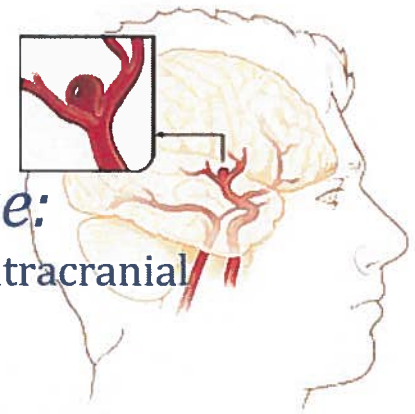

Hemodynamic Turbulence:

Detection of Complex Flow Patterns within Intracranial Aneurysms

An intracranial aneurysm is the dilation of one of the arteries in the brain and they are found in approximately 5 percent of the population. Because mortality rate after rupture is high, patients are monitored with extreme caution. Treatment, on the other hand, is also associated with morbidity and mortality so the decision to treat should carefully be considered.

The growth and risk of rupture is regulated by the blood flow and its shear stress in particular. Two approaches to determine the blood flow have become available: phase contrast MR measurement and computer fluid dynamics to simulate the blood flow in high-resolution models of the aneurysm. These methods result in high-resolution dynamic flow measurements (also known as 7-D data). It is not straight-forward to analyze this data and methods have developed to characterize patterns, such as vortices, in steady 2D flow. This is a promising method, however, clearly an oversimplification of the actual flow in the aneurysms.

We are looking for an enthusiastic and ambitious student to develop methods to detect 3D patterns in an efficient manner. During the internship, theory for scale-dependent flow pattern descriptions (as available for aircrafts for example) shall be studied and implemented for the flows as measured within intracranial aneurysms.

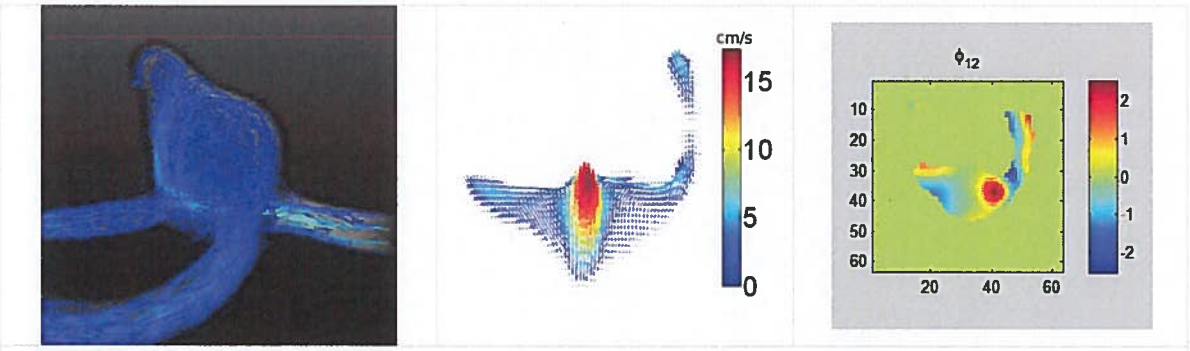

Figure 1. At the left 3D flow within an aneurysm, in the middle the flow at an axial slice through the 3D is shown. On the right a representation of the vortex scale and strength is depicted.

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