



THE MUSCULATURE AND LIMB PLEXUSES
OF TRICHOSURUS VULPECULA.

by

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Thesis submitted for the Degree of

Doctor of Medicine

in the University of Adelaide,

March, 1961.

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The regulations for the Degree of Doctor of Medicine in the University of Adelaide require:-

- (a). A declaration of originality of the thesis. This may be found immediately after the title page.
- (b). An indication as to where the thesis advances knowledge. This is included as the last paragraph of the summary on p. 200.
- (c). A historical survey of the subject on which the thesis is written. This is incorporated in the introduction beginning on p. 2.

INTRODUCTION AND HISTORICAL SURVEY.

A considerable amount of work has been done, much of it many years ago, on the myology of marsupials. In some of the papers on this subject the vulpine phalanger, Trichosurus vulpecula, has received mention, the earlier authors referring to it by its previous name, Phalangista vulpina. None of these authors has, however, given anything like a complete account of the myology of Trichosurus, their references being either to one or a few muscles only, or brief statements by way of comparison with some other animal being treated more fully. The aim of this thesis is to provide a comprehensive account of the myology of this very common marsupial, usually regarded as a fairly generalized though typical member of the Phalangerinae, and to note the peripheral innervation of the various muscles - a feature of the muscular system that has received little attention in most of the accounts given for other marsupials. As an adjunct to this latter part of the work a study has also been made of the limb plexuses, and the report of this part of the investigation is included at the commencement of the main discussion. In the discussion of the muscles of Trichosurus vulpecula an attempt has been made to draw comparisons and contrasts between the features found and those reported for other marsupials. In reporting the works of other authors I have kept the generic and specific names that they use, making no attempt to bring these into line with modern nomenclature. The only alterations I have made are to eliminate upper case initial letters

from specific names in a few instances and to standardize the spelling of Didelphys.

One of the earliest workers of importance in the field of marsupial myology was Richard Owen who, in Todd's Cyclopaedia of Anatomy and Physiology (1839-1847), put together some points from the myology of several marsupials and made some general remarks on the subject; he dealt particularly with the abdominal muscles of Phalangista vulpina, the fore-limb muscles of Perameles lagotis, the psoas parvus of the kangaroo, and the muscles of the hind-limb of Dasyurus macrurus and Phalangista vulpina. He used substantially the same text and figures for the section on marsupial myology in his book on the anatomy of vertebrates (1868).

In 1866 came Haughton's fairly brief account of the myology of two species of Macropus and the opossum, and soon after that followed the work of Macalister. In 1868 this author made some remarks on the flexor muscles of the elbow in several marsupials in a broader consideration of this region of the vertebrate fore-limb; then followed (1870) his account of the myology of Phascolumys wombata and Sarcophilus ursinus which included passing references to some other marsupials including Phalangista vulpina. Two years later he published some further information on Sarcophilus ursinus (1872a) and a brief but comprehensive account of the muscles of Phascolarctos cinereus (1872b). At about the same time came Coues' (1872) important and comprehensive report on Didelphys virginiana.

A few more years brings us to the era of Young and Cunningham

in this field. In 1879, in his study of the male genital organs of Phascolarctos cinereus, Young dealt with the perineal muscles and cremaster of the male of that species; in 1880 he accounted for the intrinsic muscles of the hand in several marsupials, and in 1882 gave a fairly full account of the muscles of Phascolarctos cinereus with an occasional comparative reference to Phalangista vulpina. Also in 1882 came Cunningham's very important work, published in the Challenger Reports, on the muscles, plexuses and nerves of the limbs of Phalangista maculata and Thylacinus cynocephalus, the fore-limb muscles of Phascogale calura and the hand and foot musculature of several other marsupials including Phalangista vulpina. Some parts of this report were published earlier in the form of shorter papers (1878a, 1878b, 1878c, 1881a). This same year also saw the publication of Katz's work on the abdominal wall of a number of marsupials including Phalangista vulpina.

As the nineteenth century neared its end several more reports appeared. In 1885 Sidebotham gave a comprehensive account of the musculature of another American marsupial, Chironectes variegatus. MacCormick's study of the limb muscles of Dasyurus viverrinus, with some comparative references to Phalangista vulpina in the case of the fore-limb, followed in 1887, and in the same year Paterson published a few points about the brachial plexus of Phascolarctos cinereus. In 1890 Windle dealt with the long flexors of the fingers in Didelphys virginiana and Phalangista vulpina amongst other mammals, and in 1894 came Bardeleben's sketchy account of

some of the long and short muscles of the hand and foot in Didelphys marsupialis, Trichosurus vulpecula and Macropus bennetti (the hand only in the last). 1894 also saw the publication of Wilson's paper on the muscles - mainly of the fore-limb - of Notoryctes typhlops, with copious comparative notes, and in 1896 Parsons gave his account of the anatomy of Petrogale xanthopus which included a fairly complete cover of the muscles, their innervation and the limb plexuses. In 1897 Parsons, together with Windle, described the anatomy of another Macropod, Macropus rufus, giving some account of the muscles of the head, neck and limbs; and in the following year Kohlbrugge, dealing with two species of Cuscus and one of Macropus, presented information on the muscles and nerves of the face, neck and shoulder girdle regions. Another comparative account of this period was that of Leche in Bronn's Klassen und Ordnungen des Thier-Reichs, where he also recorded some of his own myological observations, principally on Myrmecobius.

