THE STATUS OF RESPIRATORY TURBINATES IN THEROPODS

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Respiratory turbinates (RT) can be reliable indicators of respiratory capacity in extinct tetrapods only if their absence or presence is detectable. Avian RT are extremely variable in placement and form, and are usually cartilagenous in all aspects. The only way to falsify the presence of RT in extinct bird relatives is to show that the main (nonolfactory) nasal passage (MNP) is blocked off or too constricted to accommodate effective RT. This is difficult to do because how small MNP and RT can be and still function effectively is not yet known. In order to properly analyze MNP volume in different taxa nasal cavity dimensions should be compared at the same scale, and body size must be equalized.

Ossified RT are not observed in theropods. It has been argued that theropod MNP were too small to contain effective RT. This conclusion is an illusion due largely to misleading comparisons of MNP volume at different scales, and in small versus large headed theropods and birds. In most tetanurae theropods and *Archaeopteryx* the MNP is an L-shaped tube. The horizontal anterior section is narrow but long, the vertical section above the internal nares is short but broad. In basal theropods the MNP is simpler. In oviraptors and birds MNP are often broader, but shorter, than in most theropods. The MNP of theropods approach, equal, or exceed the volume of the same space in birds of equal size. The smallest theropod MNP are observed in ornithomimids, it is not yet known whether their passages were too small or narrow to contain working RT. It is concluded that most or all theropods had enough room for RT, but it is not known whether archosaurian RT first appeared before or among basal theropods, in tetanaurians, or birds. This lack of resolution shows that fossil RT are poor indicators of ventilation capacity.