

Facial Nerve Homologies in Cetartiodactyla

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Introduction

In the human face, the facial nerve (N. VII) is divided in five rami, each for a defined horizontal level. In the terrestrial cetartiodactyls, such as the bovine, the motor branches of the face are divided in two Rami buccales, a dorsal branch and a ventral branch (Fig. 1). Here, in general, the ventral buccal branch innervates muscles associated the lower jaw while the dorsal branch extends to the nasal region

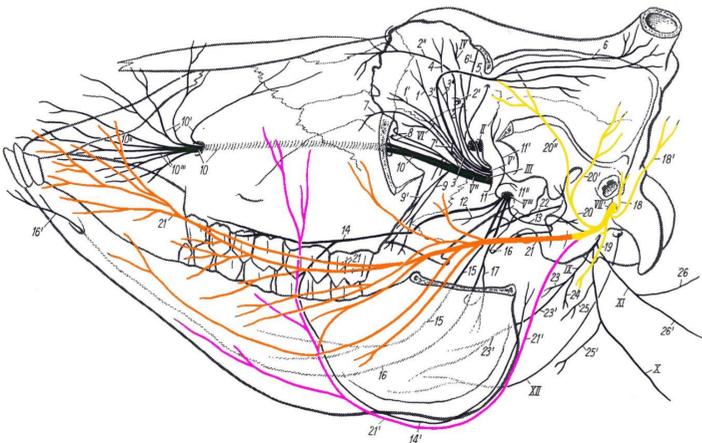


Figure 1: Schematic drawing of a bovine skull (left lateral view modified after Nickel et al. 1975) with cranial nerves (Roman numbers). Rostrally, the facial nerve (yellow) divides in dorsal (orange) and ventral (magenta) buccal rami.

Material and Methods

Morphological dissection of formalin-fixed heads of three different toothed whales with focus on the facial nerve.

- neonate *Phocoena phocoena*
- perinatal *Grampus griseus*
- fetal *Stenella attenuata*

Results

In the toothed whales dissected macroscopically for this study we found only a strong dorsal branch reaching the facial muscles of the nasal complex but no ventral branch (Figs. 2, 3, 4).

Abbreviations:

EAM – external acoustic meatus, MB – maxillary bone, MNL – maxillonasolabial muscle, Mri – ventral (inferior) rectus muscle, PN – preorbital notch, SG – styloglossus muscle, TE – temporale muscle, TR – trapezius muscle, V₂ – maxillary nerve, V₃ – mandibular nerve, VII – facial nerve, XII – hypoglossal nerve

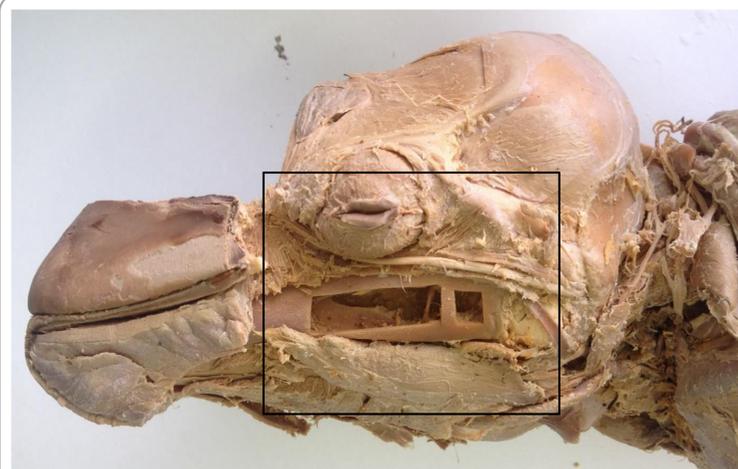


Figure 2A: Left lateral view of the head of a neonate *Phocoena phocoena* (7613) with the external eye muscles and mandible fenestrated.

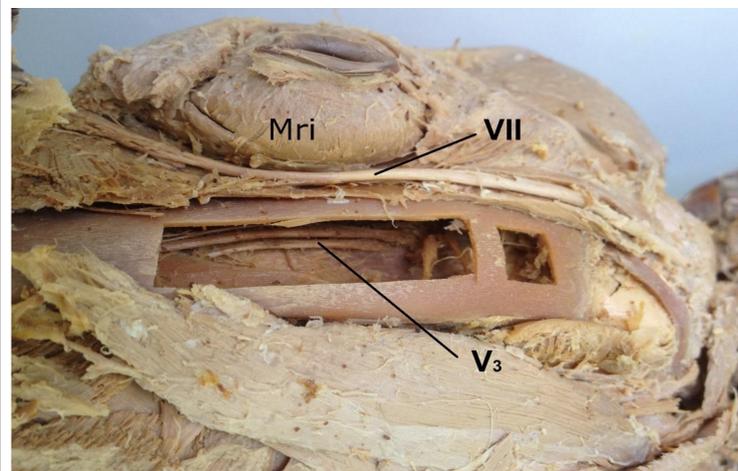


Figure 2B: Detail of Fig. 3A in left ventrolateral view with the external eye muscles (Mri), the mandibular nerve (V₃) and facial nerve (VII).



