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A comparative morphological study of the brachial plexus of domestic animals (Bovidae, Ovidae, Capridae, Suidae, Equidae)

James Henry Magilton
Iowa State University

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A COMPARATIVE MORPHOLOGICAL STUDY
OF THE BRACHIAL PLEXUS OF DOMESTIC ANIMALS
(BOVIDAE, OVIDAE, CAPRIDAE, SUIDAE, EQUIDAE)

by

James Henry Magilton, 

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INTRODUCTION

This comparative morphological study of the brachial plexuses of the ox, sheep, goat, pig and horse includes the nerve roots contributing to it and the nerves emanating from it. The nerves emanating from the plexus, and coursing distally in the forelimb, were described to the area of the elbow joint.

There has been increasing interest in the small ruminant and pig as research animals. Electro-physiological studies of nerve function are advancing with the sophistication of electronic equipment. Neurectomy and nerve blocking with anesthetics, though in use much longer, are still valuable research methods. They all require precise knowledge concerning the location of nerves in the normal intact animal.

A new approach has been attempted in describing the brachial plexus. It was for this reason that the horse, despite the fact that the brachial plexus in this animal has been described numerous times in the past by outstanding anatomists, was included. The main objective was to compare the brachial plexus as outlined above. The second objective was to dissect the specimens in such a way that they could be depicted in the same relationships to each other and surrounding structures as they occur in the living intact
animal. This was thought to be an important consideration because the plexus is usually dissected from the lateral approach which necessitates distorting the limb from its normal position. The third objective was to dissect in such a way that photography could be used to a greater extent, as compared to schemas, to record the findings.
REVIEW OF LITERATURE

Goat (Caprine)

The brachial plexus (Plexus brachialis), according to Ellenberger and Baum (1943), originates, in most ruminants, from the ventral branches of the last three cervical and first and second thoracic nerves. According to Bruni and Zimmerl (1951), the ventral branch of the second thoracic nerve does not ordinarily enter into the formation of the brachial plexus in ruminants.

Reimers (1925b) used the ox as the basic animal in describing the branches emanating from the brachial plexus. He described nerves in detail, in the goat and sheep, only where they were different from those in the ox. According to him the branches emanating from the brachial plexus are as follows:

1. The suprascapular nerve (N. suprascapularis) resembles that in the ox.
2. The subscapular nerves (Nn. subscapulares) resemble those in the ox.
3. The cranial pectoral nerves (Nn. pectorales craniales).
   a. The cranial pectoral nerve I (N. pectoralis primus) resembles that in the ox except that it is detached from the musculocutaneous nerve
proximal to the axillary artery. It receives fibers from the musculocutaneous nerve, or from the seventh cervical nerve by way of the latter nerve. It crosses the lateral face of the axillary artery and joins the cranial pectoral nerve II (N. pectoralis secundus). It forms a trunk with the latter nerve which ramifies within the superficial and deep pectoral muscles (Mm. pectoralis descendens, pectoralis transversus, pectoralis cleidospinalis, pectoralis ascendens).

b. The cranial pectoral nerve II (N. pectoralis secundus) resembles that in the ox except that it forms a common trunk with the ventral thoracic nerve (N. thoraco ventralis) and the lateral thoracic nerve (N. thoraco lateralis). The latter mentioned trunk originates from the eighth cervical and first thoracic nerves. The cranial pectoral nerve II is detached from the latter trunk, crosses the medial face of the axillary artery and joins the cranial pectoral nerve I, as described previously in "a".

c. The cranial pectoral nerve III (N. pectoralis tertius) resembles that in the ox.

4. The musculocutaneous nerve (N. musculocutaneus)
originates from the sixth and seventh cervical nerves.

5. The median nerve (N. medianus) resembles that in the ox.

6. The ulnar nerve (N. ulnaris) originates from the eighth cervical and first thoracic nerves and resembles that in the ox.

7. The radial nerve (N. radialis) resembles that in the ox. The author noted in one goat that the nerve pierced the medial head of the triceps muscle after detaching a branch to the latter muscle.

8. The axillary nerve (N. axillaris) resembles that in the ox.

9. The long thoracic nerve (N. thoracalis longus) resembles that in the ox.

10. The thoracodorsal nerve (N. thoracodorsalis) resembles that in the ox.

11. The external thoracic nerve (N. thoracalis lateralis) resembles that in the ox.

Sheep (Ovine)

The origin of the brachial plexus is described by Reimers (1925b) as resembling that in the ox, except that a root could not be demonstrated from the second thoracic nerve. Ellenberger and Baum (1943) and Bruni and Zimmerl
(1951) describe it under the heading of ruminants, all of which are set forth under the heading of the goat in this thesis. May (1964) stated that it is formed by the ventral branches of the last three cervical and the first thoracic nerves. He further stated that it appears between the two parts of the scalenus muscle cranial to the first rib. The branches emanating from the brachial plexus are as follows:

1. The suprascapular nerve, according to Reimers (1925b), resembles that in the ox. May (1964) agreed with Reimers concerning the origin. He further stated that it passes ventrolaterally to disappear between the subscapular and supraspinatus muscles and contributed branches to the supraspinatus and infraspinatus muscles.

2. The subscapular nerves, according to Reimers (1925b), resemble those in the ox. May (1964) agreed with Reimers concerning the origin of the nerves. He stated, however, that there are often three primary trunks which divide into several branches and enter the subscapular muscle near the junction of the middle and distal thirds. He further stated that one trunk runs with the suprascapular, one trunk runs alone and the other runs with the axillary and thoracodorsal nerves.

3. The cranial pectoral nerves are described, according to Reimers (1925b) and under the heading of the goat in this thesis. May (1964) stated that there are two main trunks —
cranial and caudal. According to him the cranial trunk arises from the median or external thoracic nerve, supplies the anterior pectoral muscles (*Mm. pectoralis descendens* and *Pectoralis cleidomastoideus*) and also gives a branch to the posterior deep pectoral muscle (*M. pectoralis ascensens*). The caudal branch arises from the external thoracic nerve and ramifies mainly in the posterior pectoral muscle. Small filaments pass to the posterior superficial pectoral muscle (*M. pectoralis transversus*).

4. The **musculocutaneous nerve**, according to Reimers (1925b), originates from the sixth and seventh cervical nerves. May (1964) agreed with Reimers and further stated that it appears in front of the suprascapular nerve and descends over the lateral face of the brachial artery. May, in his continuing description, stated that it then runs parallel with the ventral face of the artery and soon alters direction. Here, according to May, it sends a branch across the medial face of the artery to the median nerve. Another loop, according to May, connects it with one of the pectoral nerves which arises from the caudal part of the plexus.

5. The **median nerve**, according to Reimers (1925b), resembles that in the ox. May (1964) agreed with Reimers for the most part. A point of difference is that May stated that the nerve crosses the medial face of the brachial artery whereas Reimers called it the axillary artery.
Reimers did not mention the loop formed with the musculo-cutaneous nerve whereas May did. The latter author finally stated that the median nerve forms a common trunk with the ulnar nerve and disappears between the brachial artery and caudal deep pectoral muscle cranial to the radial nerve.

6. The ulnar nerve, according to Reimers (1925b), comes from the eighth cervical and first thoracic nerves and resembles that of the ox. Bruni and Zimmerl (1951) describe the nerve under ruminants. They stated that the ulnar and median nerves exchange one or more branches at the level of the middle of the humerus. May (1964), in his brief description, does not disagree with the previously mentioned authors.

7. The radial nerve, according to Reimers (1925b), resembles that in the ox. Bruni and Zimmerl (1951) described the nerve under the heading of ruminants. May (1964) agreed with Reimers that the nerve is derived from the seventh and eighth cervical and first thoracic nerves. Bruni and Zimmerl made no mention of the origin in ruminants. May stated that the nerve disappears between the teres major and long head of the triceps muscles, medial to the brachial artery and lateral to the brachial vein.

8. The axillary nerve, according to Reimers (1925b), resembles that in the ox. His findings relative to the origin of this nerve (sixth and seventh cervical nerves)
do not agree with May (1964) who stated that the nerve receives fibers from the sixth, seventh and eighth cervical nerves. According to May the nerve emerges in the middle of the plexus and disappears between the subscapular muscle and the subscapular artery.

9. The long thoracic nerve resembles that in the ox in course and distribution (Reimers, 1925b). His findings relative to the origin of this nerve (seventh and eighth cervical nerves) do not agree with May (1964) who designated it the N. thoracicus longus and stated that it arises from the seventh and eighth cervical and first thoracic nerves. May also stated that this nerve sends an anastomotic branch to the sixth cervical nerve from its cranial branch.

10. The thoracodorsal nerve, according to Reimers (1925b), resembles that in the ox. May (1964) agreed with Reimers as to the origin of the nerve. He did not, however, agree with Reimers relative to the structures innervated. Reimers stated that the nerve ramifies in the latissimus dorsi muscle whereas May stated that the nerve ramifies in the latter muscle and gives branches to the teres major and deep pectoral muscles.

