

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/>

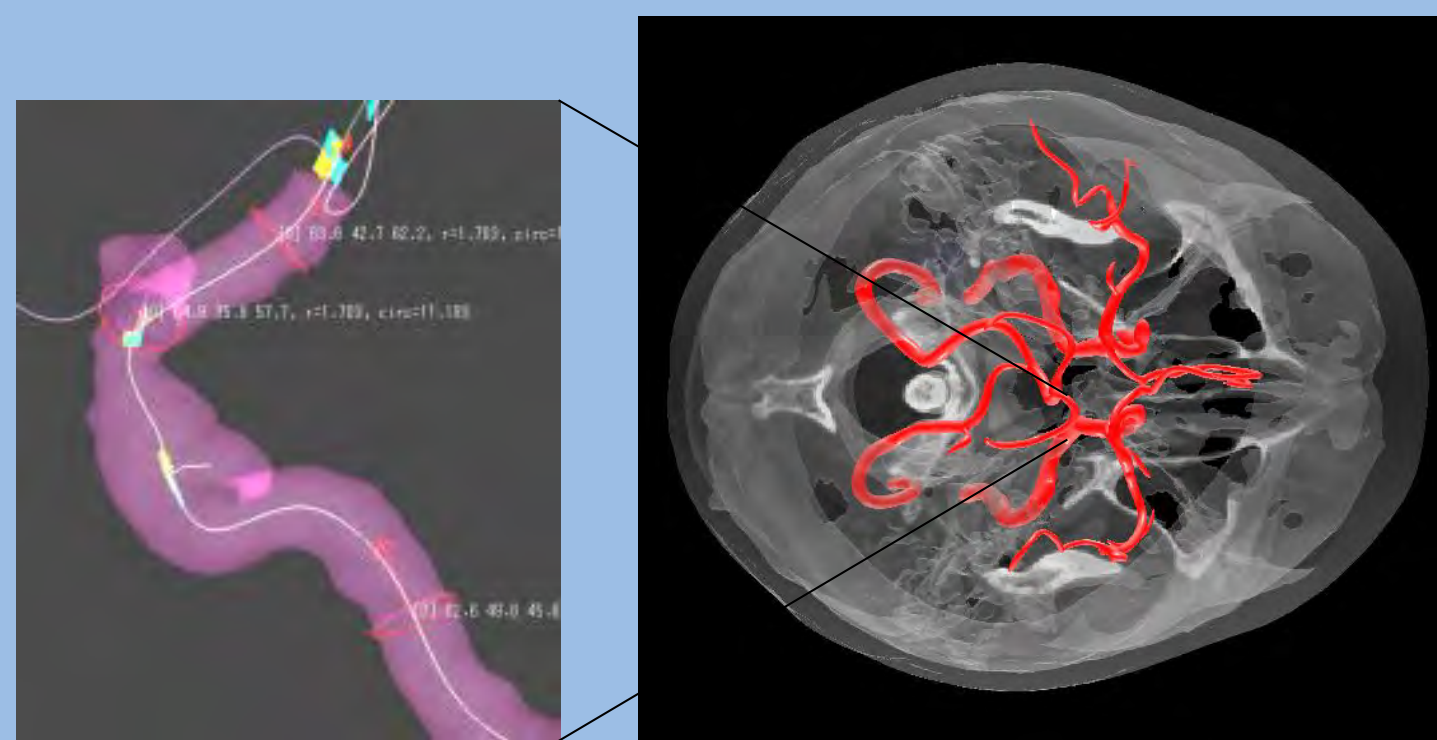
Investigation of Bio/Micro-fluid Mechanics

