

Departures from the physical optimality in the bronchial tree of rats (*Rattus norvegicus*)

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We studied the departure from the physical optimality of the bronchial tree of rats using both i) the minimum volume and power and ii) the minimum surface and drag criteria, considering the bronchial junction as the unit study based on Zamir's model for vascular trees. Our results show deviations of the junctions of the bronchial tree from the expected optimums in the proximal airway that can be explained by both, the turbulent or transitional flow regime, and the airway's necessity to distribute its terminal branches in the alveolar surface filling the thoracic volume. The departures of the observed values at the optimum for the minimum volume and power were significantly different than the obtained departure values for the minimum surface and drag criteria. The departure from the optimum was directly related to the diameter of the smallest branch. The slopes of the regressions for the two criteria were different. The regression lines intercept at a bronchial diameter $d_2 = 0.129$ mm. T