Computational fluid dynamics modelling of pulmonary airflow in varanid lizards

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Understanding the biomechanical basis of unidirectional pulmonary airflow, a condition where lung gases travel in the same direction through most of the airways and throughout the respiratory cycle, has long been of interest to scientists. Recent work has revealed a wide phylogenetic distribution of this trait, beyond the confines of Aves, to include crocodilians, green iguanas, and monitor lizards. Advances in computational fluid dynamics, a technique where patterns of flow are simulated from prescribed boundary conditions by laws of fluid motions, provide a powerful tool to study airflow through these complex and fascinating structures. Australian monitor lizards (Varanidae) are a promising group to investigate the significance of these lung traits because their adaptive radiation crosses many ecological niches with a similar body plan. Computed tomography scans of varanid species being made and segmented into a detailed computational meshes, representing the major and minor airways as has already been done for the savannah monitor, Varanus exanthematicus. Flow patterns are simulated through these airways in two ways on a high performance computing cluster using dynamic and static OpenFOAM solvers and visualized using ParaView.