

LIFE

NEXT Life Science Cluster

This cluster shall contribute to the development of medical technology for health promotion integrated with areas such as biomechanics and biochemistry.

"The Mystery of the Human Body is Clarified by Fluid Science"

Professor Toshiyuki Hayase, Head of the Life Science Cluster

Our research has apparently born fruit in the field of diagnosis and treatment of aneurysms. A bump of the artery caused by abnormal blood flow or a blood vessel is called an aneurysm, and it is a fatal disease which immediately results in death if the aneurysm ruptures in the cerebral artery or aorta. The Institute of Fluid Science succeeded in the completion of a prototype simulation device as a result of the integration of an ultrasonic blood flow measuring device and a supercomputer and the real-time visual reconstruction of factors such as blood flow structure, pressure, and wall shear stress (it is extremely important to clarify the risk level of such pressure and wall shear stress) in an aneurysm. Eventually, looking at such images will enable judgment as to whether an immediate surgical treatment to the patient is necessary or if medical therapy such as medication should be continued for a while.

Moreover, a metallic mesh tube called a "stent" is attracting attention for the treatment of aneurysms. A thin conduit tube called a catheter is inserted through the arteries in the patient's leg or wrist and advanced to the area of the aneurysm to be treated. When it reaches the area to be treated, the stent is expanded in order to reinforce the blood vessel. Introduction of the stent has greatly improved the cure rate of cerebral aneurysms in Europe and the United States. Our blood flow simulation can play an important role in

designing a stent as well. Simulation enables detailed

analysis to determine the suitable part of the patient's aneurysm and the shape of the stent used. How blood flow changes when the mesh structure is changed can also be clarified at a high rate. Accordingly, the worst case of vascular occlusion caused by thrombus formation in the area surrounding the stent can be avoided, and the best treatment by a stent can be designed for each individual patient. The engineering treatment method "stent" and the engineering analysis method "blood flow simulation" are currently beginning to demonstrate their usefulness in the treatment of aneurysms, and the Institute of Fluid Science is proud that we are playing an important role in such progress. The next generation supercomputer called a "peta computer" (which enables peta times of calculation per second) is currently under development, and if it is put in practical use, medical technology will be dramatically advanced. A Peta computer integrated with a measuring device provides a three-dimensional vision of a living body and enables observation of the etiological area from vertical, horizontal and oblique angles. Moreover, the vision is not that of the past but of real-time. It will bring dramatic progress in the diagnosis and treatment of cardiovascular diseases. The mortality rate from subarachnoid hemorrhage caused by the rupture of cerebral aneurysms and cardiovascular diseases such as myocardial infarctions caused by arterial sclerosis may be dramatically reduced.