In 1901 Alezais made some rather general remarks about the hind-limb muscles of Macropus bennetti, and G8ssnitz dealt with the brachial plexus in three marsupial species with special reference to the phrenic nerve origin. The next year saw Tobler's account of the anatomy and innervation of the panniculus carnosus in Macropus bennetti and other mammals; and in 1903 the more important works of Carlsson on the sphincter marsupii and some abdominal and inguinal muscles in several marsupials, and of Parsons on the anatomy (including a brief account of the muscles) of Choeropus castanotis

made their appearance. A further addition to the knowledge of Notoryctes typhlops came in 1905 with Thompson and Hillier's account of the hind-limb myology which included some allusions to the conditions in Trichosurus, and in the same year Taylor and Bonney dealt with the deep calf muscles of a range of vertebrates including Trichosurus among the few marsupials discussed.

Several reports appeared in 1908: Bijvoet, in his comparative studies on the digastric muscle, described some of the submental musculature of Trichosurus vulpecula and some other marsupials; Lubosch gave an account of the muscles of mastication in several marsupials; Boas and Paulli dealt with the facial muscles - especially the ear muscles of Didelphys, and Frets included one marsupial - Didelphys cancrivora - in his work on the peronei and foot extensors. In this year also appeared Glaesmer's work on the flexors of the leg and foot in Didelphys cancrivora, Dasyurus hallucatus and Trichosurus vulpecula, where she noted the innervation of the muscles and made comparisons with the monotremes: in 1910 she followed this with a similar study of several other marsupials and compared them with other mammals. Also in 1910 Kajava gave his account of the long flexors and intrinsic muscles of the hand in several marsupials, and van den Broek described the perineal muscles and some muscles of the inguinal region in a wide range of marsupials including Trichosurus vulpecula (and also Phalangista vulpina, as if he thought it was a different species).

In 1914 Carlsson's account of Dendrolagus dorianus was published.

In this she also dealt briefly with four Macropods and Trichosurus vulpecula (representing the Phalangerinae) for purposes of comparison. Then in 1921 followed Osgood's important and comprehensive study of Caenolestes, and in the same year Sonntag (1921a, 1921b) described some of the neck muscles of several marsupials, of which Trichosurus vulpecula was one. A further work by Sonntag on many of the muscles of Phascologomys wombata, Phascolarctos cinereus, Phalanger orientalis and Pseudochirus peregrinus followed in 1922.

The late 1920's saw the revival of work (and dispute) on the innervation of the facial muscles and platysma (Huber, 1924a, 1924b, 1925; Huber and Hughson, 1926; Adams, Wheeler and Edgeworth, 1929; Smith, 1931), and in 1930 Huber included some discussion of marsupials in his evolutionary considerations of the facial musculature.

The brachial flexors of Didelphys virginiana were considered by Howell and Straus in 1931 in dealing with the corresponding muscles in Primates, and in 1932 the opossum was subject to further study by Langworthy who described the pectorals and panniculus together with their innervation.

In 1934 Miller made a study of the brachial plexus in several vertebrates, including Trichosurus vulpecula as the marsupial example. In the following year, in his book on the cranial muscles of vertebrates, Edgeworth dealt with the branchial muscles of marsupials, and in 1937 he gave a short account of the digastric

and related muscles in two species of cuscus.

1939 saw the publication of Harris's extensive work on the vertebrate brachial plexus in which he dealt with five marsupials, and in this year Heighway submitted her comprehensive thesis (unpublished) on the anatomy of Hypsiprymnodon moschatus which included a large section on the muscles. Also in 1939 Haines, in a comparative study, described the fore-arm extensors of Didelphys virginiana, Campbell dealt with the interossei of Didelphys from a morphological and embryological approach, Lightoller gave some space to Trichosurus vulpecula and other marsupials in his comparative account of the mandibular and hyoid arch muscles, and Abbie (1939a) gave the results of a study of the region of attachment to the mandible of the masseter and medial pterygoid muscles in many marsupials.

One of the most recent anatomical studies in this field is that of Boardman (1941) on the chest wall and shoulder region of Macropus robustus, and in 1942 Straus described the fore-arm flexors of Didelphys in a comparative study of tetrapods in general.

Some further references to work on very restricted aspects of the field are given in the main text of this thesis but would be, I feel, rather out of place here.

The above review is not completely exhaustive. Some works not available locally (especially some of the older ones) have not been obtained elsewhere as it was felt that, since in most cases the genera concerned have been dealt with in other accounts, the result

would not have been worth the time and trouble involved. A fairly recent example is Carlsson's article on Hypsiptymnodon moschatus (1915. Kungl. Svensk. Vetenskapsakad. Hand. 52, 5.) quoted by Heighway (1939). Vrolik, Cuvier and Ruge are perhaps the most important early workers whose names do not appear in the foregoing review.