Figure 3: Right lateral view of the head of a late-fetal *Stenella attenuata* (RXM 056) showing the course of the mandibular nerve (V₃) within the right opened mandible and the facial nerve (VII) (dissection by Steffen de Vreese 2019).

References

1. Nickel R, Schummer A, Seifferle E. 1975. Lehrbuch der Anatomie der Haustiere (3. Auflage). Berlin: Paul Parey.
2. Barthelmeß NG. 2017. Topographic Anatomy and Course of Cranial Nerves in the Risso's Dolphin (*Grampus griseus*) (bachelor thesis). University of Cologne, Faculty of Mathematics and Natural Sciences.

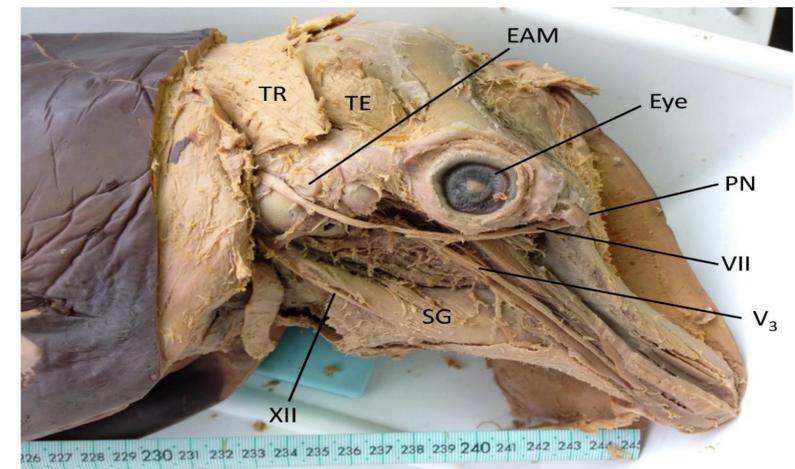


Figure 4A: Right lateral view of the head of a perinatal *Grampus griseus* (PEN 842) and the muscles proper to the tongue, the epicranial complex as well as mandibular nerve (V₃) and facial nerve (VII), the stylohyoid muscle is mobilized ventrally (Barthelmeß 2017).

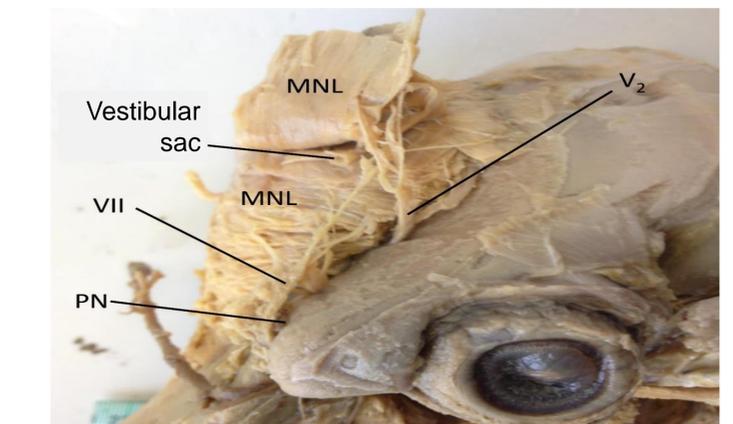


Figure 4B: Left dorsolateral view of the innervation of the epicranial complex by the facial nerve (VII) and maxillary nerve (V₂), the superficial part of the MNL muscle is mobilized dorsally of *Grampus griseus* (Barthelmeß 2017).

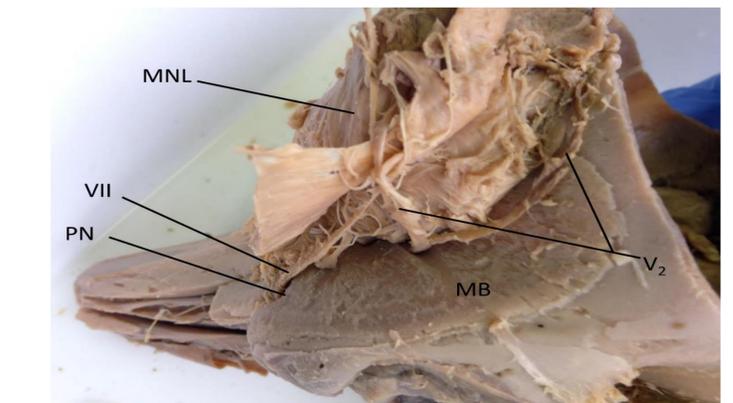


Figure 4C: Left dorso-caudolateral view of the innervation of the epicranial complex by the facial (VII) and the maxillary nerve (V₂) of *Grampus griseus*, the deeper layer of the MNL muscle is mobilized rostrally (Barthelmeß 2017).

Hypothesis

We hypothesize that the well-developed dorsal branch in toothed whales is homologous to the Ramus buccalis dorsalis of terrestrial Cetartiodactyls while a prominent Ramus buccalis ventralis is missing (minor rami may innervate the vestigial lip musculature; Figs. 2B, 3, 4A).