The dolphin external ear canal, from physical towards virtual reality

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The issue of underwater noise pollution is of concern to the community at large, while the effects it can have on marine fauna and its sensory systems are not yet understood. Also, it is not fully clear how cetaceans, dolphins and whales, receive sound through the alternative auditory pathways, including the acoustic fat bodies. Although the external ear canal is no longer considered a direct actor in this process, it shows interesting evolutionary adaptations in its morphology. Despite that the function of the ear canal is unclear at the moment, and basic knowledge on its morphology is inconclusive, studies of the peripheral nervous system could shine a light on the functional morphology of this small but possibly vital organ.

In this work, we focus on the techniques used in a more extensive study of the small-scale soft tissues of the external ear canal of toothed whales. In an international effort, post-mortem samples of the external ear canal of a variety of toothed whales were gathered and processed using conventional histological techniques and the digital recreation of the tissues in a virtual environment.

The results provide attractive visual representations of the ear canal and its associated soft tissue, of which here, we focus on a 400 micrometre-long reconstruction of the nervous tissues of the intramural auricular plexus in the superficial third of the external ear canal of a striped dolphin.

All of the software used is open-source, which makes the workflow available to anyone, independent of the resources available. The obtained visual representations can be complementary to other morphological studies and can provide intriguing perspectives for scientific outreach and education.

Keywords: Toothed whales; External ear canal; Morphology; Histology; 3D reconstruction