11. The external thoracic nerve according to Reimers (1925b), resembles that in the ox. May (1964) designated this nerve as the N. thoracicus lateralis but he did not describe its origin. He stated that it ramifies on the
ventrolateral wall of the abdomen whereas Reimers stated that it ramifies in the cutaneus trunci muscle and in the skin in the lateral wall of the thorax. Reimers designated this nerve as one of the caudal pectoral nerves which detaches some twigs to the deep pectoral muscle. May, on the other hand, stated that the caudal pectoral nerve arises as a branch from the external thoracic nerve.

Ox (Bovine)

According to Reimers (1925), the brachial plexus is formed by contributions from the ventral branches of the sixth, seventh and eighth cervical and the first and second thoracic nerves. Ellenberger and Baum (1943) stated that the brachial plexus originates from the ventral branches of the last three cervical and first two thoracic nerves in most ruminants. Bruni and Zimmerl (1951), in their description of ruminants, stated that the second thoracic nerve does not ordinarily enter into the formation of the plexus. They stated that the ventral ramus of the sixth cervical nerve goes almost entirely to the plexus after giving nerves to the angularis scapulae and rhomboideus muscles. Sisson and Grossman (1953) stated that the second thoracic nerve usually does not furnish a root to the plexus. McLeod (1958) stated that the plexus is formed by branches from the last three or four cervical and the first thoracic nerves. He stated
further that the second thoracic nerve may or may not contribute a small branch to the plexus. Koch (1965) agreed with Reimers relative to the origin of the plexus.

The branches emanating from the brachial plexus are as follows:

1. The **suprascapular nerve**, according to Reimers (1925b), is derived from the sixth and seventh cervical nerves. McLeod (1958) stated that it is formed from the anterior part of the plexus and disappears between the subscapular and supraspinatus muscles with the suprascapular vessels. He further stated that one or two branches enter the deep surface of the supraspinatus. The nerve, according to McLeod, crosses the anterior border of the scapula, turns backward on the neck of the bone below the spine and enters the infraspinatus muscle. Habel (1964) devoted one sentence to this nerve. He stated that it passes laterad between the supraspinatus and infraspinatus muscles just above the coracoid process. Koch (1965) agreed with both Reimers and McLeod regarding the origin and distribution of the nerve.

2. The **subscapular nerves**, according to Reimers (1925b), are two in number. They are formed by fractions of fibers from the sixth and seventh cervical nerves which are connected with the suprascapular nerve for a distance. They break up into several twigs which enter the subscapular muscle at about the transition of the middle to the distal
parts of the scapula (Reimers, 1925b). Bruni and Zimmerl (1951) described the inferior subscapular nerve as the nerve to the teres major muscle. They stated that the latter nerve originates from the brachial plexus in common with the nerve to the great dorsal (latissimus dorsi) muscle and frequently with the axillary nerve. It almost always furnishes branches to the subscapular muscle near the posterior margin of the latter. They also described a thicker branch provided from the plexus together with the suprascapular nerve and sometimes another branch which comes directly from the plexus itself. According to McLeod (1958) it arises from the anterior band of the brachial plexus directly posterior to the suprascapular nerve. It usually has two branches which enter the medial surface of the subscapularis muscle at, or below, its middle and near the anterior border. Koch (1965), in his description of the nerve in the horse, cattle and pig, stated that it is comprised of one to three thin nerves which develop largely from the ventral branch of the ventral branch of the seventh cervical nerve and partly from the eighth cervical nerve. He stated further that they supply the subscapular muscle to a caudal ribbon-like area which is supplied by the axillary nerve.

3. The cranial pectoral nerves are a group of three nerves which are a subdivision of the pectoral nerves as described in the goat. The cranial pectoral nerve I is
formed by fractions of fibers from the sixth and seventh cranial nerves. The cranial pectoral nerve II is formed from a fraction of fibers from the eighth cervical, and sometimes from the first thoracic, nerves and is at first connected with the cranial pectoral nerve III. The cranial pectoral nerve III runs with the cranial pectoral nerve II for a short distance and, along with the caudal pectoral nerve (N. thoracalis lateralis), is destined for the cutaneus trunci muscle (Reimers, 1925b). McLeod (1958) stated that they are at least two in number and arise from the posterior band of the plexus. Reimers described contributions from the anterior part of the plexus as well. McLeod, otherwise, agreed with Reimers. Koch (1965) stated that this group is comprised of three or four nerves. He did not mention a contribution from the sixth cervical nerve as Reimers did. Koch stated that they supply the cranial segments of the superficial and deep pectoral muscles; McLeod said they supply the superficial and the anterior part of the deep pectoral muscles; while Reimers said they ramify in the superficial and deep pectoral muscles. Reimers described a loop formed around the axillary artery by these nerves. McLeod stated that they form a loop around the brachial artery while Koch did not describe a loop.

4. The musculocutaneous nerve, according to Reimers (1925b), derives its fibers from the sixth and seventh
cervical nerves, with the contribution from the seventh being greater. McLeod stated that it arises from the anterior part of the brachial plexus and crosses the lateral surface of the brachial artery. He stated further that, as it crosses the artery, it gives a large branch which joins the median nerve, forming a loop below the artery. According to him, it continues with the median nerve a short distance, turns forward to the coracobrachialis muscle, passes through the latter muscle giving branches to it, and terminates in the biceps brachii muscle. Habel (1964) disagreed significantly with McLeod. He stated that the nerve gives muscular branches to the coracobrachialis and biceps brachii muscles and then joins the median nerve distal to the axillary artery. Habel further stated that the nerve runs with the median nerve to the middle of the arm then separates from the latter and divides into the muscular branch to the brachialis, and the medial cutaneous antebrachial nerve. Koch (1965) agreed with Reimers that the nerve is derived from the sixth and seventh cervical nerves. He agreed with Habel that it forms a loop with the median nerve ventral to the axillary artery. Habel made no mention of an exchange of fibers between the two nerves in the loop. The latter author agrees with Koch on the final disposition of the nerve.

5. The median nerve is derived from the eighth cervical and first thoracic nerves. It crosses the axillary artery
on the medial side at the level of the shoulder joint. It passes distally in a common sheath with the ulnar nerve to the distal end of the teres major muscle, where the latter nerve diverges caudally. The median nerve continues distally in the limb running along the anterior border of the brachial artery to the level of the elbow joint, where it lies medial to the latter vessel (Reimers, 1925b). McLeod named the nerves which terminate as: a branch to the brachialis muscle; and the dorsal cutaneous nerve of the forearm, the "musculocutaneous branch of the median." Bruni and Zimmerl (1951) stated that the median and ulnar nerves exchange one or more branches at the level of the middle of the humerus.

6. The **ulnar nerve** consists of fractions of fibers from the eighth cervical and first and second thoracic nerves. It courses with the median nerve across the medial face of the axillary artery then separates from the latter nerve at the transition from the proximal to the middle third of the humerus (Reimers, 1925b). Bruni and Zimmerl (1951) stated that the median and ulnar nerves exchange one or more branches at the level of the middle of the humerus.

7. The **radial nerve** consists of fractions of fibers from the seventh and eighth cervical and first thoracic nerves. The fibers from the seventh cervical nerve are closely connected with the axillary nerve and the fibers from the eighth cervical and first thoracic nerves lie lateral to
the bundles of fibers from the same ventral branches destined for the median and ulnar nerves (Reimers, 1925b). Stanić and Palić (1962) stated that it runs almost parallel with the caudal border of the humerus to the caudal border of the end part of the teres major muscle. At the latter site, according to them, it passes laterally between the long and medial heads of the triceps muscle and passes through the musculo-spiral groove. They stated further that it detaches one strong and one or two thin branches to the long head of the triceps muscle. Following these branches a twig extends from the radial to the lateral and medial heads of the latter muscle as well as a branch to the tensor fasciae antebrachii muscle. Stanić and Palić stated further that the nerve stretches distally between the brachialis and extensor carpi radialis muscles and ends in the muscles which cause extension of the carpus and digit. McLeod (1958) also described a branch to the anconeus muscle and a large cutaneous branch which is detached under cover of the lateral head of the triceps muscle and descends on the dorsal surface of the limb. In addition to the foregoing descriptions, Koch (1965) stated that there is sometimes a branch detached to the brachialis muscle. Ellenberger and Baum (1943) stated that the part of the brachialis muscle innervated by the radial nerve is larger in the bovine than in the horse.

