

# 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/>

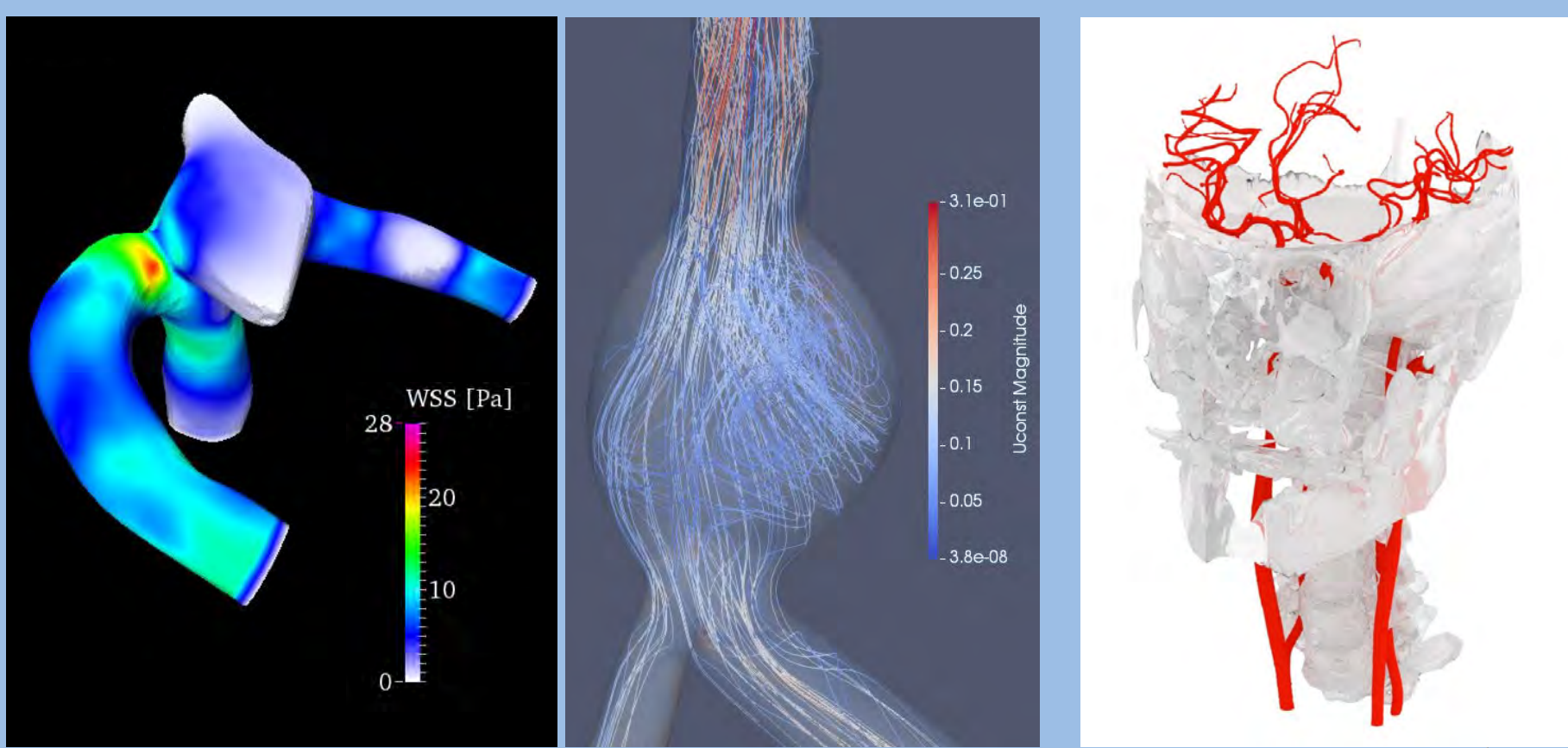
### Investigation of Bio/Micro-fluid Mechanics