◆ Objectives

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

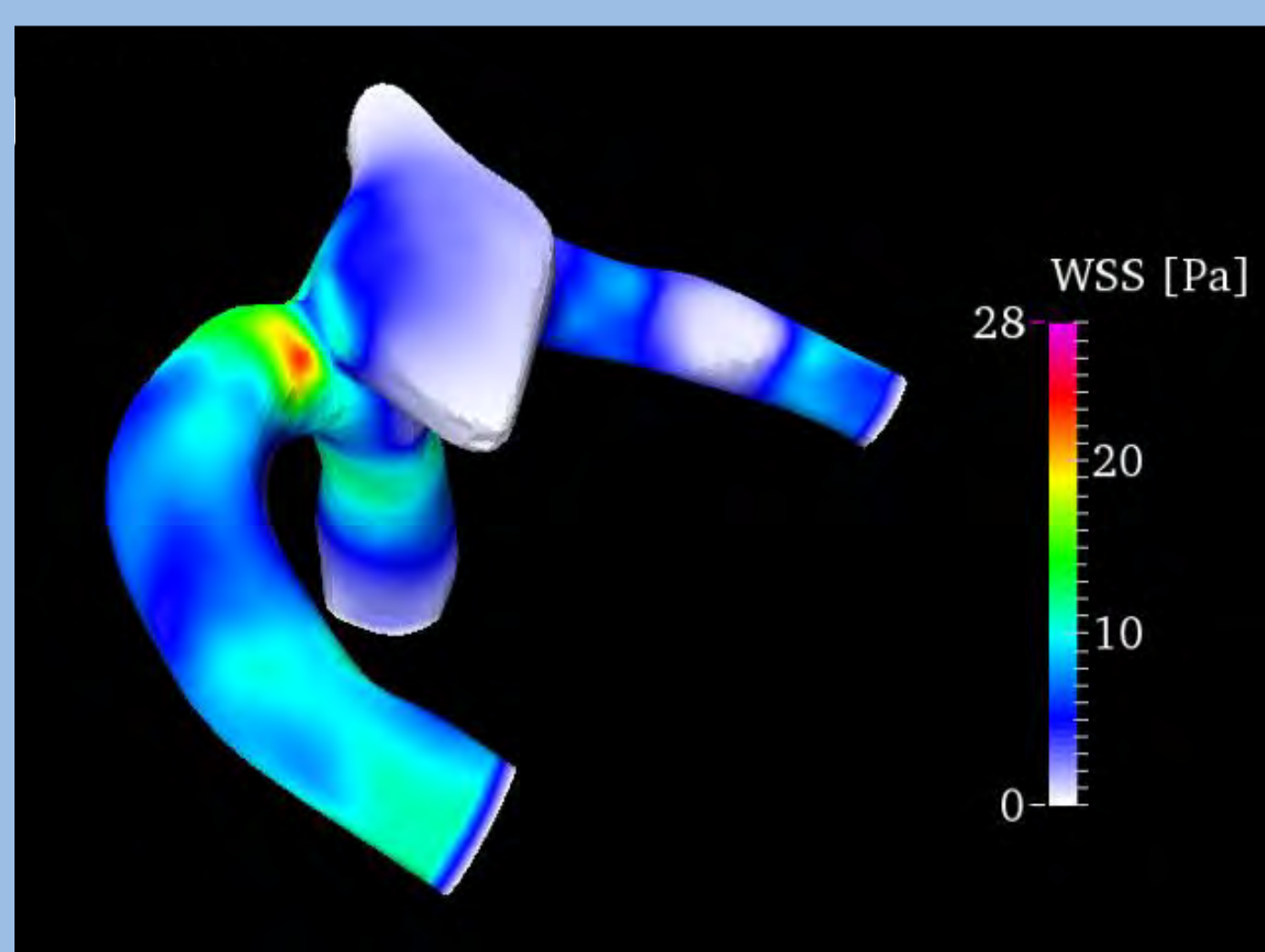
Simulation

