The Musculus mylohyoideus and M. interhyoideus in Necturus

*Joseph P. Harris, Jr.*

Casual dissection of the ventral surface of the head in Necturus reveals an extensive area of muscle fibers crossing the throat and extending from the tip of the lower jaw to the gular fold. The connective tissues and fascia in this area partly mask the fibers; and the muscle fibers collectively have in several instances been described as constituting a single muscle, the M. mylohyoideus. In reality two separate muscles are involved, and each consists of two parts. Here follows a tabulation of the synonymy, and a brief description of the muscles:

<table>
<thead>
<tr>
<th>Muscle Name</th>
<th>Authors</th>
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<tbody>
<tr>
<td>M. Mylohyoideus (both parts)</td>
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<tr>
<td>Mylohyoideus (Mylohyoïden, Mylohyoid, Mylohyoidei)</td>
<td>Siebold 1828; Carus 1828; Cuvier 1836-40 (partim); Martin-St. Ange 1831; Mayer 1835; Stannius 1854-56; Léon-Vaillant 1863; Schmidt, Goddard &amp; Van der Hoeven 1862; Fischer 1864; Owen 1866; Van der Hoeven 1867; Mivart 1869; Walter 1887; Coghill 1902, 1906</td>
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<tr>
<td>Mylohyoideus (et interhyoideus), Walter 1887</td>
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<td>Mylohyoideus (et interhyoideus et interhyoideus posterior), Funk 1827</td>
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<tr>
<td>Intermaxillaire ou mylohyoïdien, Meckel 1838</td>
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<tr>
<td>Intermandibularis anterior, Gegenbaur 1901</td>
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<td>Intermandibularis posterior, Drüner 1903, 1904; Luther 1914; Norris 1908, 1913</td>
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<tr>
<td>Sous-maxillaire ou mylohyoïdien, Dugès 1834</td>
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<tr>
<td>Intermaxillaris anterior, Hoffman 1873-78; Wilder 1891, 1892, 1896; von Plessen and Rabinowicz 1891</td>
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<tr>
<td>Cmv (post.), Ruge 1896</td>
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<tr>
<td>Mandibular part of the mylohyoideus, Platt 1897</td>
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<td>Partie antérieure du mylo-hyoidien, Rusconi 1837</td>
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<td>Mylohyoideus anterior, Fischer 1864; Mivart 1869; Fürbringer 1873; Osawa 1902</td>
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<td>Intermandibularis, Francis 1934; Edgeworth 1935</td>
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<tr>
<td>M. Mylohyoideus anterior</td>
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<tr>
<td>Intermandibularis anterior, Drüner 1901; Luther 1914; L. Smith 1921; Edgeworth 1920, 1935; Francis 1934; Piatt 1935, 1938, 1940; Eaton 1936, 1937</td>
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<td>Submentalis, Fischer 1843; Mivart 1869; Osawa 1902; Houghton 1903.</td>
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<tr>
<td>(?)Submentalis (araphic portion of Csv 1, or Csv 1a), Kesteven 1941</td>
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<tr>
<td>Genio-glossus, Schmidt, Goddard and Van der Hoeven 1864</td>
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<tr>
<td>Submaxillaris, Hoffman, 1873-78</td>
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<tr>
<td>Cmv (antr.), Ruge 1896</td>
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<tr>
<td>M. Mylohyoideus</td>
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<tr>
<td>Intermandibularis posterior, Drüner 1901; Luther 1914; L. Smith 1920; Edgeworth 1920 et seq.; Francis 1934; Piatt 1935, 1938; Eaton, 1936, 1937</td>
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<tr>
<td>Mylohyoideus anterior, Fischer 1843; Mivart 1869; Osawa 1902</td>
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<tr>
<td>Partie antérieure du mylohyoïdien, Rusconi 1854</td>
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Mylohyoideus, Schmidt, Goddard & Van der Hoeven, 1864
*Intermaxillaris anterior*, Hoffman 1873-78; Plessen & Rabinowicz, 1891
Mylosternoideus, Walter 1887
*Cv, Ruge 1897
Quadrato-pectoralis, Drüner 1901, 1904
Cephalo-dorso-pectoralis, Drüner 1901, 1904
Interbranchialis 1, Drüner 1901, 1904
Quadrato-pectoralis, Drüner 1901, 1904; Piatt 1935
*Omo-humero-maxillaris*, Hoffman 1873-78
Levator maxillae inferioris ascendens, Fischer 1864
Posterior part of intermandibularis posterior (larva), constrictor colli gularis (adult), L. Smith 1920
Csv 2 (Superficial ventral constrictor of hyoid arch), Vetter 1874; Kesteven 1941
Gularis, L. Smith 1921; Eaton 1936, 1937

The two interhyoideus muscles form a broad, thin sheet of muscle covering the under surface of the throat behind the M. mylohyoideus.