8. The axillary nerve originates from the ventral
branches of the sixth and seventh cervical nerves (Reimers, 1925b; Ellenberger and Baum, 1943; Koch, 1965). It forms a group with the radial and thoracodorsal nerves as they leave the plexus (Reimers, 1925b; McLeod, 1958). There is general agreement regarding the course and distribution of the nerve and its branches. It detaches one or two branches to the posterior part of the subscapularis muscle then turns laterally between the latter muscle and the subscapular artery. It detaches branches to the teres major muscle and sensory branches to the shoulder joint as it passes laterally caudal to the latter joint. It divides into several branches on the deep face of the deltoideus muscle. The muscular branches supply the teres minor, deltoideus and brachio-cephalicus. A cutaneous branch emerges below the deltoid tuberosity and supplies the skin on the anterior surface of the forearm. According to McLeod, the cutaneous branch gives an anastomotic branch to the radial nerve before supplying the skin.

9. The **long thoracic nerve**, along with the thoracodorsal and thoracoventral nerves, makes up the caudal pectoral group. It derives its fibers from the seventh and eighth cervical nerves and is the most dorsally placed of the group. The roots detach from the ventral branches of the corresponding nerves close to the intervertebral foramen, extend laterally on the serratus ventralis muscle and, after
splitting into numerous twigs, ramify within this muscle (Reimers, 1925b). Koch (1965) designated this, along with the thoracodorsal, lateral thoracic and thoracoventral nerves, as the "caudal thoracic nerves". Reimers and Koch agreed with McLeod (1958) who stated that it gives branches to the anterior part of the serratus ventralis muscle and passes backward on the superficial surface of the latter muscle in which it terminates.

10. The thoracodorsal nerve is formed by fractions of fibers from the same cervical nerves as the preceding (long thoracic) nerve. This nerve is closely connected to the radial and axillary nerves in the initial part of its course and finally ramifies in the latissimus dorsi muscle (Reimers, 1925b). Koch (1965) named the eighth cervical nerve as its sole origin. Bruni and Zimmerl (1951) stated that it forms a trunk with the axillary nerve and the nerve to the teres major muscle and is totally distributed in the grand dorsal (latissimus dorsi) muscle. McLeod (1958) does not describe the origin, but he agreed with the rest of the description.

11. The external thoracic nerve is designated by Reimers (1925b), as the N. thoraco ventralis which derives its fibers from the eighth cervical and first thoracic nerves. He stated further that it usually forms a common trunk with the cranial pectoral nerve III then continues caudally along the dorsolateral border of the deep pectoral muscle. It is
joined by lateral branches of most intercostal nerves in a variable manner, gives off a few accessory twigs to the deep pectoral muscle, and ramifies inside the M. subcutaneus maximus (cutaneus trunci muscle) and in the skin on the lateral wall of the thorax. McLeod (1958) stated that it divides into dorsal and ventral branches: the dorsal branch receives reinforcing branches from the second to the sixth intercostal nerves and ramifies in the cutaneous trunci muscle; the ventral branch passes posteriorly to the deep face of the deep pectoral muscle in which it ramifies.

**Pig (Swine)**

The origin of the brachial plexus, according to Reimers (1925b) and Koch (1965), is formed by ventral branches of the fifth to the eighth cervical and first thoracic nerves. Reimers stated further that it resembles that of the ox in position and pattern of emergence of the aforementioned ventral rami. The fifth cervical nerve, according to Reimers, contributes only a relatively delicate branch to the plexus while the eighth cervical nerve contributes the strongest branch. According to Bruni and Zimmerl (1951) the plexus is constituted by four pairs of nerves which are the same as in the ruminant. Chauveau and Arloing (1902) stated that three fasciculi are detached from the brachial plexus; the posterior is the most voluminous, and furnishes the radial,
median and ulnar nerves. They stated further that the branches of the plexus that pass to the trunk and the first segments of the anterior limb resemble those of the ruminants. According to Montané and Bourdelle (1920), the general disposition of the nerves of the brachial plexus is similar to that of the ox and horse. The branches emanating from the brachial plexus are as follows:

1. The **suprascapular nerve** consists of fractions of fibers from the ventral branches of the fifth, sixth and seventh cervical nerves (Reimers, 1925b). Reimers further stated that the nerve is in close proximity to the subscapular nerves and otherwise resembles that of the ox.

2. The **subscapular nerve** (nerves) is formed by fractions of fibers from the ventral branches of the fifth, sixth and seventh cervical nerves (Reimers 1925b). Reimers stated that it may occur singly or as two nerves. Where two nerves are present: one arises from the fifth and sixth cervical nerves; and the other arises from the seventh cervical nerve. Reimers further stated that the course and area of innervation resemble those of the ox.

3. The **cranial pectoral nerves**, in general, resemble those of the ruminant, according to Reimers (1925b). He described three main cranial pectoral nerves as in ruminants, and, in addition, one or two accessory cranial pectoral nerves which arise between cranial pectoral nerve II and the
common trunk of origin of the cranial pectoral nerve III and ventral thoracic (external thoracic) nerves. He further stated that they arise from the eighth cervical nerve and enter the posterior deep pectoral muscle in the area of the shoulder joint.

4. The *musculocutaneous nerve*, according to Reimers (1925b), derives its fibers from the ventral branches of the sixth and seventh cervical nerves, and inconstantly from the fifth cervical nerve. Koch (1965) also stated that the contribution from the fifth cervical nerve is inconstant, and sometimes there are contributions from the eighth cervical nerve. According to Reimers, the general disposition of the nerve resembles that of the ox.

5. The disposition of the *median nerve* is similar to that of solipeds and ruminants as far as the carpus (Chauveau and Arloing 1902). According to Reimers (1925b), it essentially resembles that of the ox in its origin. According to the latter author a few fibers extend from the median nerve into the branch to be considered along with the musculocutaneous nerve. The latter mentioned branch is detached from the median nerve at the transition from the middle to the distal third of the humerus and, after supplying the brachialis muscle, forms the cutaneous nerve, "ramus cutaneus antebrachii nervi musculocutanei" (*N. cutaneus antebrachii medialis* S. dorsalis).
6. The ulnar nerve consists of fractions of fibers from the eighth cervical and first thoracic nerves (Reimers 1925b). Reimers further stated that it separates from the median nerve at the middle of the arm, or further proximal, then courses, as in the ox, sheep and goat, in the direction of the olecranon.

7. The radial nerve consists of fractions of fibers from the ventral branches of the seventh and eighth cervical and first thoracic nerves (Reimers 1925b). According to him fractions of fibers from the eighth cervical and first thoracic nerves detach laterally from those of the median and ulnar nerves. He stated further that the contribution from the seventh cervical nerve, at the beginning, is closely associated with the contribution from the axillary nerve. The radial nerve, according to Reimers, forms a trunk with the axillary and thoracodorsal nerves. He further stated that it separates from the other members of the latter trunk somewhat proximal to the shoulder joint and crosses the medial side of the end tendon of the teres major and latissimus dorsi muscles. Reimers further stated that on the medial side of the teres major muscle it gives branches to the triceps, tensor fasciae antebrachii and anconeus muscles and enters with these and its continued trunk between the long and medial heads of the triceps muscle. He further stated that in one half of the cases there was an extra
muscular anastomosis between the brachialis twig of the radial nerve and the musculocutaneous nerve.

8. The axillary nerve is formed by fractions of fibers from the sixth and seventh cervical nerves and passes, in close association with the radial and thoracodorsal nerves, close to the shoulder joint (Reimers 1925b). According to the latter author it separates from the associated nerves slightly proximal to the latter joint. It immediately gives off a branch in a caudal direction which divides, as in the ox, into a twig for the subscapular muscle, which can also be designated as a second or third subscapular nerve, and a strong branch for the teres major muscle.

9. The long thoracic nerve, according to Reimers (1925b), is a component of the caudal pectoral nerve group which, in relation to course and area of innervation, resemble those of the ox, sheep and goat. Reimers further stated that it arises from the seventh and eighth cervical nerves.

10. The thoracodorsal nerve arises from the seventh and eighth cervical nerves and otherwise resembles the nerve in the ox (Reimers, 1925b).

11. The external thoracic nerve arises from the seventh and eighth cervical nerves and otherwise resembles the nerve in the ox (Reimers, 1925b).
Horse (Equine)

The brachial plexus results from anastomoses established between the ventral branches of the sixth, seventh and eighth cervical and the first and second thoracic nerves. It passes between the two parts of the scalenus muscle (Bradley, 1920; Ellenberger and Baum, 1943; Bruni and Zimmerl, 1951; Sisson and Grossman, 1953; Tagand and Barone, 1964; Koch, 1965). The seventh and eighth cervical and first thoracic nerves contribute most to the plexus (Bradley, 1920; Sisson and Grossman, 1953; Bruni and Zimmerl, 1951). According to Bradley and Sisson and Grossman the root derived from the sixth cervical nerve is very small. Bruni and Zimmerl (1951) stated that the latter nerve detaches from the phrenic nerve while Tagand and Barone (1964) stated that it arises with the phrenic. The first thoracic nerve contributes its entire ventral branch to the plexus, except a small first intercostal branch (Bruni and Zimmerl, 1951; Sisson and Grossman, 1953; Tagand and Barone, 1964). The root from the second intercostal nerve is small, since the major portion makes up the second intercostal nerve (Bruni and Zimmerl, 1951; Sisson and Grossman, 1953).

