µPIV in the Heart of a Chicken Embryo

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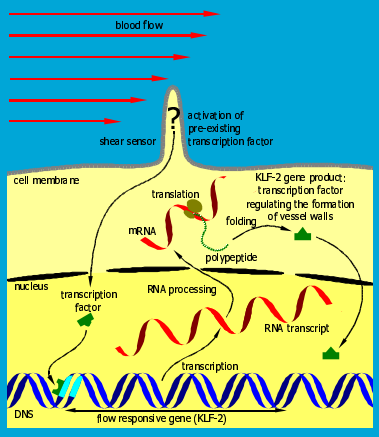
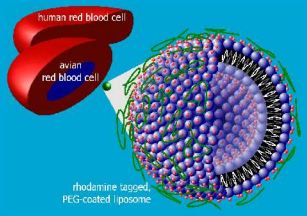
1. Can shear stress determine cardiovascular development?

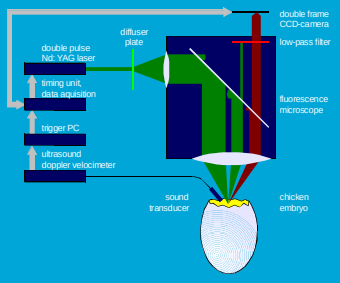
Experiments have shown that endothelial cells can respond to shear stress. This response is quantified by visualising mRNA that is produced during the gene expression process in the surface of the developing heart. The corresponding shear stress distribution can only be derived from spatial velocity information that may be provided by particle image velocimetry.



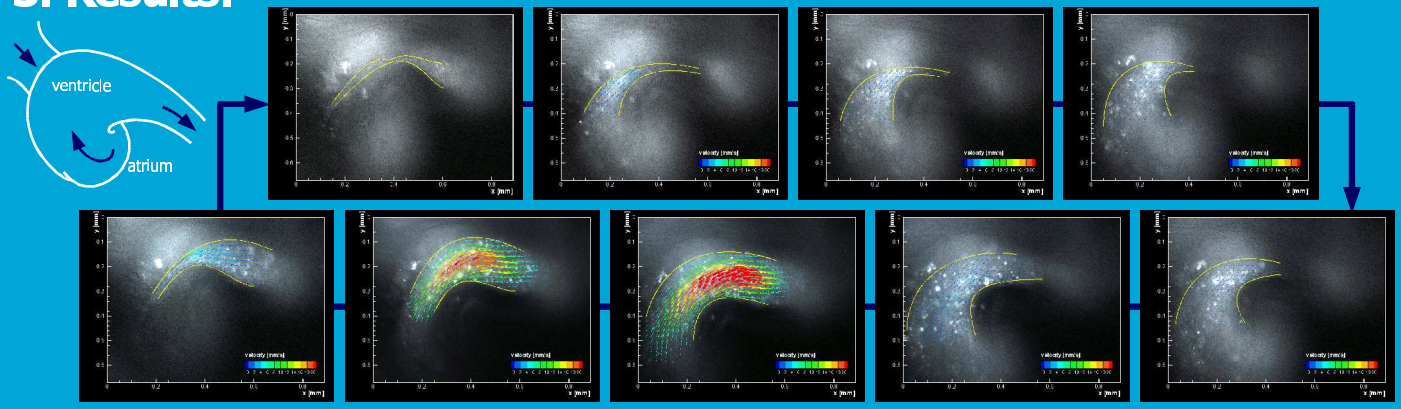
2. The measurement system:

We use fluorescent liposomes with a nominal diameter of 400 nm to trace the movement of the blood plasma. Because of their small dimension the particles also penetrate the cell depleted layer very close to the vessel-walls. A fluorescence microscope is used to separate the light that is emitted by the particles, from the light that is scattered at surrounding tissue and red blood cells.





3. Results:



These measurements show the velocity distribution in the outflow tract of a Stage 15 embryonic heart over a whole cardiac cycle. Contrary to Newtonian-fluid flows the velocity peak is shifted into the direction of the higher curvature wall.

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