- Modeling of 3D arterial geometry based on medical images

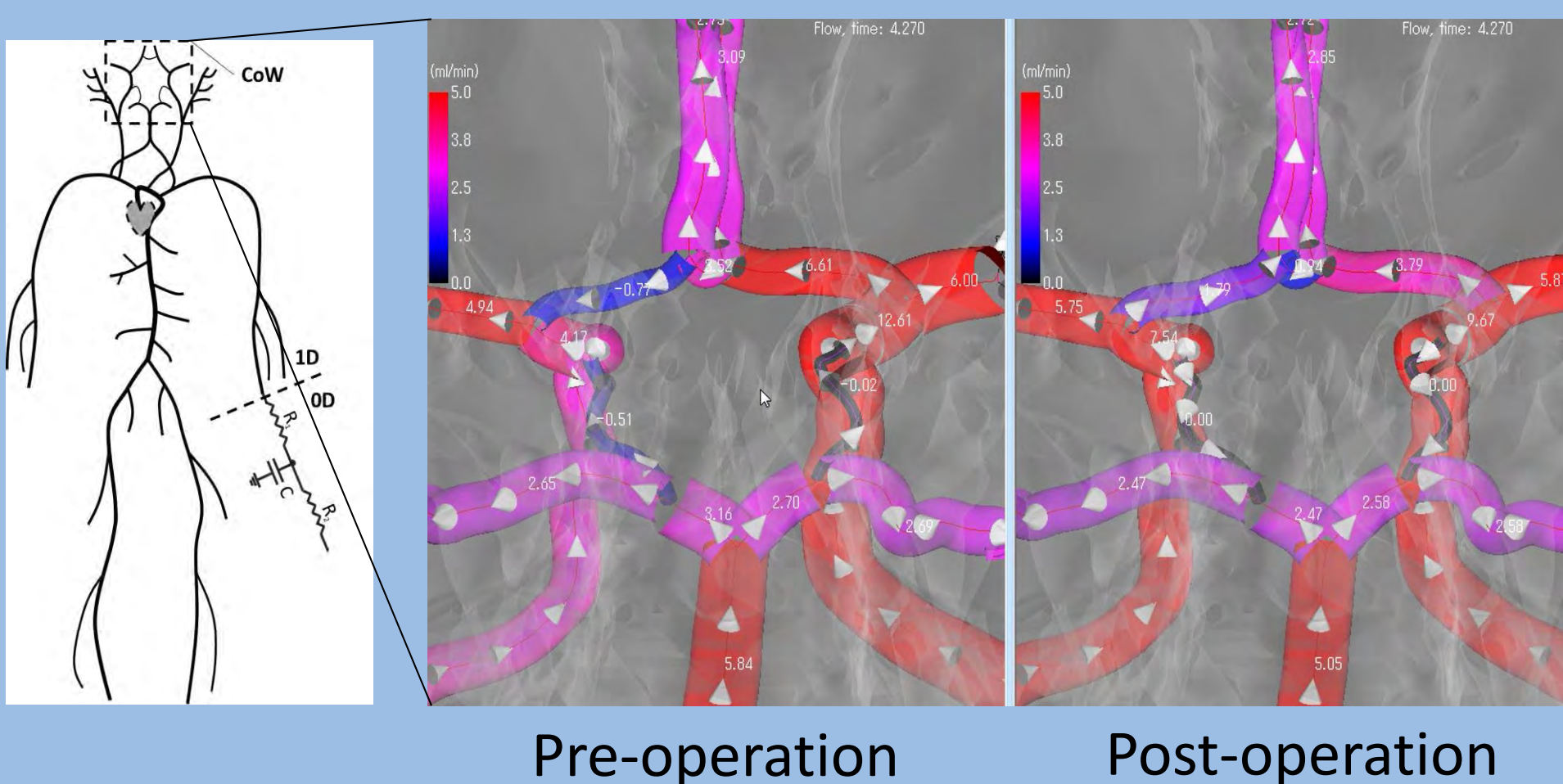


Cerebral aneurysm Circle of Willis

