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MODELLING AND SIMULATION OF CEREBROSPINAL FLUID AND INTRACRANIAL DYNAMICS

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MINI-SYMPOSIUM PROPOSAL

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1 ABSTRACT

The human brain evolved to become an organ of unsurpassed ability, though its power comes at the price of anatomical, biochemical and logistical complexity. The cerebrospinal fluid (CSF) system is one of several fluid compartments involved in the function of the central nervous system (CNS), comprising the brain, spinal cord and neural parts of the eye. CSF is mainly contained in the cerebral ventricles, cisterns, sulci, brain subarachnoid spaces and spinal subarachnoid space. The traditional view of CSF physiology assumes that the majority of CSF is produced by the choroid plexus, circulates through ventricles,cisterns and the subarachnoid spaces to be reabsorbed into the venous blood by the arachnoid villi. Moreover, CSF research has for a long time been a topic in itself and has largely ignored the anatomical and functional links between the CSF system and other CNS fluid compartments, particularly the venous and the lymphatic systems.

An astonishingly small body of work has been devoted to study the CNS as a system, and hence the CSF compartment as an integral part of several interacting fluid compartments, although it is widely recognized that functional insights are likely to be discovered only when biochemical, mechanical and electrophysiological evidence are causally integrated.

This symposium posits multifunctional and multiscale mathematical analysis to unlock pressing questions about brain and CNS. This mini-symposium wishes to introduce a small number of carefully selected frontiers of CNS function. A set of select experts will provide lectures on the most pressing problems and possible solutions using computational and mathematical techniques. The emphasis will be on multiscale multi physics systems approaches. Invited contributions will be sought but are not limited to the following topics:

- Dynamics and control of cerebral blood flow
- CNS wise pharmacokinetics and metabolism of the brain
- Tissue simulation bringing the gap between cellular and macroscopic biomechanics models (blood brain barrier modeling)
- CSF dynamics and its interaction with cerebral blood flow and tissue mechanics
- CSF compartments and the lymphatic system

- Interstitial transport and molecular water exchange in the brain
- Refined experiments to assist mathematical modelling
- Diseases associated with CSF pathologies