

CISS

OSHIMA LAB.

[Hemodynamic Simulation and in vitro Experimental Measurement for Predictive Medicine]

Department of Mechanical and Biofunctional Systems /
Center for Research on Innovative Simulation Software

Computational Fluid Dynamics

Department of Mechanical Engineering /
Interfaculty Initiative in Information Studies

<http://www.oshimalab.iis.u-tokyo.ac.jp/>

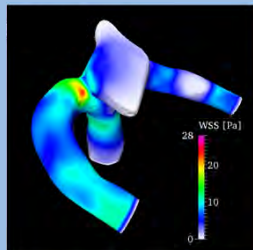
Investigation of Bio/Micro-fluid Mechanics

◆ Objectives

- ❑ To investigate the influences of vascular geometry on hemodynamics
- ❑ To develop a numerical simulation system for clinical diagnosis

Simulation

● 3D modeling of arterial geometry & simulation

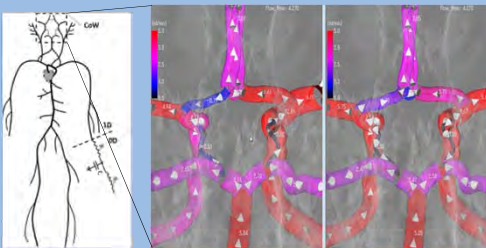


Simulation Results



Circle of Willis

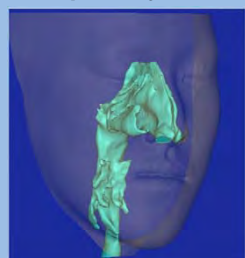
● Patient-specific 1D0D simulation taking systemic circulation into consideration



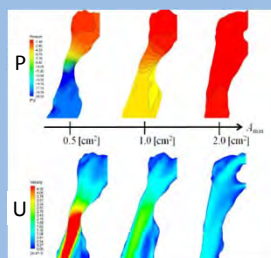
Pre-operation

Post-operation

● Airflow simulation in upper respiratory tract



3D Modeling



Pressure/Flowrate Distributions

Experiment

● Stereo-PIV flow measurement in realistic blood vessel geometry

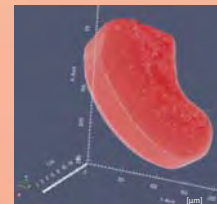


Realistic model of cerebral aneurysm

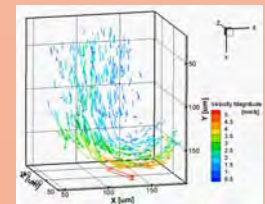


Streamlines inside aneurysm

● Flow measurement for droplet formation inside microchannel using digital holography

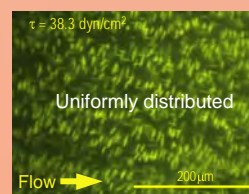


3D interfacial geometry between water and oil



3D flow inside droplet

● Empirical evaluation of endothelial cell damage under wall shear stress (WSS) load

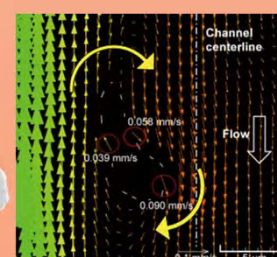


Low WSS load



High WSS load

● Simultaneous measurement of the motion of a single Red Blood Cell and surrounding flow using multicolor confocal micro-PIV



Tank-treading motion and surrounding velocity distribution of a single RBC