The branches emanating from the brachial plexus are as follows:

1. The suprascapular nerve passes between the supraspinatus and subscapularis muscles and innervates the
supraspinatus and infraspinatus muscles (Ellenberger and Baum, 1943; Sisson and Grossman, 1953; Koch, 1965). Bruni and Zimmerl (1951), in addition to the foregoing description, stated that the nerve detaches some twigs to the subscapular muscle.

2. The subscapular nerves arise immediately caudal to the suprascapular nerve. They are usually two in number and originate from the sixth and seventh, and sometimes the eighth, cervical nerves (Reimers, 1925b). Bruni and Zimmerl (1951) designated this the superior subscapular nerve which originates from the seventh and eighth cervical pair and usually reaches the subscapular muscle already divided into two branches. According to Koch (1965), this nerve is comprised of one to three branches which develop from the seventh and eighth cervical nerves. It supplies the subscapular muscle, except for a caudal ribbon-like area which is supplied by the axillary nerve.

3. The cranial pectoral nerves may vary from three to five in number. The most anterior (cranial pectoral nerve I) receives its fibers from the seventh, and sometimes from the eighth, cervical nerves, and enters the prescapular portion and cranial segment of the humeral portion of the deep pectoral muscle in front of the shoulder joint. The next caudal nerve (cranial pectoral nerve II) consists of two roots. The cranial root derives its fibers from the seventh
and eighth cervical nerves and courses in association with the musculocutaneous nerve in the region of the axillary artery. The caudal root derives its fibers from the eighth cervical and first thoracic nerves and arises from the plexus either independently; or from a common trunk with the median and ulnar nerves; or from a common trunk with the N. thoraco-ventralis (external thoracic) and the cranial pectoral nerve III. The next nerve, which is included in the cranial pectoral group, is designated as the cranial pectoral nerve III. It derives its fibers from the eighth cervical and first and second thoracic nerves. In some cases a nerve originating from the latter described nerve and running parallel to it may be found which is designated as the accessory cranial pectoral nerve III (Reimers 1925b). Ellenberger and Baum (1943) stated that the cranial pectoral nerves supply the cranial segments of the superficial and deep pectoral muscles. Bradley (1920) stated that this group is made up of three or four nerves and supplies the cranial part of the pectoral mass as well as a part of the brachiocephalic muscle. Bruni and Zimmerl (1951) described the ventral thoracic (or pectoral) nerves as being five in number. According to them, the first one originates from the seventh, or sixth and seventh, cervical nerves and can anastomose with the second nerve to the biceps muscle. It divides into two branches which terminate in the sternoprescapular (anterior deep
pectoral) muscle. The second one originates from the musculocutaneous and median nerves and, consequently, from the seventh and eighth cervical and first and possibly second thoracic nerves, forming two roots which reunite under the axillary artery, gives off some filaments to the anterior and posterior deep pectoral muscles, and ramifies in the anterior and posterior superficial pectoral muscles. The third, fourth and fifth nerves originate from the common trunk which detaches from the brachial medial cutaneous (external thoracic) or from the ulnar nerve and are entirely distributed to the posterior deep pectoral muscle. Sisson and Grossman (1953) agreed with Bradley (1920) that these nerves detach branches to the brachiocephalic muscle. They stated that the nerves are derived from the anterior part of the plexus. According to Koch (1965) this group is derived either from the seventh and eighth cervical, or eighth cervical and first thoracic nerves, and supplies the cranial segment of the superficial and deep pectoral muscles.

4. The musculocutaneous nerve, according to Reimers (1925b), consists of fibers from the seventh and eighth, and a delicate branch from the sixth, cervical nerves. He stated further that it crosses the axillary artery laterally and enters the median nerve with its fraction of fibers almost entirely from the eighth, and partly from the seventh, cervical roots. It conveys bundles of fibers to the median,
and sometimes to the cranial pectoral nerve. The proximal muscular ramus distributes fibers to the coracobrachialis and biceps brachii muscles. The remaining part runs along with the median nerve and finally terminates as the *ramus muscularis distalis* to the distal portion of the brachialis muscle, and the *N. cutaneus antebrachii medialis*. According to Bruni and Zimmerl (1951) the nerve receives a reinforcing twig from the median nerve and terminates in the biceps brachii muscle. They stated further that it releases three branches: one to the superficial portion of the coracobrachialis muscle; one to the deep portion of the latter muscle; and the third to the superior portion of the biceps brachii muscle. Sisson and Grossman (1953) stated that it furnishes one of the nerves to the pectoral muscles. They stated further that in some cases it sends a branch to join the cutaneous branch of the median. Koch (1965) stated that there is a strong exchange of fibers in the loop formed by the musculocutaneous and median nerves. He agreed with Reimers (1925b) relative to the further distribution of the nerve.

5. The *median nerve* consists of a strong portion which crosses the axillary artery medially and a slender portion which crosses the preceding vessel laterally. The medial thick portion is formed by fractions of fibers from the eighth cervical and first thoracic, seldom also from the
second thoracic, nerves. The lateral portion is formed by fractions of fibers from the seventh and eighth cervical nerves. The lateral portion forms, with the musculocutaneous nerve, a single trunk which goes cranially to the shoulder joint from the medial portion of fibers. Here, the branch destined to supply the biceps brachii and coracobrachialis muscles (Ramus muscularis proximalis n. musculocutanii) is detached. The lateral portion then crosses the lateral face of the axillary artery and unites with the medial portion of the median nerve. Bruni and Zimmerl (1951) stated that the nerve derives from the eighth cervical and first and second thoracic nerves. They stated further that it descends along the axillary artery between the latter and the corresponding vein and exchanges fibers with the anterior brachial (musculocutaneous) nerve. It then courses in front of the brachial artery to the level of the elbow joint where it crosses the superficial face of the vessel to course distally along the caudal surface of the median artery. According to the latter authors, it gives off the following branches: in the vicinity of the axillary artery a branch unites with one from the anterior brachial which constitutes the second ventral thoracic nerve; distal to the latter mentioned union it furnishes a twig to the superficial portion of the coracobrachialis muscle; below the medial tuberosity of the humerus it furnishes the long
musculocutaneous branch which passes below the biceps brachii muscle and divides into two branches, one to the brachialis muscle and the other turns distomedially as a cutaneous nerve. Sisson and Grossman (1953) stated that it derives its fibers chiefly from the eighth cervical and first thoracic nerves. They stated that the musculocutaneous branch is, in reality, the continuation of the nerve of that name.

6. The ulnar nerve receives its fibers from the eighth cervical and the first and second thoracic nerves. In the beginning it is connected with the median nerve for a distance of about five centimeters, then separates from it and lies along the caudal border of the radial nerve. It courses with the latter nerve across the medial face of the subscapular artery and vein and thoracodorsal artery, medially, and the thoracodorsal vein, laterally. It leaves the radial nerve at the end of the teres major muscle, runs distally, caudal to the brachial artery in company with the vein of the same name, to the middle of the arm. Here it deviates caudally and extends to the medial surface of the extensor side of the elbow joint covered by the tensor fasciae antebrachii muscle (Reimers, 1925b). Bruni and Zimmerl (1951) and Tagand and Barone (1964) stated that the fibers are derived from the first and second thoracic, and sometimes from the eighth cervical, nerves. Sisson and Grossman
(1953) gave the origin as the thoracic components of the plexus. Bruni and Zimmerl (1951) stated that the nerve diverges at the origin of the deep brachial artery and courses ventrally and obliquely on the humeral vein until it reaches the collateral ulnar vessels. It courses distally in front of the latter and with them to the humero-radial-ulnar articulation where it passes under the ulnar head of the oblique flexor of the metacarpus (flexor carpi ulnaris) muscle. At the level of the emergence of the deep brachial artery it detaches a slender branch to the thick extensor of the forearm (long head of the triceps muscle). A little further it gives off the palmer cutaneus nerve which courses with the collateral radial artery between the tensor fasciae antebrachii and sterno aponeurotic muscles. Neither Reimers (1925b), Sisson and Grossman (1953) nor Tagand and Barone (1964) made any mention of a branch to the long head of the triceps muscle.

