

Inner ear of a notoungulate placental mammal: anatomical description and examination of potentially phylogenetically informative characters

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ABSTRACT

We provide the first detailed description of the inner ear of a notoungulate, an extinct group of endemic South American placental mammals, based on a three-dimensional reconstruction extracted from CT imagery of a skull of *Notostylops murinus*. This description provides new anatomical data that should prove to be phylogenetically informative, an especially significant aspect of this research given that both the interrelationships of notoungulates and the position of Notoungulata within Placentalia are still unresolved. We also assess the locomotor agility of *Notostylops* based on measurements of the semicircular canals. This is the best available data on the locomotion of a notostylopid because significant postcranial remains for this group have not been described. The cochlea of *Notostylops* has 2.25 turns, and the stapedial ratio is 1.6. The stapedial ratio is one of the lowest recorded for a eutherian, which typically have ratios greater than 1.8. The fenestra cochleae is located posterior to the fenestra vestibuli, a condition previously only reported for some stem primates. The separation of the saccule and utricle of the vestibule is visible on the digital endocast of the bony labyrinth. The posterior arm of the LSC and the inferior arm of the PSC are confluent, but these do not form a secondary crus commune, and the phylogenetic or functional significance of this confluence is unclear at this time. Locomotor agility scores for *Notostylops* suggest a medium or 'average' degree of agility of motion compared to extant mammals. In terms of its locomotion, we tentatively predict that *Notostylops* was a generalized terrestrial mammal, with cursorial tendencies, based on its agility scores and the range of locomotor patterns inferred from postcranial analyses of other notoungulates.

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