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Understanding Lymphatic Valve Function via Computational Modeling[1] KI WOLF, ZHANNA NEPIYUSHCHIKH, MOHAMMAD RAZAVI, BRANDON DIXON, ALEXANDER ALEXEEV, Georgia Inst of Tech — The lymphatic system is a crucial part to the circulatory system with many important functions, such as transport of interstitial fluid, fatty acid, and immune cells. Lymphatic vessels' contractile walls and valves allow lymph flow against adverse pressure gradients and prevent back flow. Yet, the effect of lymphatic valves' geometric and mechanical properties to pumping performance and lymphatic dysfunctions like lymphedema is not well understood. Our coupled fluid-solid computational model based on lattice Boltzmann model and lattice spring model investigates the dynamics and effectiveness of lymphatic valves in resistance minimization, backflow prevention, and viscoelastic response under different geometric and mechanical properties, suggesting the range of lymphatic valve parameters with effective pumping performance. Our model also provides more physiologically relevant relations of the valve response under varied conditions to a lumped parameter model of the lymphatic system giving an integrative insight into lymphatic system performance, including its failure due to diseases.

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