7. The radial nerve derives its fibers from the seventh and eighth cervical, and first thoracic, nerves (Reimers, 1925b; Nickel, 1941; Koch, 1965). According to Koch, it runs distally along the caudal border of the ulnar nerve. The latter, in turn, runs along the caudal border of the brachial artery, to the muscular septum between the medial and long heads of the triceps brachii muscles. The radial nerve bends laterally along the sharp edge of the teres major.
muscle. Previous to bending it gives off motor twigs to the triceps brachii heads and tensor fasciae antebrachii muscle. It crosses the humerus laterally and divides, closely proximal to the elbow, into superficial and deep branches. According to Nickel (1941), it leaves the plexus about 10 centimeters above the shoulder joint. He stated further that it detaches a twig to the brachialis muscle then follows the caudal border of the latter muscle, winding around from the medial to the lateral heads of the triceps brachii through the musculo spiral groove to the lateral side of the humerus on which it lies very closely. According to the latter author, it extends below the origin of the extensor carpi radialis muscle. Between the latter muscle and the brachialis muscle it inclines medially on its distal course. In addition to innervating the three heads of the triceps brachii and tensor fasciae antebrachii muscles (as described by Koch, 1965) he includes the anconeus muscle. He stated further that, at the point of bending, it detaches two cutaneous twigs which run on the brachialis muscle around the ventral border of the lateral head of the triceps muscle, sometimes piercing through the ventral border of the latter muscle. The cranial of these cutaneous twigs usually divides into three branches. The most cranial one bends proximally and innervates the segment of skin lateral to the arm (N. cutaneus brachii lateralis caudalis). Both caudal
branches ramify in the skin over the muscular bellies of the common and lateral digital extensor muscles (N. cutaneus antebrachii lateralis). The parent trunk also innervates the extensor muscles of the carpus and digits as well as the ulnaris lateralis muscle. Stanić and Palić (1962) agreed with Nickel (1941). Reimers (1925b); Sisson and Grossman (1953); Nickel (1941); and Koch (1965) described an inconstant branch to the brachialis muscle.

8. The axillary nerve is derived from fibers of the ventral branches of the seventh and eighth cervical nerves (Reimers, 1925b; Nickel, 1941; Koch, 1965). It courses caudoventrally dorsal to the radial nerve, dips between the subscapular muscle and artery and runs laterally behind the joint and divides into its terminal branches above the caudal border of the teres minor and below the deltoideus muscles. It gives off branches to the flexors of the shoulder joint, the pars clavicularis of the brachiocephalicus muscle, the caudal part of the subscapular muscle, and the cranial area of the skin of the arm and forearm extending medially and laterally to the shoulder joint (Nn. cutaneus brachii lateralis cranialis and cutaneus antebrachii cranialis). It also detaches branches to the shoulder joint (Nickel, 1941). Bruni and Zimmerl (1951) described a branch which detaches from the parent nerve behind the shoulder joint and enters the brachialis muscle. Reimers (1925b)
stated that it lies close to the shoulder joint with the radial and thoracodorsal nerves.

9. The long thoracic nerve derives its fibers from the ventral branches of the seventh and eighth cervical nerves (Reimers, 1925b; Bruni and Zimmerl, 1951; Koch, 1965). The branches forming the nerve do not emerge between the two scaleni muscles but converge together running in a caudal direction on the lateral surface of the thoracic part of the serratus ventralis muscle (Reimers, 1925b).

10. The thoracodorsal nerve derives its fibers in a variable manner from the ventral branches of the seventh and eighth cervical and first thoracic nerves (Reimers, 1925b); from the ventral branch of the eighth cervical and first thoracic nerves (Bruni and Zimmerl, 1951); or from the ventral branch of the eighth cervical nerve (Koch, 1965). It courses dorsocaudally, passes on the medial surface of the subscapular and teres major muscles and is totally distributed in the grand dorsal (latissimus dorsi) muscle. In its first portion the nerve is frequently united with the axillary and always with the inferior subscapular nerves. It can be derived from the superior subscapular nerve (Bruni and Zimmerl, 1951).

11. The external thoracic nerve (N. thoracalis lateralis of Sisson and Grossman, 1953), according to the latter authors, arises by a common trunk with the ulnar nerve and
passes backward in company with the external thoracic vein. Its branches innervate the cutaneous muscle and the skin of the abdominal wall as far back as the flank. It gives collateral branches to the deep pectoral muscles and others which anastomose with perforating branches of intercostal nerves. A branch from it, accompanied by a large perforating intercostal branch, winds around the ventral border of the latissimus dorsi and ramifies in the cutaneous muscle and skin on the lateral surface of the shoulder and arm. Reimers (1925b) stated that the lateral thoracic nerve arises in a common trunk with the ventral thoracic and cranial thoracic III nerves. He stated further that they all arise from the eighth cervical and first and second thoracic nerves. He described the ramification of these nerves in the ox but not in the horse. Bruni and Zimmerl (1951) described this nerve as the medial cutaneous nerve of the arm or the subcutaneous thoracic nerve. Its origin, according to them is from the eighth cervical and first and second thoracic nerves as described by Reimers (1925b), or it may be from the first and second thoracic, or only from the second thoracic, nerve. Bruni and Zimmerl further stated, as did Sisson and Grossman (1953), that it is initially in a common trunk with the ulnar nerve; it reaches to the flank and innervates the panniculus carnosus (cutaneous trunci) muscle; it is joined by intercostal branches; and detaches branches
to the posterior deep pectoral muscle. Koch (1965) described this nerve as two: the lateral thoracic which originates from the eighth cervical and first thoracic nerves, innervates the cutaneous trunci muscle and takes part in the formation of the intercostobrachialis nerve which supplies the cutaneus omobrachialis muscle; and the ventral thoracic nerve which also originates from the eighth cervical and first thoracic nerves and supplies the overlapping border of the cutaneus trunci and the deep pectoral muscles.
MATERIALS AND METHODS

Ten brachial plexuses (Plexus brachiales) were dissected in each of five domestic animals (goat, sheep, ox, pig and horse).

The animals were anesthetized with a solution of chloral hydrate and magnesium sulfate¹ and exsanguinated via a cannula in the right carotid artery. Embalming solution² was injected through the cannula after exsanguination was completed. A solution of lead oxide and cornstarch³ was injected via the cannula forty-eight hours after embalming.

An additional animal for each species was employed for colored photography. The only treatment they received before dissection was anesthesia and exsanguination.

The structures, from the lateral aspect, (Figures 2, 15, 27, 38, 47) were exposed as follows: The skin and cutaneous trunci muscle were removed from an area bounded dorsally by the dorsal midline; ventrally by the ventral midline, and carpus of the forelimb; posteriorly to the last rib; and anteriorly beyond the transverse process of the

¹Two ounces of each in 500 cc of water.

²Isopropyl alcohol, 60%; formalin, 4%; phenol, 6%; corn syrup, 2.5%; H₂O, 27.5%.

³Lead oxide, 1 gm; corn starch, 1.5 pounds; water, 1 gallon.
fourth cervical vertebra. The trapezius and rhomboideus muscles were transected along the dorsal midline. The serratus ventralis thoracis muscle was transected close to the scapula. The serratus ventralis cervicis muscle was transected near its attachments to the transverse processes of the cervical vertebrae. The latissimus dorsi muscle was removed from the lateral surface of the thorax posteriorly to the eleventh rib. The portion of the scapula, above the entry of the subscapular and suprascapular nerves into their respective muscles, was then removed.

The final dissections from the lateral approach (Figures 3, 16, 28, 39, 48) were accomplished to expose the spinal cord and the roots which contribute to the brachial plexus. The lumbodorsal fascia was removed posteriorly to the tenth rib and the serratus dorsalis cranialis muscle was removed. The remaining serratus ventralis thoracis muscle was removed to the level of, and on a line parallel with, the long thoracic nerve. The following muscles were removed in the area extending cranially to the level of the fourth cervical, and caudally to the third thoracic, vertebral spines: splenius; complexus; spinalis et semispinalis; longissimus dorsi; multifidus dorsi; dorsal scalenus; middle scalenus and ventral scalenus. The vertebrae (fourth cervical through the third thoracic) were sculptured out, exposing the spinal cord and the fifth, sixth, seventh and eighth
cervical and first and second thoracic nerves.\textsuperscript{1}

The structures, from the medial aspect, were exposed as follows: The head was removed at the level of the first cervical vertebra; the specimens were divided into front and hind parts at the level of the fifth lumbar vertebra; the front parts were eviscerated and were then divided into symmetrical halves with a band saw,\textsuperscript{2} the longus colli muscle was removed and the ribs (one through six) were resected from a medial approach; the intervening musculature was removed (internal and external intercostals, serratus ventralis thoracis, external abdominal oblique, longissimus costarum, serratus dorsalis cranialis and the scaleni); the pectoral muscles were detached from the sternum and the latter was removed.

