RESTORING CEREBROSPINAL FLUID TRANSPORT

Andreas Linninger, MD, PhD is a Professor of Chemical Engineering at the University of Illinois at Chicago. Dr. Linninger is focused on fluid dynamics and micro-electronic device design. In his study, Molecular Intervention for Brain Water Regulation in Hydrocephalus, Dr. Linninger will use a novel microfluidic platform to quantify the amount and speed of water flux through aquaporin-4 channels, which are present in the brain and are involved in fluid regulation. This work will create the foundation to test drug interventions to increase fluid flow.

GOAL
Enhance physiological absorption of cerebrospinal fluid (CSF)

THEORY
Flow of Fluid
GOAL
Enhance physiological absorption of cerebrospinal fluid (CSF)

GOAL
Enhance physiological absorption of cerebrospinal fluid (CSF)

THEORY

Fluid leaves the brain through blood vessels
Astrocytes, a type of cell in the brain, aids this process
Increase density of a fluid channel on astrocytes
Increase CSF outflow

Flow of Fluid

Fluid Channels
Astrocytes
Junctions between Astrocytes

WHY IS THIS WORK INNOVATIVE?

Develops a new way to test CSF absorption
This is important for quickly testing new drugs

Potential for non-invasive Intracranial Pressure (ICP) management
Increasing physiological CSF outflow may negate the need for a shunt

METHODS

1 Grow astrocytes in a controlled environment
2 Measure Fluid Flow
   - Volume of fluid flow
   - Route of fluid flow
3 Enhance fluid flow
   - Increase fluid channels
   - Measure changes in flow

Microscope used to plant astrocytes
Microfluidic Chip = Controlled Environment
AQP4 staining on astrocytes

Relative AQP4

Control
9 hrs 1.1
18 hrs 1.9

SUL 9
1.48
SUL 18
1.68

Hydrocephalus Association