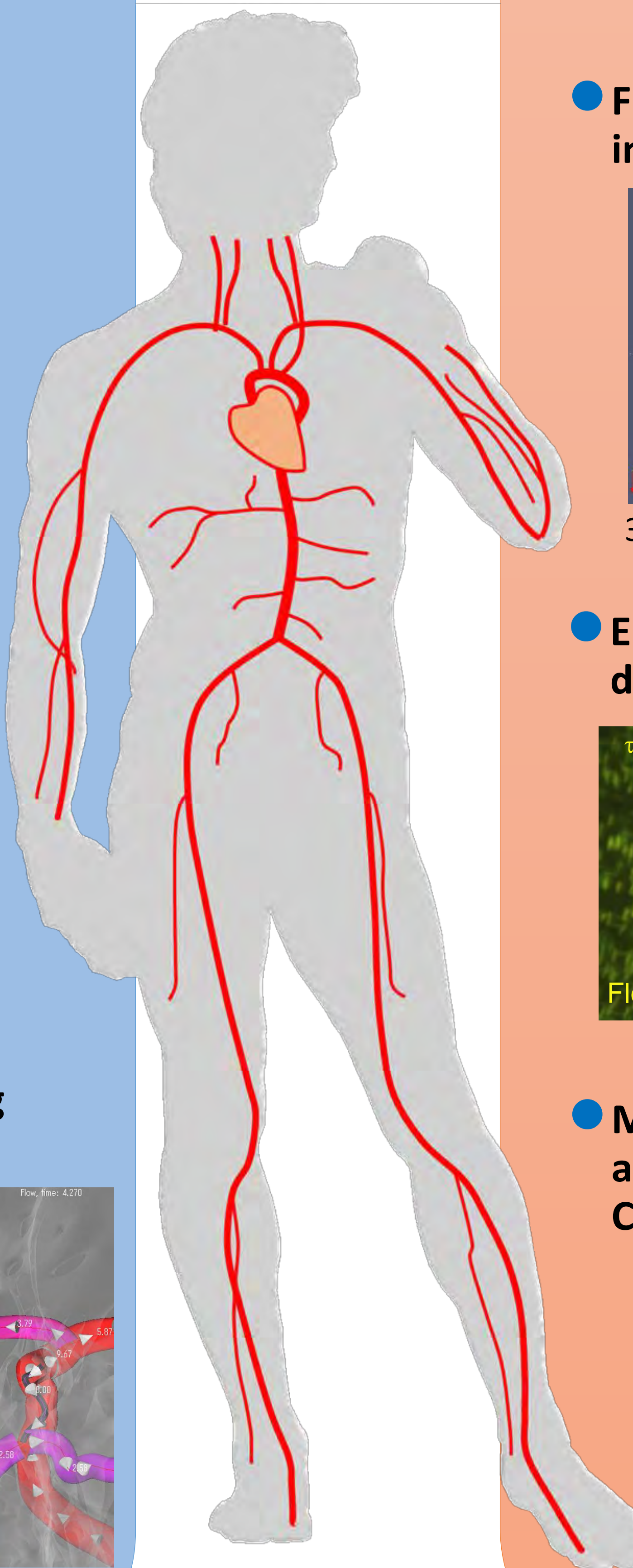
- Wall shear stress distribution on cerebral aneurysm from Fluid-Structure Interaction (FSI) simulation



