Computational Modeling of Cerebrospinal Fluid (CSF) flow in pathological conditions

The cerebrospinal fluid (CSF) is a colorless and odorless bodily fluid that surrounds the brain and the spinal cord and is contained within the cerebral ventricles. The CSF performs a number of functions that are vital to the central nervous system (CNS). Pathological disorders can disturb the CSF hydrodynamics, and conversely analysis of CSF dynamics can shed light on various pathological conditions. A full understanding of the CSF physiology and pathophysiology remains elusive to physicians and researchers – making it an active field of research.

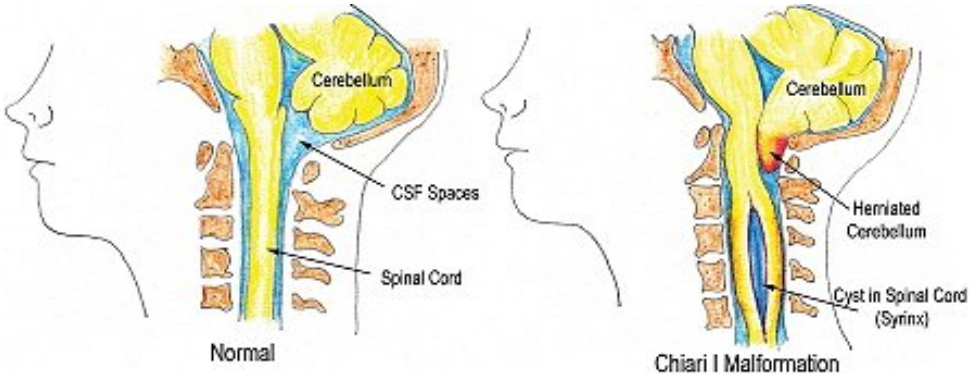

Figure 1 A schematic representation of Chiari I malformation. The left part of the image shows cerebellum of a healthy person where the blue fluid shows free movement of the CSF. This passage of the CSF is blocked by the herniation of cerebellar tonsils due to Chiari I malformation in the right part of the image. The Chiari case also has a fluid filled cavity in the spinal cord termed syringomyelia.
Source: Chiari Institute

Chiari malformation is a condition in which part of the cerebellum descends down the foramen magnum and causes obstruction to the CSF outflow. Using advanced mathematical models for fluid dynamics and simulations on parallel clusters, we aim to understand detailed characteristics of the CSF flow and associate them with conditions like Chiari malformation.

The master thesis will specifically involve:

- Medical image analysis and development of 3D surface models
- Computations using the Lattice Boltzmann Method (LBM) and analysis of results thereof
- Study of the effect of different flow rates and respiration on CSF hydrodynamics

What we offer:

- Interdisciplinary and international environment
- Exposure to and experience with high performance computing resources
- Expert interdisciplinary supervision

What we expect:

- Interest in contributing to emerging area of computational biofluid dynamics
- Basic knowledge of any programming and scripting language, and experience with linux systems
- Proactivity, teamwork, and willingness to learn

For further information, or to apply, please send an email to:
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