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Mathematical and Computational Modelling of Fluid Flow and Transport in the Brain and Spinal Cord

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ABSTRACT

This minisymposium is dedicated to mathematical and computational modelling of the flow of cerebrospinal and interstitial fluid in the brain and spinal cord, transport of solutes within the central nervous system and associated biomechanical topics. These physiological processes play a fundamental role in regulating the homeostasis of our central nervous system, and are associated with neurodegenerative diseases such as Alzheimer's disease, with cerebral edema caused by e.g. brain stroke, and therapeutic interventions such as e.g. cerebral drug/agent delivery. Despite their importance, even fundamental mechanisms remain poorly understood. However, mathematical and computational modelling could contribute to fundamentally new avenues of investigation and new insight. The mechanics of the central nervous system is inherently multiscale and amenable to a multitude of modeling approaches, see e.g. [1]. We will invite and welcome contributions on

- Mathematical and computational modelling of cerebrospinal and interstitial fluid dynamics, tissue interaction and associated solute transport;
- Multiscale modelling bridging spatial and temporal scales from the molecular through the cellular to the tissue level;
- Multiphysics modelling coupling mechanical, electrical and chemical features;
- Numerical topics such as design and analysis (stability, robustness, convergence) of new numerical methods and efficient solution algorithms for biological porous media flow;
- Computational or implementational aspects relevant for large-scale simulation, reduced order modelling, uncertainty quantification and/or parameter estimation;
- Applications including but not limited to neurological conditions such as Chiari malformations, syringomyelia, and normal pressure hydrocephalus.

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