

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/>

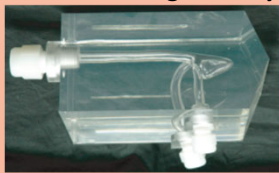
## Investigation of Bio/Micro-fluid Mechanics

### Objectives

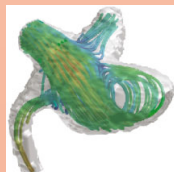
- To investigate the influences of vascular geometry on hemodynamics
- To develop a numerical simulation system for clinical diagnosis

### Experiment

- Stereo-PIV flow measurement in realistic blood vessel geometry

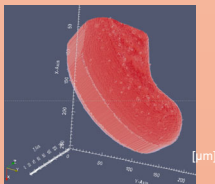


Realistic model of cerebral aneurysm

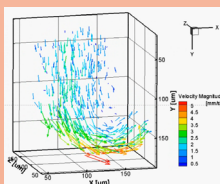


Streamlines inside aneurysm

- Flow measurement for droplet formation inside microchannel using digital holography

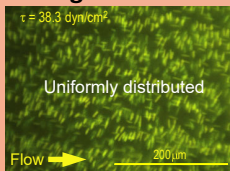


3D interfacial geometry between water and oil

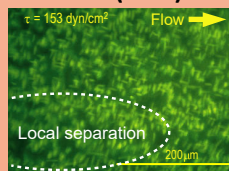


3D flow inside droplet

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

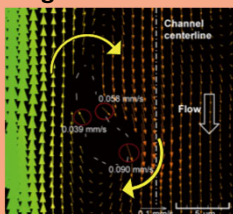


Low WSS load



Low WSS load

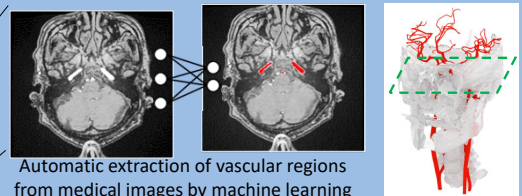
- Simultaneous measurement of the motion of a single Red Blood Cell and surrounding flow using multicolor confocal micro-PIV



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

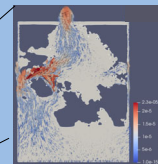
### Simulation

- 3D modeling of arterial shape using machine learning and blood flow prediction using statistical shape models

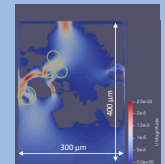


Automatic extraction of vascular regions from medical images by machine learning

- Improvement of drug efficiency by simulating the behavior of drug micelles in AAA

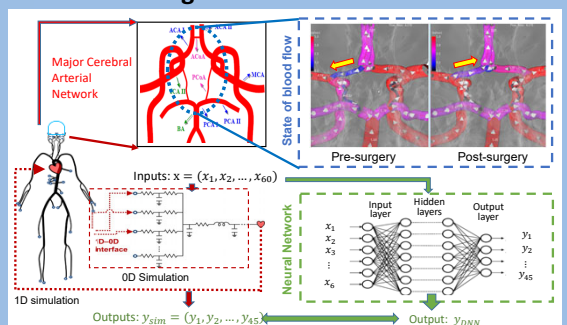


Nanoscale blood flow simulation in the vessel wall of AAA



Analysis of trap position of drug micelle using the result on the left

- Machine learning assisted prediction of hemodynamics in the cerebral circulation after stenting



- Study of the effect of surface smoothing method on hemodynamic factors in blood

