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The mechanics of endothelial gap formation JOYJIT CHATTORAJ, EMANUELA DEL GADO, Georgetown Univ, C. COREY HARDIN, Division of Pulmonary and Critical Care Medicine, Massachusetts General Hospital, Boston, MA, RAMASWAMY KRISHNAN, Center for Vascular Biology Research, Beth Israel Deaconess Medical Center, Boston, MA — The vascular endothelium is a layer of specialized cells, referred to as endothelial cells (EC) that line the internal surfaces of blood vessels and are largely responsible for regulating the transit of fluids, solutes and immune system cells from the circulation, across the vessel wall, and into the tissues. We investigate the physics of the mechanical events that may proceed and eventually lead to dramatic increase of its permeability, leading to serious illness. In combination with experiments measuring local stresses and gap formation in EC in different conditions, we devise a minimal model based on an amorphous assembly of adhesive particles, subjected to an imposed tension. Numerical simulations of the model show that, as a function of the rate at which the tension is imposed, the system goes from an elastic regime in which small gaps increase in number to a plastic one, where pre-existing gaps increase in size, and internal stresses display large hetereogeneities and long range correlations. This second regime bears intriguing similarities with the experimental finding in EC monolayers.

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