communication of fluid between the cochlear and the subarachnoid spaces of the brain has been controversial for decades. Observations of transport between the cochlea and the subarachnoid space contrast with the different composition of the fluids. The recent discovery of a membrane in the cochlear aqueduct raises further questions about the restrictions of transport between the compartments. This study aims to numerically quantify the diffusive and advective modes of transport of inert molecules from CSF to an intact cochlea. We use imaging data of the transport of a small tracer (Omnipaque, X kDa) through the cochlear aqueduct and scala tympani in five C57B6 mice (8-week-old males). The imaging is done using dynamic contrast-enhanced Computed Tomography (CT) of the injection of the tracer into the CSF via cisterna magna during ketamine/xylazine anesthesia. To estimate the transport model parameters, we use a Bayesian statistical approach which allows the diffusivity to vary with potential membranes. We carry out the implementation using the software tool CUQIpy (Computational Uncertainty Quantification for Inverse Problems in Python).

Joint work with Peter Bork, Barbara K Mathiesen, and Jakob S Jørgensen