

# The ontogeny of the vocal apparatus in male and female goitred gazelle (*Gazella subgutturosa*)

Efremova Kseniya<sup>1</sup>, Frey Roland<sup>2</sup>, Volodin Ilya<sup>3,4</sup>, Fritsch Guido<sup>2</sup>, Soldatova Natalia<sup>5</sup>, Volodina Elena<sup>4</sup>

<sup>1</sup> Pirogov Russian National Research Medical University, Russia

<sup>2</sup> IZW-Berlin, Germany

<sup>3</sup> Lomonosov Moscow State University, Russia

<sup>4</sup> Moscow Zoo, Russia

<sup>5</sup> Ecocenter "Djeiran", Uzbekistan

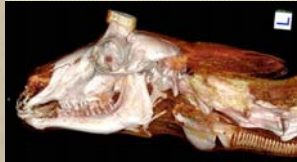
frey@izw-berlin.de

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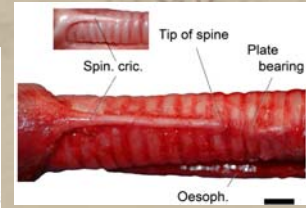
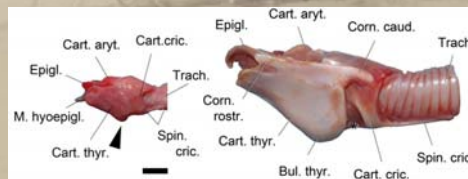


**IDEA:** A descended larynx occurs in several species of mammals, including humans. Sexual dimorphism of larynx size and position is more pronounced in adult goitred gazelles than in human adults, whereas the vocal organs are isomorphic in male and female neonates. This study quantitatively documents the vocal ontogeny of goitred gazelle from neonates, via adolescents to adults.

**METHODS:** We examined the vocal anatomy of 19 (11 male, 8 female) naturally died goitred gazelle specimens across age-classes from neonates via sub-adults to adults.



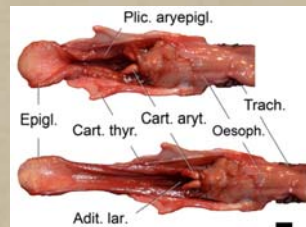
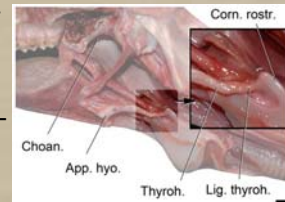
## Larynx and pharynx



Ontogenetic growth of the larynx

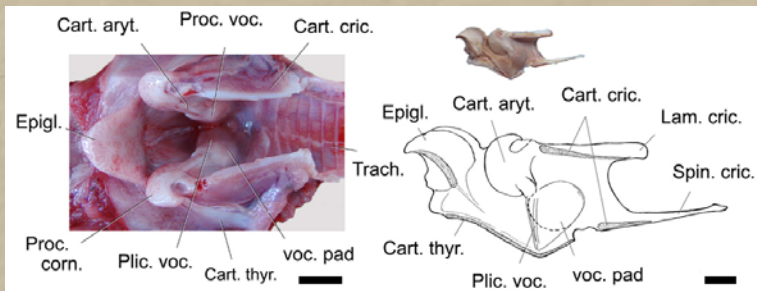
Unique long cricoid spine

Resiliency of pharynx and thyrohyoid ligament involved in larynx retraction.



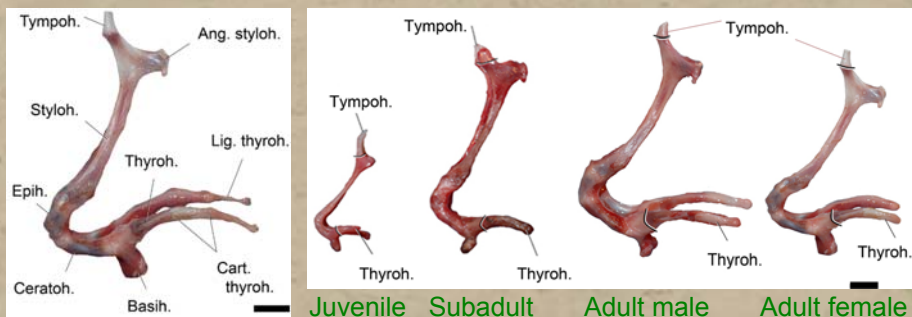
Highly elastic vestibulum

## Vocal folds and vocal pads



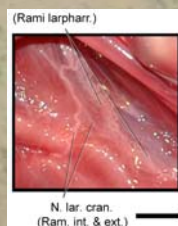
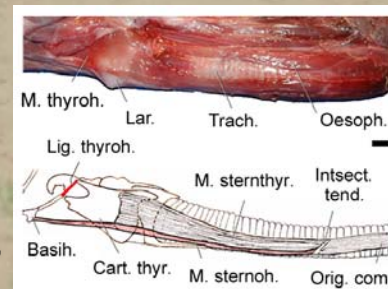
Long and thick vocal folds with large vocal pads produce fundamental frequencies comparable to those in elephant rumbles.

## Hyoid apparatus and thyrohyoid ligament



The hyoid apparatus gets sexually dimorphic towards adulthood. The larger, strongly descended, highly mobile larynx of males requires longer thyrohyoids.

## Muscles retracting the larynx and the trachea, nerves



**CONCLUSION:** Both sexes share the same traits of vocal morphology yet differences in size and proportions emerge along vocal ontogeny. The hyoid apparatus, resilient pharyngeal structures and highly contractile muscles evidently play a decisive role in the mobility of the larynx in both sexes but more so in males.

The larynx is mobile in both sexes but particularly so in adult males during rutting call production, when sternohyoid and sternothyroid muscles strongly contract to effect larynx retraction. Nerves cannot be extended, so they are strongly elongated and course in dense loops that straighten during laryngeal descent.

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