Title: Function of the Posterior Laryngeal Constrictor in the Túngara Frog (Engystomops pustulosus)

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Introduction

The túngara frog produces a mating call consisting of a frequency modulated whine and a facultative chuck. The current model of amphibian vocal function cannot account for the acoustic complexity of this call. The larynx contains two vocal folds encapsulated in a cartilaginous framework whose movements are controlled by five overlying muscles. A finer understanding of the action of the laryngeal muscles is necessary to explain the production of calls such as that of the túngara frog.

Purpose

The objective of this study is to determine the action of the posterior laryngeal constrictor muscle. This muscle has been suggested to cause frequency modulation in the calls of other frogs by shortening or lengthening the vocal folds. It has also been suggested to bring the vocal folds into opposition to give a sharp onset to the call. We will test these suggestions in the túngara frog though an experimental approach.

Method

Glass suction electrodes will be used to stimulate the long laryngeal nerve producing contraction of the posterior constrictor muscle. Simultaneous filming of the larynx will allow for quantification of laryngeal movements in response to muscle contraction. Once the laryngeal movement is characterized, it must be confirmed that movement of the vocal folds does affect the frequency. This will be tested by through surgical clipping of the tendinous attachment of the posterior constrictor muscle so that the muscle can no longer move the larynx.

Results

Both lateral and longitudinal movements of the vocal folds occur when electrically stimulating the branch of the long nerve that innervates the posterior laryngeal constrictor muscle. This suggests that the muscle may have control over both onset and frequency of the call. Additionally, a surgical procedure has been designed and tested on preserved specimens that is minimally invasive for the frog.

Significance

Studies on the mating call of the tungara frog have contributed significant advancements to the understanding of how complexity evolves in communication systems. Elucidation of this animal's vocal control can reveal how behavioral evolution ties to structural modifications. This study can also reveal novel bioacoustical mechanisms which could have potential medical applications for voice restablishment treatments after laryngectomy.