#### ◆ Objectives

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

#### Simulation

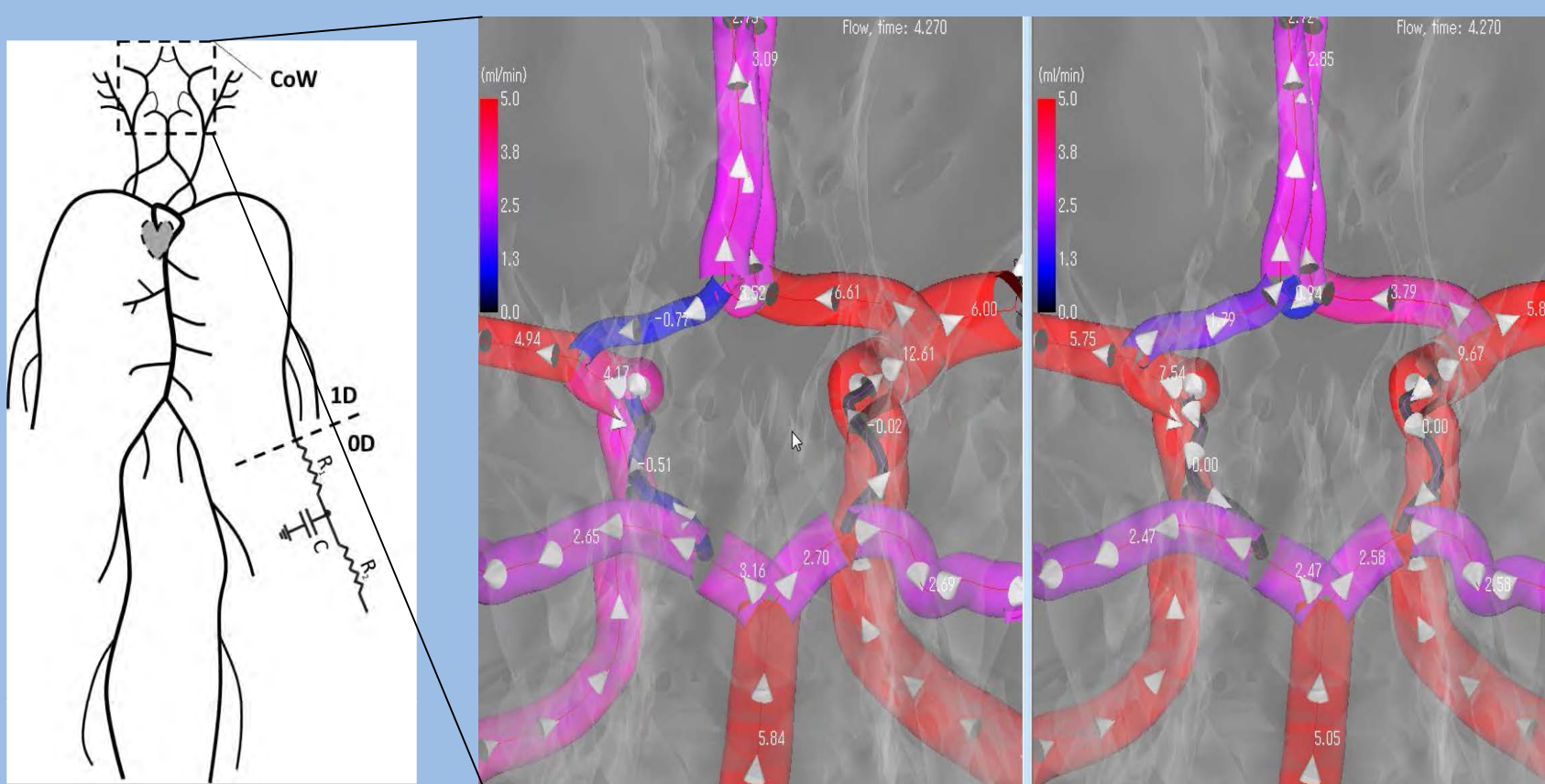
##### ● 3D modeling of arterial geometry & simulation