The excised plexuses were dissected as follows: the nerves were traced to their terminations for positive identification, they were then tagged near the plexus and cut a short distance distal to the tag; the plexus was then lifted from the specimen and pinned onto a sheet of styrofoam\textsuperscript{3} covered with black cloth; the styrofoam was then

\begin{footnotes}
\item[1] Varied according to species: Tables 1, 2, 3, 4 and 5.
\item[3] Styrofoam one inch in thickness and cut to fit into a pan twelve inches wide and sixteen inches long.
\end{footnotes}
placed in a pan which was deep enough to allow the latter, with the attached plexus, to be completely immersed in a one percent formalin solution. The nerves were pinned in their normal relationships except where, in my opinion, some deviation contributed to clarity. The pins remained in their original position throughout the dissection except where: spacing dissected branches apart added to clarity; where the caudal-cranial relationship of the nerves entering the plexus were reversed (ruminants). Dissection was done with the nerve plexus immersed in the formalin solution. When the dissection had progressed to a stage where a photograph was desireable, the styrofoam was lifted out of the solution and allowed to drain for five minutes. A photograph was taken, the specimen was again immersed and dissection was resumed.

Three cameras were employed: 1. The colored photographs were taken with a Leica camera with a 3F bellows focus reflex housing fitted with a Hektor 135 cm., 4.5 lens, and a Kodak Wratten filter number 82C. The film was Kodachrome II, Type A, Professional 35 mm., 36 exposure; 2. The photographs on the intact gross specimen were taken with a Burke and James 4" x 5" Grover view camera fitted with a Goerz Dagor 12 inch lens. The film was polaroid type 52 P.N. in a Polaroid #500, 4" x 5" adapter; 3. The photographs of the extirpated plexuses were taken with a Leitz Aristophot,
4" x 5" back fitted with a 12 cm., F5.6 Summar lens. The film was Polaroid type 52 P.N. in a Polaroid #500, 4" x 5" adapter.
RESULTS

In the goat and sheep, the nerves emanating from the brachial plexus were divisible into three groups which were arbitrarily designated A, B and C. The groups were made up of the same combination of nerves in these two species. The grouping was possible because of the torsion of the plexus which occurred during development. This grouping was not evident in the other species because the torsion was less pronounced.

Goat

Table 1, Figures 1 through 13

The suprascapular nerve derives its fibers chiefly from the sixth and seventh cervical roots of the brachial plexus. (The right brachial plexus in one specimen originated from only the sixth cervical root.) It is the chief component of nerve group A.

Shortly after it leaves the plexus it turns caudally, in company with the anterior branch of the subscapular nerve, and crosses the lateral face of the remaining nerves of the plexus. It turns laterally at the level of the interstice between the supraspinatus and subscapularis muscles ca 3.3 cm. above the tuber scapulae and passes between the latter two muscles. It divides into two branches of near equal size.
as it enters the interstice between the above named muscles.
The above named branches are distributed as follows:

1. One branch turns dorsally and soon divides into
three branches of nearly equal size which enter the supraspinatus muscle in which they terminate.

2. The remaining branch passes around the anterior
border of the scapula and continues posteriorly on the
lateral surface of the latter. It passes ventral to the
scapular spine, turns dorsally in the infraspinous fossa
and is disseminated in the infraspinatus muscle.

The subscapular nerves occur as two trunks:

1. The anterior trunk derives its fibers chiefly from
the sixth and seventh roots of the brachial plexus. It is
a component of nerve "Group A". (In one specimen the two
trunks of the subscapular nerve were side by side. They, in
turn, were in close proximity to the suprascapular nerve.
In this case nerve "Group A" included both trunks of the
subscapular nerve.) It turns back, in company with the
suprascapular nerve, to which it is related dorsally, and
crosses the lateral face of the remaining nerves of the
plexus. It inclines dorsally on the medical surface of the
subscapular muscle and terminates in the anterior part of
the latter.

2. The posterior trunk of the subscapular nerve
derives its fibers chiefly from the seventh root of the
plexus. It is in close proximity to the common trunk of the axillary, radial and thoracodorsal nerves, usually being included with the above-named nerves to form nerve "Group B". (In one specimen this nerve was included in nerve "Group A".) As it approaches the anterior border of the subscapular muscle it gradually diverges dorsally from the other members of the group. It continues backward and upward behind its mate and terminates in the posterior part of the subscapular muscle.

The anterior thoracic or pectoral nerves derive their fibers chiefly from the sixth, seventh and eighth cervical roots of the brachial plexus. (The branches from the sixth and seventh roots are not constant.) They are components of nerve "Group C". The courses of the nerves are as follows:

1a. (Two out of ten cases) Nerves are detached from the sixth and seventh cervical roots which join and course ventrally across the lateral face of the brachial artery. A nerve is detached from the eighth cervical root which courses ventrally across the medial face of the brachial artery and joins its mate from the sixth and seventh cervical roots just ventral to the artery.

1b. A nerve is detached from the seventh cervical root which courses ventrally across the lateral face of the brachial artery and joins the nerve from the eighth cervical as previously described.
lc. (One out of ten cases) All of the fibers are derived from the eighth cervical root. They course ventrally across the medial face of the brachial artery as a single nerve.

In those cases where the two nerves join immediately ventral to the vessel, the joined nerves pass ventrally across the lateral face of the brachial vein. They remain joined for approximately one centimeter then divide into anterior and posterior branches. They may each retain their own identity, and be completely separable, in the one centimeter interval where they are joined; or a large branch may pass from the medial to the lateral nerve and lose its identity in the latter.

In those instances where nerves pass ventrally across both medial and lateral faces of the brachial artery, the nerve which crosses the lateral face of the artery soon becomes anterior to its mate. Where the nerve is derived from a single cervical root (eighth), it follows the same course medial to the brachial artery and lateral to the brachial vein and also divides into anterior and posterior branches. The latter two branches will be designated as the anterior and posterior nerves and are distributed as follows:

1. The anterior nerve (deriving from the sixth and seventh cervical roots, or from the seventh cervical root
alone) passes lateral to the brachial artery. It soon divides into two branches nearly equal in size. One branch passes to the deep face of the anterior superficial pectoral muscle (M. pectoralis descendens). The remaining branch passes mostly to the deep face of the anterior deep pectoral muscle (M. pectoralis cleidoscapularis) (a few fibers pass to the superficial surface of the latter muscle). In seven specimens one or the other of the above-described branches continued posteriorly to innervate the posterior superficial pectoral muscle (M. pectoralis transversus).

2. The posterior nerve (deriving from the eighth cervical root) passes medial to the brachial artery. It courses along the superficial surface of the posterior deep pectoral muscle (M. pectoralis ascendens). It enters the muscle by three-to-five branches, which are more-or-less evenly spaced to the level of the fourth intercostal space. In eight specimens this nerve continued to the opposing surface of the posterior superficial pectoral muscle and innervated the latter muscle.

Where only one nerve is present it crosses the medial face of the brachial artery and continues to the anterior border of the anterior pectoral muscles as previously described. It then divides into one small nerve and two large nerves of nearly equal size. The latter nerves are distributed as follows:
1. The small nerve enters the medial aspect of the posterior deep pectoral muscle in the area of the shoulder joint.

2. One of the larger branches passes between the opposing surfaces of the posterior deep pectoral muscle, on the one hand, and the anterior deep pectoral muscle, on the other hand, and terminates in the two above-mentioned muscles.

3. The remaining large branch passes between the opposing surfaces of the anterior deep pectoral and anterior superficial pectoral muscles terminating in both muscles.

The musculocutaneous nerve derives its fibers chiefly from the sixth and seventh cervical roots of the brachial plexus. It is a component of nerve "Group C".

It Descends across the lateral surface of the brachial artery below which it spirals medially to join the median nerve and exchanges fibers with the latter.

It continues downward in the limb in company with the median nerve from which it is detached at the level of the distal insertion of the coracobrachialis muscle. It passes downward and laterally in the interval between the insertion of the latter muscle and the biceps brachii muscle. In this area it divides into two branches: one branch, the "distal muscular branch of the musculocutaneous" nerve (Ramus muscularis distalis ni. musculocutanei), passes on laterally
and terminates in the brachialis muscle; the remaining branch, the "medial cutaneous nerve of the forearm" (N. cutaneus antebrachii medialis s. dorsalis), inclines downward and outward spiraling around the biceps brachii near its insertion.

It detaches a large branch, "proximal muscular branch of the musculocutaneous" (Ramus muscularis proximalis ni. musculocutanei), from its lateral surface, at the level of the shoulder joint. The latter branch passes downward and forward for a short distance and dips between the two parts of the coracobrachialis muscle. It gives branches to the two parts of the latter muscle as it continues its course downward and forward between them to the biceps brachii muscle. It runs distally along the anterior border of the latter for a short distance then dips into the muscle where it terminates.

The median nerve derives its fibers from the eighth cervical and first thoracic roots of the brachial plexus. It is a component of "Group C".

It descends over the medial face of the brachial artery, which it crosses obliquely, and continues distally in the axillary space ventral to the vessel and separated from the latter by the ulnar nerve. The three structures remain in the same relationship as they pass distally over the medial tuberosity of the humerus and the lateral face of the
brachial vein. Continuing down the limb they cross the lateral surface of the posterior deep pectoral muscle and continue distally on the deep face of the posterior superficial pectoral muscle. The ulnar nerve gradually inclines posteriorly beginning just below the shoulder joint so that the median nerve is related posteriorly to the brachial artery distally from the proximal one third of the arm. It is related anteriorly to the coracobrachialis muscle, then to the biceps brachii. It dips under the anterior superficial pectoral muscle in the region of the elbow joint and continues down the forearm and is related anteriorly to the radius and posteriorly to the flexor carpi radialis.

