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Understanding the glymphatic mystery:
Analysis and discretization methods for network models

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ABSTRACT

The brain is an energy intensive organ, consuming nearly 20% of the body's energy. Strangely, however, the brain does not have lymphatic vessels for removing metabolic waste. This raises the central question: How does the brain rid itself of waste? This question is critical to answer as several neurological diseases, among them Alzheimer's disease, are caused by an accumulation of toxic proteins.

Intriguingly, recent experiments have shown that cerebrospinal fluid flows preferentially through so-called perivascular spaces. In this talk, we develop a network model describing this flow, and show that it can be succinctly described and discretized using concepts from graph calculus. Solutions are sought in suitable graph Sobolev spaces. The discretized network model offers both cheap and accurate simulations of perivascular fluid flow, allowing us to answer fundamental questions regarding its driving forces.