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



Pre-operation Post-operation



Experiment

- Stereo-PIV flow measurement in realistic blood vessel geometry

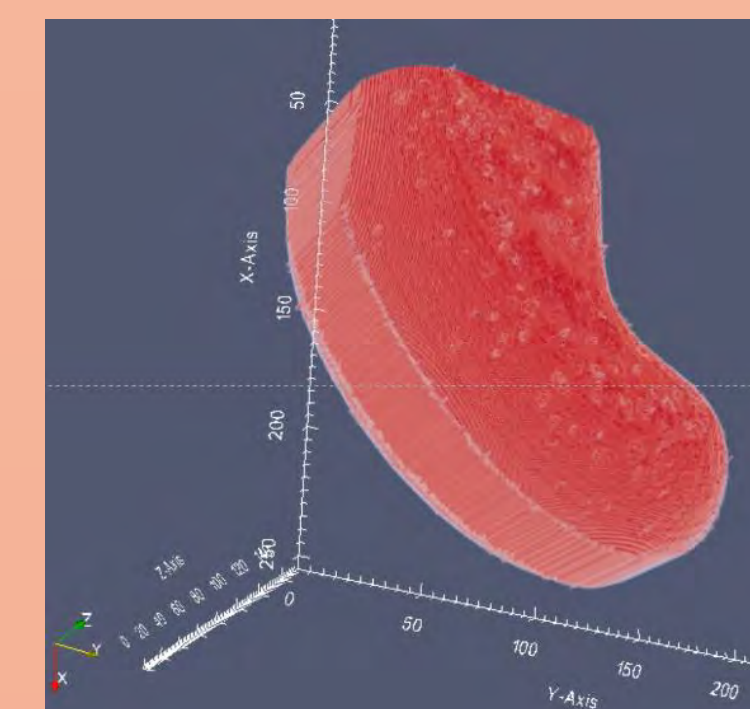


Realistic model of cerebral aneurysm

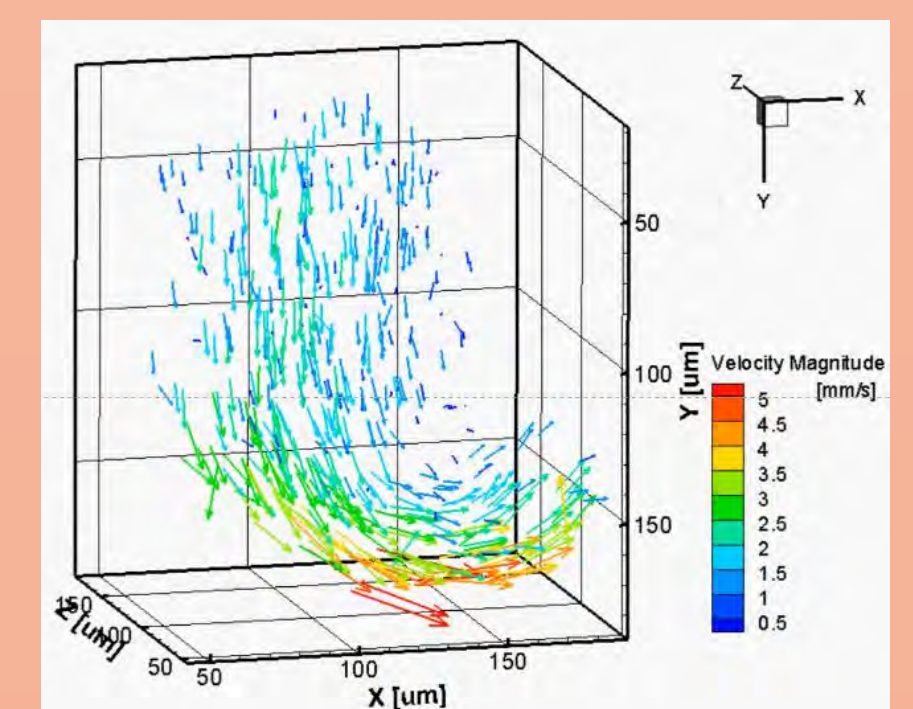


Streamlines inside aneurysm

- Flow measurement for droplet formation inside microchannel using digital holography