The M. interhyoideus takes its origin on the distal half of the ceratohyal cartilage. Its fibers are directed cranio-mesad to insert on a connective tissue raphe which passes dorsad to the caudal portion of the M. mylohyoideus, and which lies just ventral to the M. geniohyoideus. Some of the fibers of the connective tissues of the raphe attach to the posterior and mesial borders of the aponeurosis of the M. genioglossus. The origin of the M. interhyoideus posterior is on the superficial ventral fascia of the M. myo- or branchiomandibularis and of the M. branchiohyoideus externus. The fibers pass tranversely across the throat, and at their posterior border form an opercular or gular fold. Their insertion is on a median raphe which is a continuation of the raphe of the M. interhyoideus anterior. Anterior and posterior parts of this muscle can be distinguished only at their origins; although this method of distinguishing them is easily used, it may be entirely artificial.

M. Interhyoideus (both parts)
Mylohyoideus, Mylohyoid, Mylohyoïdien (partim), Stannius 1854; Schmidt, Goddard & Van der Hoeven 1862; Owen 1866; Humphry 1872
*Intermandibularis posterior*, L. Smith 1920
Mylohyoideus, posterior part of mylohyoid, partie postérieure du mylohyoïdien, Van der Hoeven 1867; Mivart 1869; Fischer 1864; Platt 1897; Osawa 1902
Adult interhyoideus/larval intermandibularis posterior plus posterior part of intermandibularis anterior, Piatt 1955

M. Interhyoideus
*Interhyoideus*, Drüner 1903, 1904; Eaton 1936, 1937; Francis 1934; Edgeworth 1935; Piatt 1938; Kesteven 1941
Constrictor pharyngis internus, Siebold 1828
Mylohyoïdien, portion moyenne, Rusconi 1854
*Cv, Ruge 1897*
Inter-ossa-quadrata, Drüner 1901
Subhyoideus s. genio-hyoideus lateralis, Walter 1887
Anterior part of intermandibularis posterior (larva), interhyoideus (adult), L. Smith 1920

M. Interhyoideus posterior
Interhyoideus posterior, Francis 1934; Edgeworth 1935; Piatt 1938, 1940
Constrictor pharyngis externus, Siebold 1828
Mylo-hyoïdien, partie postérieure, Rusconi 1854
Canv (post.), Ruge 1896
Csv 1b, Kesteven 1941
M. submaxillaris, Houghton 1903

The two divisions of the mylohyoideus form a thin sheet of muscle stretching across the chin between the rami of the lower jaw. The M. mylohyoideus anterior is located in the broad angle formed by the symphysis of the dentary bones. It is perhaps 3 mm. wide in fully grown Necturus. Its fibers are araphic, and cross the midline of the chin between the dentary bones. It is therefore not possible to name the origin and insertion.

The M. mylohyoideus is located posterior to the M. mylohyoideus anterior. It originates along the median border of the anterior three-fourths of the dentary bone, and inserts along an extensive median raphe. Its fibers are long and straight, and (with minor exceptions) are strictly transverse.

Innervation of both parts of the mylohyoideus is provided by the ramus mandibularis of cranial N. trigeminus (V), as it is in Salamandra (Francis 1934), Ambystoma (Piatt 1938), and other vertebrata (Edgeworth 1935). The mylohyoidei arise from the ventral end of the embryonic mandibular arch. The posterior part originates first; from it a large mass of cells buds off anteriorly to become the mylohyoideus anterior (Piatt 1938).

The mylohyoidei are constrictor muscles, functioning in swallowing and in bucco-pharyngeal respiration. Eaton (1936) though that if the mylohyoideus anterior had any function in Dicamptodon it was to resist separation of the mandibles during the swallowing of large prey.

Innervation of the M. interhyoideus is from a ventral ramus of the cranial N. facialis (VII). The ramus has been named the jugularis by Francis (1934) and Piatt (1938), and hyomandibularis by Edgeworth (1935). The embryonic origin of both parts of the M. interhyoideus is from the hyoid arch (Piatt 1938).
The interhyoidei are constrictor muscles, and function in swallowing and in movement of the external gills.