Simulation Results

Circle of Willis

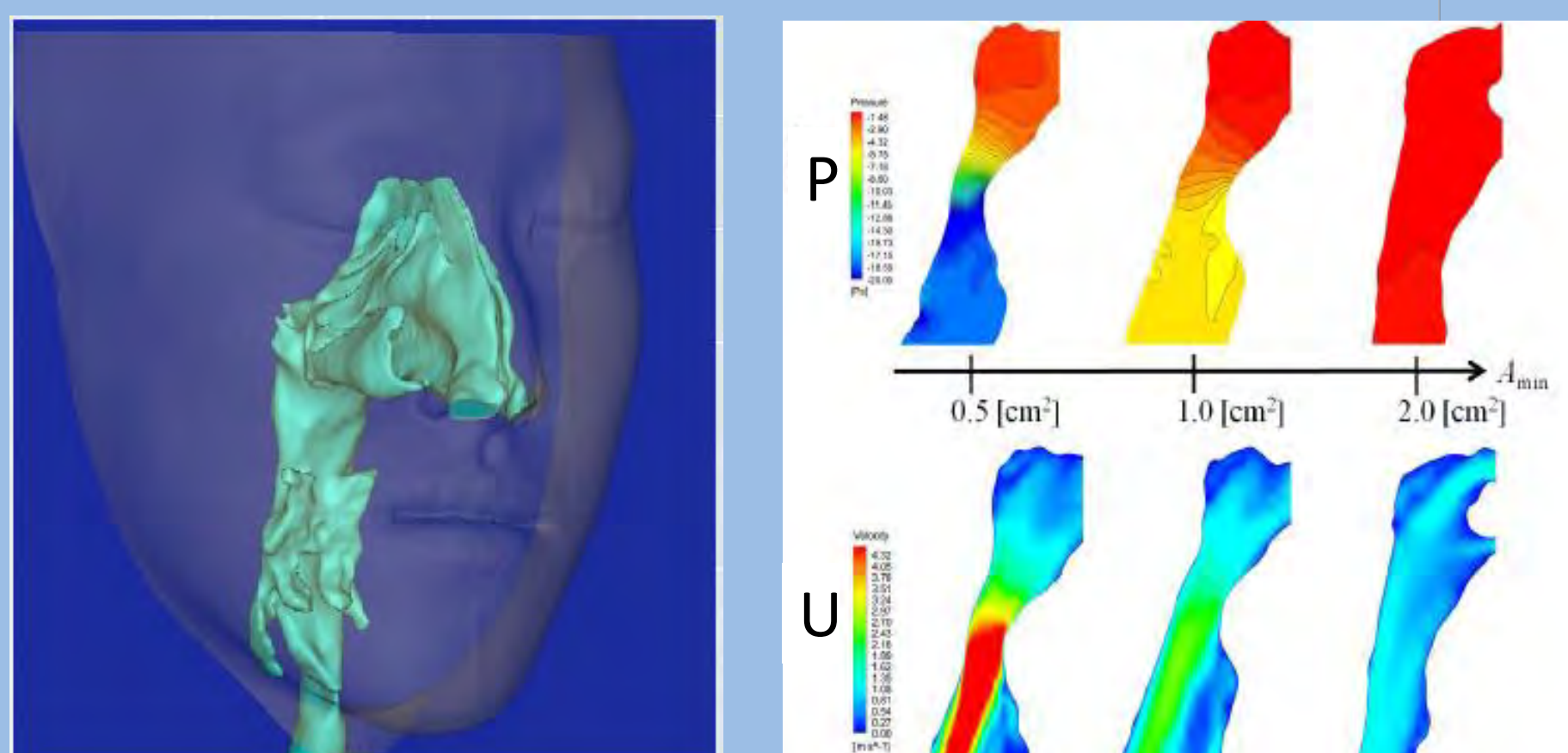
##### ● Patient-specific 1D0D simulation taking systemic circulation into consideration



