Airflow Dynamics in a Short Inhalation

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A highly resolved numerical simulation (time step 10μs, >14 million polyhedral cells) of a short inhalation was performed on a realistic human airway extending from outside the face to the fourth bronchial branch. The temporal flow profile was determined from measurements in volunteers[1]. Three distinct phases of flow were identified; development, peak and decay. The partitioning of flow through different regions of the nasal cavities was found to vary through these phases. Spontaneous flow fluctuations arose in each nasal airway, as well as downstream of the nasopharynx as the flow undergoes transition, accentuated by anatomical features such as the nasal valve and the position of the tongue. Scalar species were also tracked throughout the inhalation, as an indicator for the transport and eventual deposition of inhaled nanoparticles.

[1] Rennie CE, Gouder K, Taylor DJ, Tolley NS, Schroter RC, Doorly DJ, 2011, Nasal inspiratory flow: at rest and sniffing, *International Forum of Allergy & Rhinology*, Vol:1, 2042-6976, Pages: 128-135

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