Near its origin it is in a common sheath with the ulnar nerve. It is joined by the musculocutaneous nerve after it crosses the medial face of the brachial artery. The latter nerve spirals around the anterioventral aspect of the vessel to join the median nerve. (The median nerve does not enter into the formation of a loop with the musculocutaneous nerve in the usual sense. It remains on a non-deviating course across the medial face of the vessel.) It remains on the lateral surface of the median nerve to the level of the distal extremity of the coracobrachialis muscle. The two nerves exchange fibers along the course where they are in close proximity.

The ulnar nerve derives its fibers from the eighth
cervical and first thoracic roots of the brachial plexus. It is a component of nerve "Group C".

It descends over the deep face of the brachial artery which it crosses obliquely in company with the median nerve. It descends in the region of the axillary space interposed between the brachial artery and in a common trunk with, and related laterally to, the median nerve. Shortly after crossing the lateral aspect of the brachial vein, just below the shoulder joint, it gradually inclines backward, crossing the medial aspect of the brachial artery and the caudally placed brachial vein obliquely in the upper one third of the arm region.

Soon after crossing the latter vessels it divides into a cutaneous and a muscular branch which are distributed as follows:

1. The cutaneous branch diverges caudally from its mate. It passes backward and downward related laterally first to the medial head of the triceps then to the long head of the latter muscle. It is related medially first to the posterior deep pectoral muscle, then to the posterior superficial pectoral muscle, then to the skin on the medial aspect of the arm. As it spirals down the limb it pierces the cutaneous omobrachialis muscle on the posterior aspect at the elbow joint and ramifies in the skin.

2. The muscular branch passes backward and downward
slightly in front of the cutaneous branch. It dips under the ulnar head of the flexor carpi ulnaris muscle and is distributed to certain flexors of the carpus and digits.

The radial nerve derives its fibers from the seventh and eighth cervical nerves and the first thoracic roots of the brachial plexus. It is a component of nerve "Group B".

It is so closely applied to the axillary and thoraco-dorsal nerves that the three of them appear to be one large nerve as they leave the plexus. It passes downward to the level of the brachial artery and continues distally in the axillary space along the dorsal aspect of the latter vessel. It inclines downward and backward between the subscapular artery, laterally, and subscapular vein, medially, near the origins of the latter vessels. It continues over the deep surface of the distal part of the teres major muscle. On this part of its course it is related in front to the brachial vein which separates it from the ulnar nerve.

The nerve passes laterally in the interval between the common tendon of the latissimus dorsi and teres major muscles and the long and medial head of the triceps muscles. The nerve spirals around the lateral aspect of the limb related deeply to the brachialis muscle and superficially to the lateral head of the triceps muscle. It divides into the "dorsal cutaneous nerve of the forearm", (N. cutaneus ante-brachii dorsalis) and a muscular branch near the cranial
border of the above-mentioned triceps muscle. The muscular branch is distributed in the carpal and digital extensor muscles. The cutaneous branch is distributed to the skin on the dorsolateral aspect of the limb distal to the elbow. Several branches are detached at the ventral border of the teres major muscle:

1. A large branch turns sharply dorsally, enters the long head of the triceps muscle and continues upwards and backwards nearly to the proximal extremity of the muscle.

2. A large branch enters the cranial border of the long head of the triceps muscle and ramifies in its middle and its distal extremity.

3. A small branch passes backward on the deep face of the long head of the triceps muscle, covered by the deep fasciae of the muscle, and enters the tensor fasciae antebrachii muscle below its middle. (May be detached from the branch that enters the cranial border of the long head of the triceps muscle.)

The parent nerve detaches branches to the lateral and medial heads of the triceps muscle as it spirals distally in the arm. It also detaches a branch to the anconeus muscle.

The axillary nerve derives its fibers from the sixth and seventh roots of the brachial plexus. It is a component of nerve "Group B".

The nerve is so closely applied to the radial and
thoracodorsal nerves, to the level of the subscapular vessels, that the three of them appear to be one large nerve. It passes downward to the level of the brachial artery and continues distally in the axillary space along the dorsal aspect of the latter vessel related laterally to the two previously mentioned nerves. The three nerves are lying side by side in a dorsoventral relationship at the level of the posterior border of the subscapularis muscle, the axillary nerve is in the middle.

The nerve dips between the subscapular artery and muscle (in one specimen it crossed the deep surface of the subscapular artery and dipped between the latter vessel and the teres major muscle) just above the shoulder joint and passes laterally behind the above-mentioned joint, detaching several small branches to it. It emerges between the acromial and scapular heads of the deltoideus muscle as the "lateral cutaneous nerve of the arm" (N. cutaneus brachii lateralis). It passes downward in the superficial fascia of the groove formed by the acromial part of the deltoideus muscle and the lateral head of the triceps muscle and crosses the distal extremity of the brachiocephalicus muscle obliquely as it gradually inclines toward the cranial aspect of the limb. It then passes deep to the cephalic vein and terminates medial to the extensor carpi radialis muscle on the front of the elbow joint. This cutaneous nerve furnishes
sensory fibers from the shoulder to the elbow. Caudally, they meet cutaneous fibers from the lateral thoracic and the intercostal nerves and, cranially, they meet cutaneous fibers from the cervical nerves.

The parent nerve detaches muscular branches along its course as follows:

1. A branch is detached near the brachial plexus. It joins the thoracodorsal nerve and runs along with the latter to the level of the teres major muscle where it is detached to enter the latter muscle.

2. Several small fibers are detached from the parent nerve as the latter turns lateral across the posterior border of the subscapularis muscle. They ramify in the posterior part of the latter muscle just above the shoulder joint (The nerve terminates in four branches in this area. They are arranged in a dorsoventral relationship. The ventral branch is the cutaneous nerve previously described).

3. A dorsal branch is detached which continues laterally and innervates the scapular part of the deltoideus and the teres minor muscles.

4. A branch ventral to the above-mentioned dorsal branch (3) which innervates the acromial part of the deltoideus muscle.

5. The remaining branch passes craniolaterally, first between the teres minor and acromial part of the deltoideus
muscles, then the latter muscle and the interval between the lateral tuberosity and deltoid tuberosity of the humerus. It turns down the limb at the anterior border of the latter muscle related superficially to the brachiocephalicus muscle. It enters the latter muscle at the level of the distal extremity of the deltoid tuberosity.

The long thoracic nerve derives its fibers from the seventh and eighth cervical roots of the brachial plexus. The branches from the above-named roots join shortly after being detached from their respective roots. The nerve does not enter the brachial plexus. It emerges between the middle scalenus muscle (M. scalenus medius) ventrally and the dorsal scalenus muscle (M. scalenus dorsalis) dorsally. It flattens out and courses posteriorly on the superficial surface of the serratus ventralis thoracis muscle in a gentle curve. The latter-mentioned curve is concave dorsally and is located on a line between the middle and distal one-thirds of the muscle. The nerve detaches small branches dorsally and ventrally along its course, and terminates in the above-named muscle.

The branch from the seventh cervical root is larger than the contribution from the eighth. The former detaches a large branch (or several small ones) before it joins its mate. The detached branch (or branches) enters the serratus ventralis cervicis muscle in the area where the main nerve
emerges between the scalenii muscles. The nerve fibers are deeply situated in this part of the muscle and are not observable on the superficial surface of it.

The **thoracodorsal nerve** derives its fibers from the eighth cervical root of the brachial plexus. It is a component of nerve "Group B".

The nerve is so closely applied to the radial and axillary nerves to the level of the subscapular vessels that the three of them appear to be one large nerve. It descends to the level of the brachial artery and continues distally in the axillary space separated from the latter vessel by the radial nerve and related laterally to the axillary nerve. The three nerves are lying side by side in a dorsoventral relationship at the level of the posterior border of the subscapularis muscle; the thoracodorsal nerve is the dorsal one. It continues upward and backward across the deep face of the teres major muscle, crosses the deep face of the thoracodorsal artery and ramifies in the latissimus dorsi muscle.

A branch is detached from the axillary nerve near the brachial plexus. It joins the thoracodorsal nerve and runs along with the latter to the level of the teres major muscle where it is detached to enter the latter muscle.

The **external thoracic nerve** derives its fibers from the eighth cervical and first thoracic roots of the brachial
plexus. It is a component of nerve "Group C".