3D interfacial geometry between water and oil

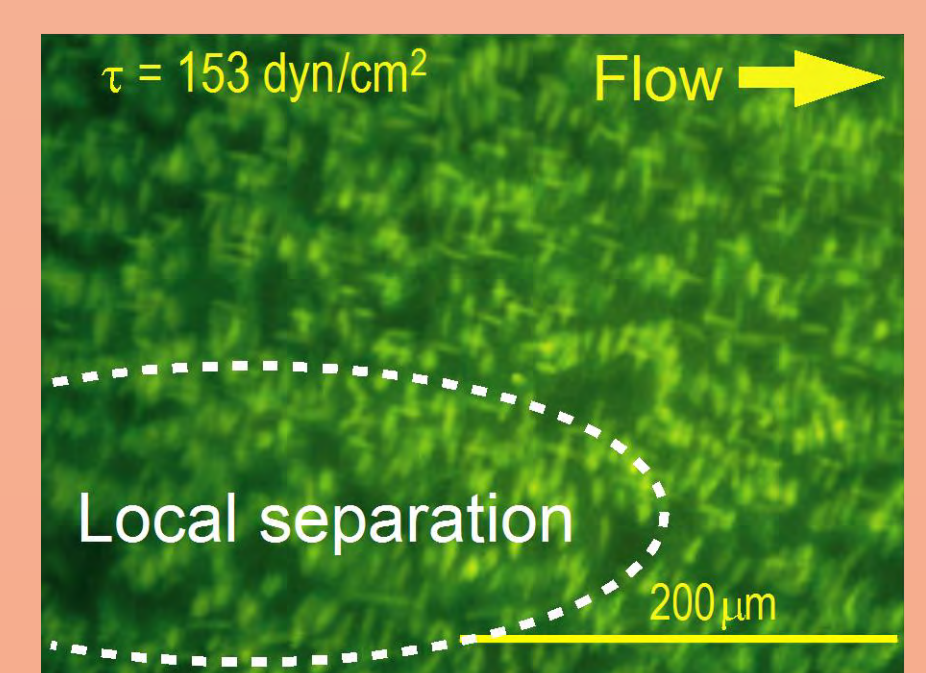


3D flow inside droplet

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

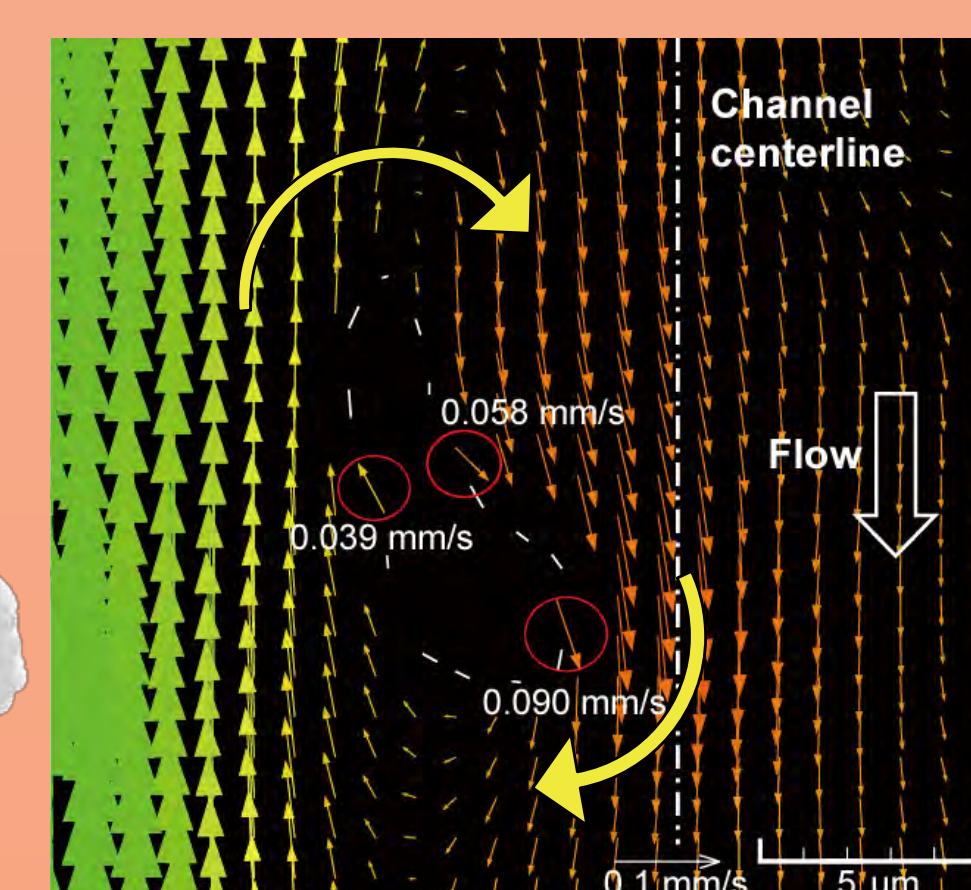


Low WSS load



High WSS load

- Measurement of the tank-treading motion and surrounding flow of a single Red Blood Cell (RBC) using confocal micro-PIV



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