Pre-operation

Post-operation

##### ● Airflow simulation in upper respiratory tract

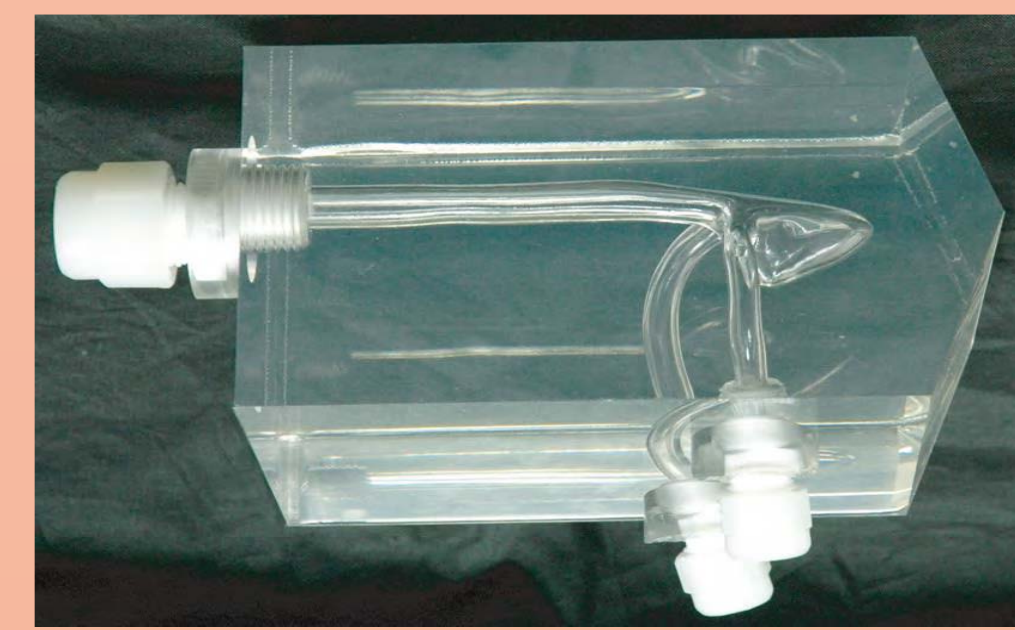


3D Modeling

Pressure/Flowrate Distributions

#### Experiment

##### ● Stereo-PIV flow measurement in realistic blood vessel geometry

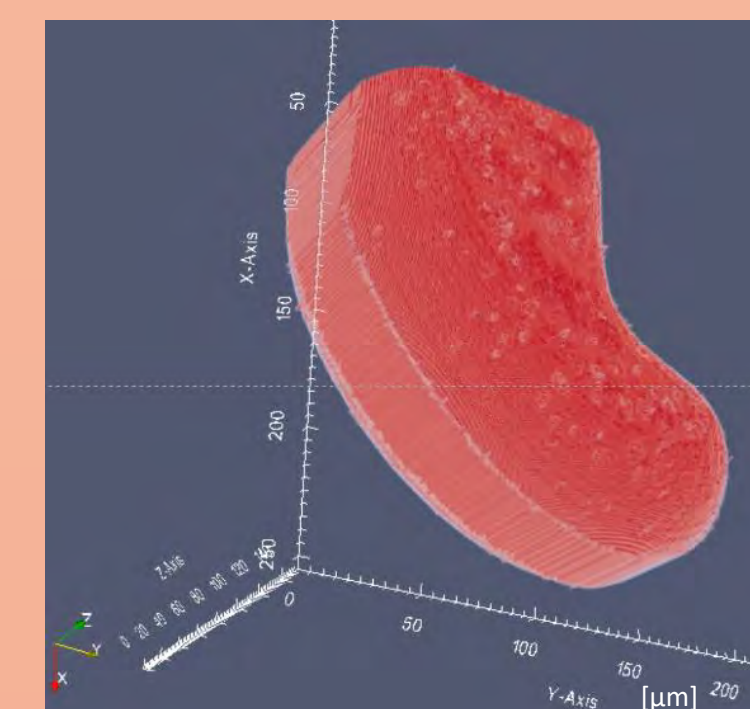


