Brain membranes and vasculature
- a computational mathematics tale of dimensional gaps

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ABSTRACT

Structurally, brain tissue is characterized by thin cell membranes and slender vessels, defining submanifolds of codimension one and two respectively. Functionally, your brain fundamentally relies on the transport of ions and nutrients and movement of water in and between these spaces. These physiological processes are clearly crucial for brain function and health, but the precise mechanisms and their association with neurodegenerative diseases such as Alzheimer's and Parkinson's disease and neurological events such as seizures remain only partially understood. Notably, mathematical and computational modelling are beginning to play an important role in gaining new insight.

In this talk, I will discuss key mathematical, numerical and computational challenges associated with modelling brain mechanics and transport across scales with an emphasis on coupled systems of partial differential equations with dimensional gaps.