

COMPARATIVE MORPHOLOGY OF THE EXTERNAL EAR CANAL IN SEVERAL SPECIES OF ODONTOCETES

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The external ear canal in cetaceans has long been considered to be vestigial, an evolutionary remnant that has lost its function with the development of alternative acoustic pathways, such as the mandibular fat bodies. Recent research indicates this is a misconception, as the ear canal proved a well-innervated, well-vascularized complex structure with many active components such as glands, striated musculature, and an abundance of sensory nerve formations (De Vreese et al., 2014). However, the function of the external ear canal in cetaceans is still under debate and the knowledge on its morphology is largely incomplete.

We applied macroscopic dissection and a variety of microscopic analysis, including electron microscopic and immunohistochemical techniques on the ear canals of several species of odontocetes and terrestrial Cetartiodactyla. In this presentation, we highlight the intense innervation of the external ear canal of odontocetes with the abundant presence of lamellar corpuscles over its entire course, and the absence of sensory nerve formations in all studied terrestrial mammals. For the characterization of the corpuscles, we used four different antibodies: anti-S100, anti-NSE, anti-NF, and anti-PGP 9.5. Each corpuscle consisted of a central axon, which stained positive for anti-NF, anti-PGP 9.5, and anti-NSE, and was surrounded by several lamellae of Schwann receptor cells, positive for anti-S100. The periphery comprised a thin cellular layer that stained positive for anti-PGP 9.5 and anti-NSE. These findings show that the corpuscles are mechanoreceptors with a morphological resemblance to the inner core of Pacinian corpuscles and without any capsule or outer core. Based on morphological data, these corpuscles were labeled as simple lamellar corpuscles. Such a sensory innervation may represent a unique phylogenetic feature of cetaceans, and an evolutionary adaptation to life in the marine environment.

We also provide an essential understanding of the comparative morphology of the ear canal in several species of odontocetes, including striped dolphin, bottlenose dolphin, harbor porpoise, long-finned pilot whale, and Cuvier's beaked whale. We give detailed descriptions of the intra- and interspecific differences and similarities in the presence, shape, and characteristics of soft tissues, their interrelations and the association with the middle ear components, and the differences in sensory innervation.

Although the exact function of the ear canal is still not well understood, we provide a basic understanding, essential for further research of the functional morphology of the ear canal of cetaceans, as well as a preliminary hypothetical deviation on its function as a unique sensory organ.

De Vreese, S., Doom, M., Haelters, J., and Cornillie, P. (2014). Heeft de uitwendige gehoorgang van walvisachtigen nog enige functie? *Vlaams Diergeneeskundig Tijdschrift* 83, 284–292.