Realistic model of cerebral aneurysm

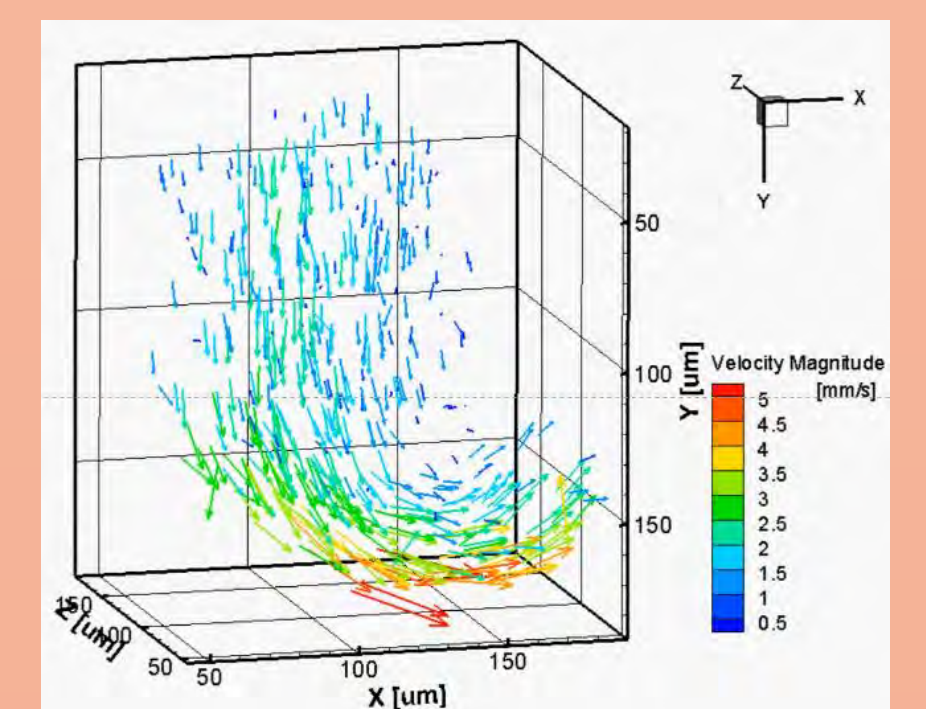


Streamlines inside aneurysm

##### ● Flow measurement for droplet formation inside microchannel using digital holography

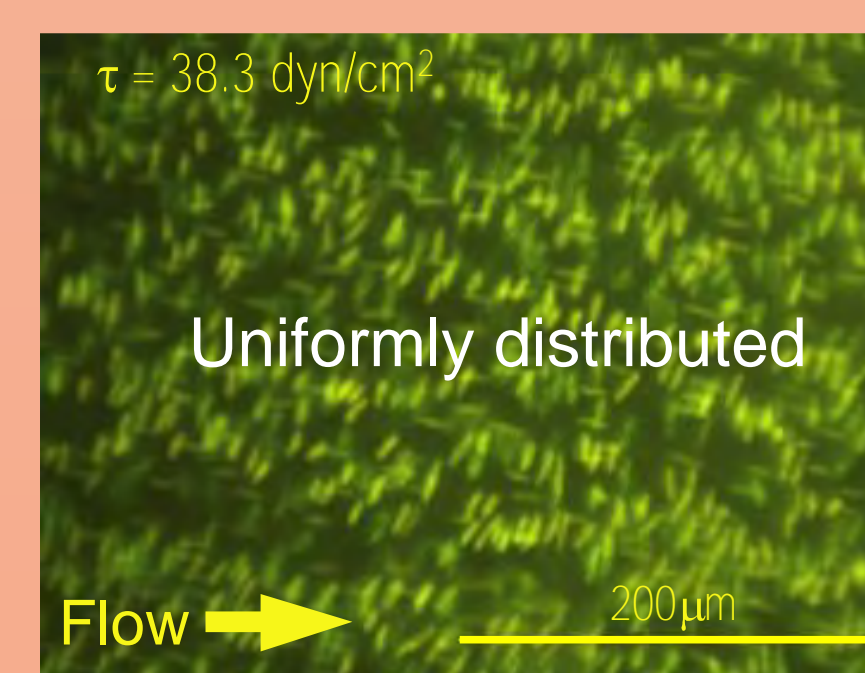


