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The anatomy and internal aerodynamics of canine olfaction
BRENT CRAVEN, ERIC PATERSON, GARY SETTLES, Penn State — High-resolution magnetic resonance imaging (MRI) scans of the nasal airway of a large dog reveal an intricate scrollwork of nasal conchae providing large surface area for heat, moisture, and odorant transfer. From these anatomical scans we reconstruct a 3-D surface model of the nasal passage and extract detailed morphometric data providing insight into the internal airflows of canine olfaction. A complicated airway network is revealed, wherein the branched maxilloturbinate and ethmoturbinate scrolls are structurally distinct. 3-D airway connectivity also reveals separate respiratory and olfactory flow paths. Knowing the approximate airflow rate and frequency of canine sniffing, we find Reynolds numbers that are, surprisingly, well below the turbulent-flow threshold. Finally, the internal aerodynamics and transport phenomena of canine olfaction are considered via non-dimensional analysis and initially-simple theoretical and computational models. (To appear in the Anatomical Record.)

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