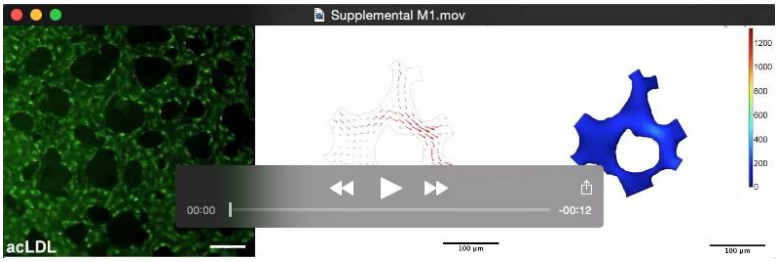
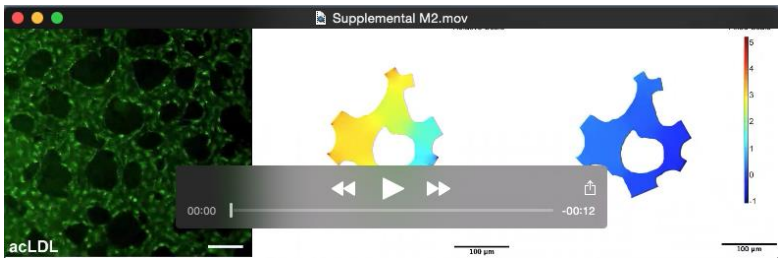
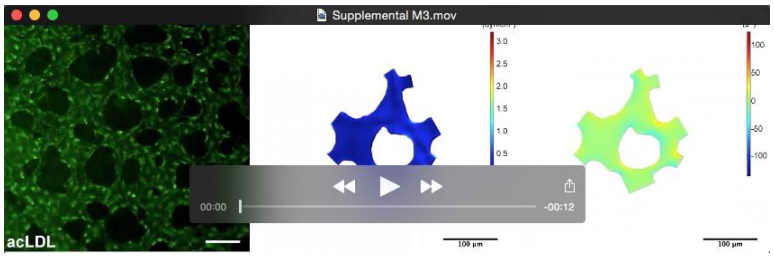


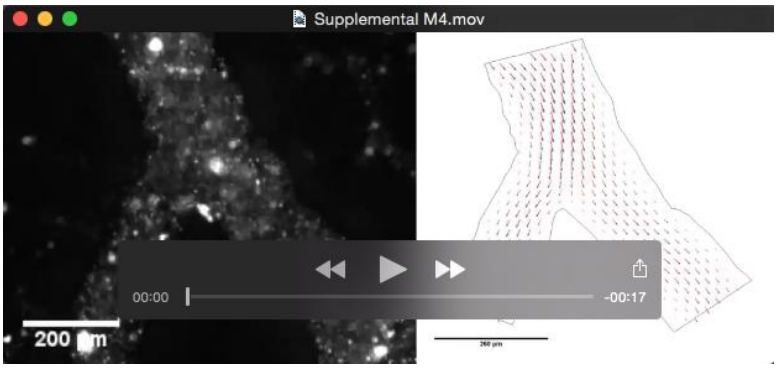
Movie 1. Blood velocity analysis during vascular remodelling. Results of the analysis of blood velocity changes during remodelling are presented. The left panel shows the endothelial cell behaviour during the time period of analysis. Endothelial cells were labelled with AlexaFluor488 acetylated low-density lipoprotein. Both intussusceptive angiogenesis (cyan arrowhead) and sprouting angiogenesis (yellow arrow) are visible in this example. The centre panel shows the velocity vectors for the blood flow during peak systole in the network. Velocity vectors in the middle panel are sized based on the maximum velocity at that specific time point (i.e., scale is relative). The right panel shows the absolute velocity magnitude during peak systole in these vessels. All scale bars represent 100 μm.