3D interfacial geometry between water and oil

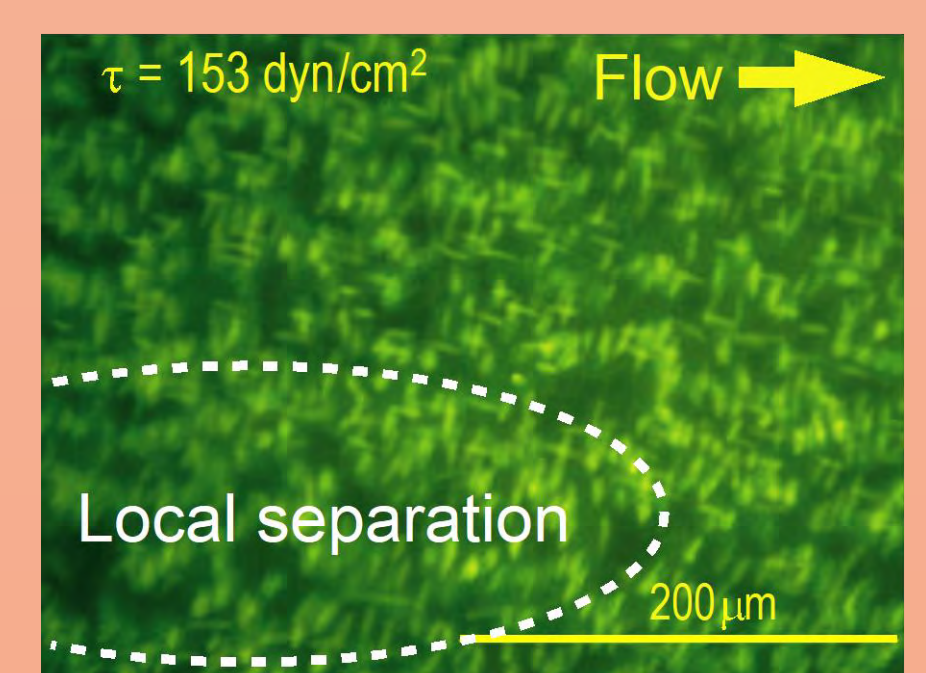


3D flow inside droplet

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

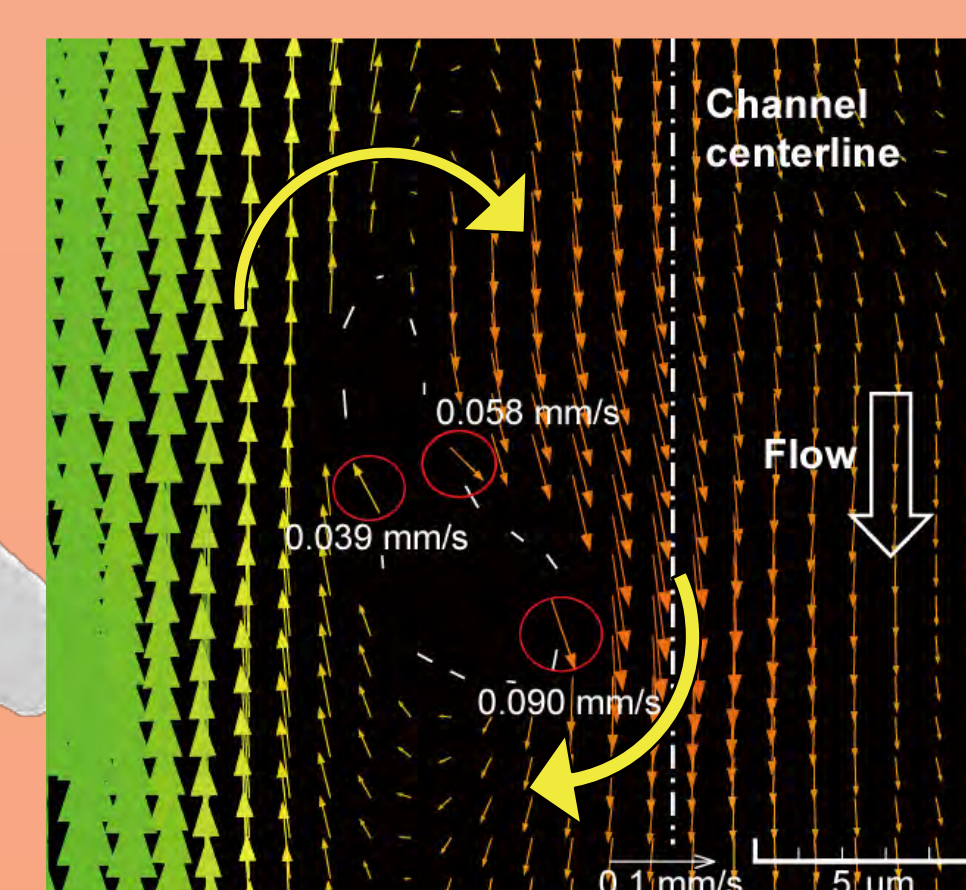


Low WSS load



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