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On boundary-layer and free-shear resistances in the human airways[1] JIWOONG CHOI, CHING-LONG LIN, The University of Iowa, MERRYN TAWHAI, The University of Auckland, ERIC HOFFMAN, The University of Iowa — The airway resistance has been reported to be greater on expiration than inspiration. To understand the underlying mechanism, we perform large eddy simulation of airflow in the 3D CT-resolved 7-generation airways constrained by physiologically-consistent lobar ventilation. The dimensionless viscous pressure drops in all the airway segments exhibit a similarity behavior proportional to $(ReD/L)^n$ with the average optimal values of 1.4 and 1.6 for inspiration and expiration, respectively, where Re is the Reynolds number, and D and L are the respective average diameter and length of an airway segment. It is found that the dissipations in the boundary layer as well as the free-shear core flow contribute to the airway resistance, thus the n value. Flow is partitioned to examine the roles played by the boundary layer and the free-shear flow, respectively. A hypothesis is proposed to explain higher airway resistance on expiration.

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