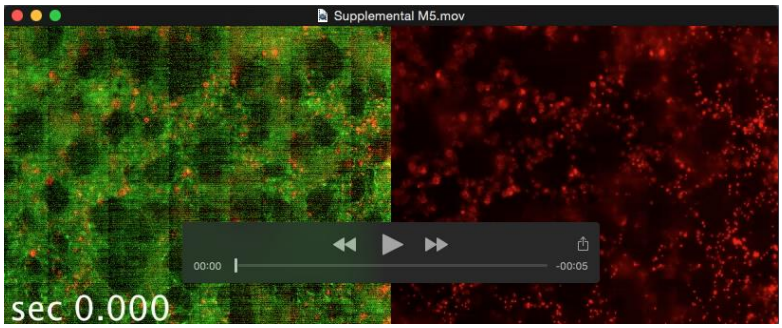
Movie 2. Pressure changes over the time-lapse experiment. Results of the pressure calculations are presented. The left panel shows the endothelial cell behaviour during the time period of analysis. Endothelial cells were labelled with AlexaFluor488 acetylated low-density lipoprotein. The centre panel shows the relative pressure, where red represents the highest pressure at that specific time point. The right panel shows the same data, but the colour scale remains constant throughout all time points. All presented values are for peak systole, however, blood flow dynamics were analysed for the entire cardiac cycle at each time point. All scale bars represent 100 μm.



Movie 3. Shear stress and vorticity analysis during vascular remodelling. Results of the shear stress and vorticity calculations at peak systole are presented. The left panel shows the endothelial cell behaviour during the period of analysis. Endothelial cells were labelled with AlexaFluor488 acetylated low-density lipoprotein. The centre panel shows the results for the shear stress calculations, with a constant colour scale for all time points. The right panel shows the results for the vorticity calculations, with a constant colour scale for all time points. All scale bars represent 100 µm.



Movie 4. Computational analysis can accurately predict flow pattern in embryonic yolk sac blood vessels. To test the ability of the computational technique to accurately model flow, we investigated blood flow in an older embryo (HH15) where a region of flow reversal was observed. The flow was visualized by injection of fluorescent microsphere and high-speed imaging (250 fps, A). The velocity of the blood flow for the two vessels on the left was used as the input to the CFD analysis (A). The resulting velocity vectors (B) show that the solver accurately determined the pattern of flow including the flow reversal in the vessel on the right. Movie played back at 1/8 speed.



Movie 5. Verification of the rigid wall assumption. Our computational analysis assumed rigid vessel walls. To verify this assumption, we imaged the movement of the vessel wall with a high-speed camera. The green labelling shows the endothelium and the red images show the fluorescent particle tracer motion. No motion of the walls is apparent over the entire cardiac cycle, thereby validating the rigid wall assumption. Movie played back at 1/3 speed.

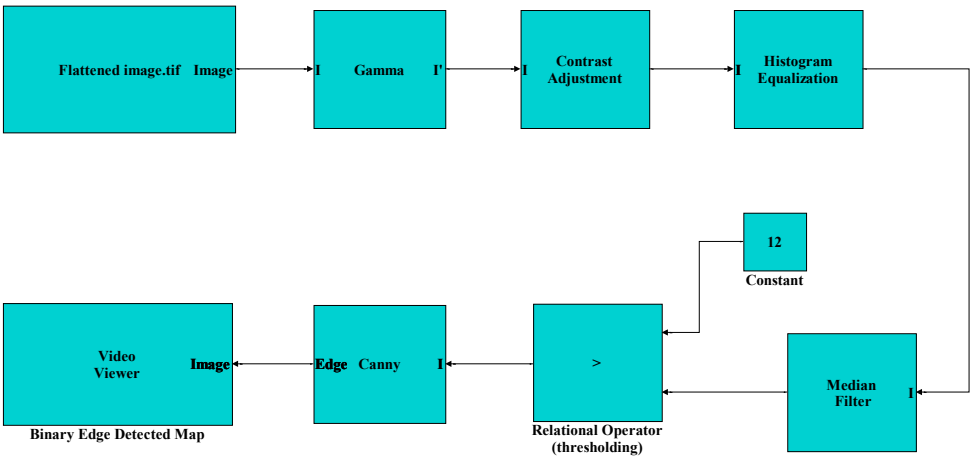


Fig. S1. Block diagram of the Simulink MATLAB program for image processing. After conversion of image stacks into a flattened image, a series of actions was applied to the image to acquire a binary edge detected map using MATLAB image processing toolbox. The detailed schematic view of used toolboxes and their order is depicted here for more information.