Discussion

Several minor errors have helped to create the confusion that surrounds the names of these two muscles in the Urodela. Both muscles have been several times described as constituting the M. mylohyoideus in whole or in part, as the tables of synonymy show. Only when the innervation has also been studied (Francis 1934; Edgeworth 1935; Piatt 1938) has it been possible to recognize the muscles as superficial ventral constrictors of the mandibular and hyoid visceral-arches.

The M. mylohyoideus anterior has been described as a strictly “larval” muscle which disappears at metamorphosis. Francis (1934) reported the muscle present in larval Salamandra, but not in the adult. Piatt (1938) described it in larval Ambystoma punctatum, but not in the adult. Edgeworth (1935) noted the presence of an anterior portion of the muscle in Salamandra, Amphiuma, and Cryptobranchus, but did not specify whether he was treating of larval or adult stages. Eaton (1936) found the mylohyoideus anterior present in larval Dicamptodon ensatus, but disappearing at metamorphosis. Kesteven (1941) stated that an anterior portion of the mylohyoideus (his “submentalis” or Csv 1a) is “of very general occurrence” in the Amphibia, as well as present in all reptiles and in many birds. He suggested it is the “submentalis” and not the more posterior part of the M. mylohyoideus which gives rise to the M. mylohyoideus of the Theria. This conclusion Kesteven based upon his finding that the “submentalis” is commonly deeper than the more superficial and posterior M. mylohyoideus. Eaton (1936) printed a quotation from Bronn’s Klassen und Ordnungen des Thier-Reiches to the effect that the mylohyoideus anterior is lacking in all perennibrachiates and in Amphiuma, but is strongly developed in Cryptobranchus.

I have dissected several specimens of Urodela to discover the presence or absence of the M. mylohyoideus anterior. The muscle is consistently present in Necturus, in the axolotl of Ambystoma tigrinum, and in Siren lacertina. The muscle is absent in metamorphosed Ambystoma tigrinum, A. maculatum, A. jeffersonianum, Amphiuma means tridactylum,
Aneides lugubris, Cryptobranchus alleghaniensis, Plethodon cinereus, Triturus torosus, T. viridescens. There is some doubt about the presence of the muscle in the adult Eurycea melanoplura, for in the one small specimen I had for dissection there appeared to be a narrow band of araphic transverse fibers in the position appropriate to the M. mylohyoideus anterior.

I found a muscle answering the description of the "submentalis" of Kesteven in all of my specimens, including those in which the M. mylohyoideus anterior was present. It is possible that Kesteven used the name "submentalis" to describe the M. genioglossus of the Urodela; a muscle used for manipulation of the tongue, and not a derivative of the mandibular arch.

The position and attachments of the M. interhyoideus in Necturus have been described by Edgeworth (1935) as essentially "larval." In Caducibranchiata the muscle at metamorphosis undergoes considerable change—the extent of which is correlated with the changes in the position of the ceratohyal. Usually the M. interhyoideus posterior is lost at metamorphosis.

The homologies of the muscles treated here appear to be clear. Because of their origin, innervation, and obvious structural affinities, the M. mylohyoideus and M. interhyoideus of Necturus are homologous with the mandibular and hyoidean ventral constrictors of the Elasmobranchii, and with the mylohyoideus and stylohyoideus muscles of Amniotes.

Edgeworth (1935) used the names "intermandibularis" and "interhyoideus" to denote the superficial ventral constrictor muscles and their phylogenetic derivatives (as he interpreted them) in the vertebrate classes. His system has much merit, but the name "mylohyoideus" is so widely used that it can or should be supplanted. Hence I have used the name mylohyoideus for this muscle in Necturus. I follow Edgeworth (and others), however, in the matter of a name to be applied to the hyoidean ventral constrictor in Necturus, and hence call it the M. interhyoideus. Kesteven (1941) noted that while the M. interhyoideus is truly interhyoid, the M. interhyoideus posterior, arising from the superficial fascia, is not. Accordingly, he recommended that the anterior part be named "interhyoid" and
the posterior part "Csv 2" (hyoidean superficial ventral constrictor). Eaton (1937) had previously recommended that the M. interhyoideus posterior be called the "gularis" since this name is brief, clear as to the position of the muscle, and non-committal as to its origin and insertion. Worthy though these suggestions are, it seems better to use the names interhyoideus and interhyoideus posterior, since these tell the approximate position, and indicate a common segment of origin for the two portions.

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