

The Larynx of Roaring and Non-Roaring Cats

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Summary

Dissections were made of the larynges of 14 species of the cat family, with representative specimens from all genera. It was found that the vocal folds of the larynx: of genus *Panthera* (with the exception of the snow leopard) form the basic structure of a sound generator well-designed to produce high acoustical energy. Combined with an efficient sound radiator (vocal tract) that can be adjusted in length, a *Panthera* can use its vocal instrument literally to blow its own horn with a "roar." Also, it is proposed that laryngeal morphology can be used as an anatomical character in mammalian taxonomy.

Introduction

In most species of the cat family the hyoid bone is suspended from the skull by a series of small bones: the tympanohyal, stylohyal, epihyal, and ceratohyal. The proximal tympanohyal is embedded in the tympanic bulla whilst the distal part of the ceratohyal is attached to the basihyal (body of the hyoid). The larynx: attaches to the hyoid by way of the thyrohyal bone and thyrohyoid ligament.

The ability to increase the distance between the oral pharynx and larynx, because the hyoid apparatus is not fixed, enables lengthening of the acoustic pipe. certainly lowering the pitch of voice and probably increasing its resonance. But this is not the mechanism that produces the intense amplification of sound called "roaring." In order to determine that mechanism, the sound generator of voice, the larynx. was studied in single specimens of most big cats and a few small felids. The results. presented in a previous short report by Hast showed that the larynges of the four "roaring" cats. the lion, tiger, leopard. and jaguar, can be distinguished from larynges of "non-roaring" cats by a large pad of fibro-elastic tissue which constitutes the rostral portion of the proportionately very large vocal fold.

Results and Discussion

It was found that all species of genus *Panthera* ("roaring cats"). with the exception of *P. uncia.* can be distinguished from "non-roaring" cats by a large pad of fibro-elastic tissue which constitutes the rostral portion of each of the proportionately very large undivided vocal folds. Sections of this pad of fibro-elastic tissue demonstrate collagenous and elastic fibres. denser near the epithelial mucosal lining, with reticular fibres around the basement membrane and arteries. Because of their large mass, the *Panthera* vocal folds- the sound generating element-have a low natural frequency and, when vibrating, will produce a high acoustical energy. The design of the *Panthera* vocal folds allows for a gradual transition of sound energy from a high to a low air resistance, resulting in a better transfer of acoustical energy in an efficient sound radiator ("roaring"). Genus *Panthera* can also be distinguished from other cats by the proportionately very large cricothyroid muscle, a single rounded vocal fold with a very thick mucosal lining, a large vocalis muscle and a long and narrow median cricothyroid membrane. As in other species of the cat family, sexual differences are quantitative, with the male larynx. on the average, larger than the female.

The snow leopard possesses an incomplete hyoid apparatus with an elastic ligament, undivided thyroarytenoid folds, and its larynx is similar in size to that of a small jaguar. However, the snow leopard

has no pad of fibro-elastic tissue to increase the length and mass of its vocal fold. and it does not roar. In the sound-producing mechanism of the snow leopard and other non-pantheran cats. transfer of energy is less efficient, and the ability to radiate sound is poorer because of the form of the vocal folds.

Using the larynx as an anatomical character supports the snow leopard's classification as a separate genus *Uncia uncia*, not as *Panthera uncia*.