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Anisotropic viscoelastic properties and cytoskeletal structure of endothelial cells subject to shear flow

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Adherent cells remodel in response to mechanical stimuli leading to a redistribution of intracellular forces that depends on the viscoelastic properties of the cytoskeleton. We have analyzed the magnitude and anisotropy of these properties in confluent vascular endothelial cells subject to continuous flow. For this purpose we used Directional Particle Tracking Microrheology, which measures the second-order tensor of intracellular marker displacements, allowing us to determine the principal directions of highest and lowest shear modulus at each position. We studied the orientation of these principal directions relative to those of the actin stress fibers. After the application of flow shear the cells' stress fibers gradually orient parallel to the flow and the principal directions of the shear modulus become parallel and perpendicular to the flow. The role of ATP-driven myosin-II contractions in the observed anisotropy is analyzed by using cells treated with drugs inhibiting myosin-II function.

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