This nerve, medially, and the trunk of the median and ulnar nerves, laterally, form the posterior border of the brachial plexus. This relationship to the median-ulnar trunk continues down the limb to the level of the brachial vein. It begins to curve posteriorly at the level of the above-mentioned vessel and divides into two main branches a short distance ventral to it. The latter mentioned main branches are distributed as follows:

1. The dorsal main branch, in most areas (In three specimens the dorsal branch diverged from its ventral mate before crossing the brachial vein and passed along the superior border of the latter), passes across the medial face of the brachial vein in close proximity to its mate. It diverges dorsally from the latter a short distance after traversing the above-mentioned vein then passes caudally along the lateral edge of the posterior deep pectoral muscle and on beyond the latter muscle to the level of the prepuce.

   a. A branch to the posterior one-third of the posterior deep pectoral muscle.

   b. A variable number of branches (mostly four) which pass between the posterior deep pectoral muscle and the cutaneous trunci muscles innervating the latter muscle and the skin to the level of the ventral mid-line.

   c. A relatively large branch is detached in the area
ventral to the axillary lymph node. It passes upward and backward along the ventroposterior border of the latissimus dorsi muscle and soon passes between the latter muscle and the cutaneus trunci muscle. It innervates the latter muscle and the skin on the lateral thoracic wall.

d. Several branches are detached which pass backward between the cutaneus trunci muscle and the skin in the midthoracic region, continuing caudally in the abdominal region to the flank.

2. The ventral main branch divides into several branches which are distributed to the posterior deep pectoral muscle. The dorsal branch is joined by cutaneous branches of the intercostal nerves from the second intercostal caudally for a variable distance.

Sheep

Table 2, Figures 14 through 25

The suprascapular nerve derives its fibers from the sixth and seventh cervical roots of the brachial plexus. It is the chief component of nerve group A.

It courses ventrally along the anterior border of the plexus for a short distance. It then turns caudally, in company with the anterior branch of the subscapular nerve, and crosses the lateral face of the remaining nerves of the plexus. It turns laterally at the interstice between the
supraspinatus and subscapularis muscles in their distal one third and continues laterally between them. It divides into two branches of nearly equal size as it enters the interstice between the above named muscles. The above named branches are distributed as follows:

1. One branch turns dorsally, soon divides into four branches of nearly equal size which enter the supraspinatus muscle where they terminate.

2. The remaining branch passes around the anterior border of the scapula and continues posteriorly on the lateral surface of the latter. It gives off several small branches which innervate the distal part of the infraspinatus muscle. The parent branch passes ventral to the scapular spine, turns dorsally in the infraspinous fossa and is disseminated in the remainder of the infraspinatus muscle.

The subscapular nerves occur as two trunks:

1. The anterior trunk derives its fibers from the sixth and seventh roots of the brachial plexus (It derived all of its fibers from the seventh root in three specimens). It is a component of nerve "Group A".

It turns back, in company with the suprascapular nerve, to which it is related dorsally, and crosses the lateral face of the remaining nerves of the plexus. It inclines dorsally on the medical surface of the subscapular muscle and terminates in the anterior part of the latter.
2. The posterior trunk of the subscapular nerve derives its fibers chiefly from the seventh root of the plexus. It is in close proximity to the common trunk of the axillary, radial and thoracodorsal nerves, usually being included with the above-named nerves to form nerve "Group B". It diverges dorsally from the other members of the group on the medial surface of the subscapular muscle in its distal one third. It continues backward and upward for a very short distance and divides into two branches of nearly equal size, both of which terminate in the posterior part of the subscapular muscle.

The anterior thoracic or pectoral nerves derive their fibers from the seventh and eighth cervical roots of the brachial plexus. They are components of nerve "Group C". The courses of the nerves are as follows:

1. A nerve is detached from the seventh cervical root which courses ventrally across the lateral face of the brachial artery. 2. A nerve is detached from the eighth cervical root which courses ventrally across the medial face of the brachial artery. 3. A large branch is detached from the nerve which crosses the medial aspect (from the eighth cervical root). The latter branch joins the nerve which crosses the lateral aspect of the artery (from the seventh cervical root) just ventral to the artery.

The nerve which crosses the lateral face of the artery
(deriving from the seventh cervical root) soon becomes anterior to its counterpart which crosses the medial face of the vessel. The continuing parent nerve which crosses the medial face of the brachial artery (after giving off the branch to the seventh) soon becomes posterior as previously mentioned. They are distributed as follows:

1. The anterior nerve soon divides into two branches nearly equal in size; one branch passes to the deep face of the anterior superficial pectoral muscle; the remaining branch passes mostly to the deep face of the anterior deep pectoral muscle (a few fibers pass to the superficial surface of the latter muscle). In two specimens one of the branches coursing on the deep face of the latter muscle continued posteriorly to innervate the posterior superficial pectoral muscle as the sole innervation to this muscle from the anterior thoracic nerves. In one specimen both the anterior and posterior branches innervated the latter muscle.

2. The posterior nerve courses along the superficial surface of the posterior deep pectoral muscle. It enters the muscle by three to five branches, which are more-or-less evenly spaced, to the level of the fourth intercostal space. In eight specimens this nerve continued to the opposing surface of the posterior superficial pectoral muscle and innervated the latter muscle. In one of the eight specimens it shared innervation of the latter muscle with a branch from
the cranial nerve. In the remaining seven cases it was the only innervation to the muscle from the anterior thoracic nerves.

The musculocutaneous nerve derives its fibers chiefly from the sixth and seventh cervical roots of the brachial plexus. It is a component of nerve "Group C".

It descends across the lateral surface of the brachial artery below which it spirals medially to join the median nerve and exchanges fibers with the latter.

It continues downward in the limb in company with the median nerve from which it is detached at the level of the distal insertion of the coracobrachialis muscle. It passes downward and laterally in the interval between the insertion of the latter muscle and the biceps brachii muscle. In this area it divides into two branches: the large branch "distal muscular branch of the musculocutaneous" passes on laterally and terminates in the brachialis muscle; the remaining small branch "medial cutaneous branch of the forearm" inclines downward and outward spiraling around the biceps brachii near its insertion.

It detaches two, closely-placed branches, the "proximal muscular branches of the musculocutaneous", from its lateral surface at the level of the shoulder joint. One branch passes downward and forward for a short distance and dips between the two parts of the coracobrachialis muscle. It
gives branches to the two parts of the latter muscle as it continues its course downward and forward between them to the biceps brachii muscle. It runs distally along the medial border of the latter muscle for a short distance then dips into it where it terminates. The remaining branch courses in close proximity to its mate and terminates in the more deeply placed part of the coracobrachialis muscle.

The median nerve derives its fibers from the eighth cervical and first thoracic roots of the brachial plexus. It is a component of "Group C".

It descends over the medial face of the brachial artery, which it crosses obliquely, and continues distally in the axillary space ventral to the vessel separated from the latter by the ulnar nerve. The three structures remain in the same relationship as they pass distally over the medial tuberosity of the humerus and the lateral face of the brachial vein. Continuing down the limb they cross the lateral surface of the posterior deep pectoral muscle and continue distally on the medial surface of the posterior superficial pectoral muscle. The ulnar nerve gradually inclines posteriorly, beginning just below the shoulder joint so that the median nerve is related posteriorly to the brachial artery distally from the proximal one-third of the arm. It is related anteriorly to the coracobrachialis muscle, then to the biceps brachii. It dips under the
tendon of insertion of the biceps brachii muscle. It continues its distal course, passing deeply to the tendon of insertion of the anterior superficial pectoral muscle in the region of the elbow joint. It passes under the pronator teres muscle and continues down the forearm related anteriorly to the radius and posteriorly to the flexor carpi radialis muscle.

Near its origin it is in a common sheath with the ulnar nerve. It is joined by the musculocutaneous nerve ventral to the brachial artery. The latter nerve spirals around the anterioventral aspect of the vessel to join the median nerve. (The median nerve does not enter into the formation of a loop with the musculocutaneous nerve in the usual sense. It remains on a non-deviating course across the medial face of the vessel.) It remains on the lateral surface of the median nerve to the level of the distal extremity of the coracobrachialis muscle. The two nerves exchange fibers along the course where they are in close proximity.

The ulnar nerve derives its fibers from the eighth cervical and first thoracic roots of the brachial plexus. It is a component of nerve "Group C".

It descends over the deep face of the brachial artery which it crosses obliquely in company with the median nerve. It descends in the region of the axillary space interposed between the brachial artery and the median nerve, in a
common trunk with the latter nerve. Shortly after crossing the lateral aspect of the brachial vein just below the shoulder joint it gradually inclines backward and crosses the medial aspect of the brachial artery and caudally placed brachial vein obliquely, in the upper one third of the arm region. (The ulnar nerve crosses the brachial vein twice: 1. laterally in the region of the shoulder; 2. medially in the proximal one third of the arm.)

Soon after crossing the latter vessels it divides into a cutaneous and a muscular branch which are distributed below the elbow joint.

The radial nerve derives its fibers from the seventh and eighth cervical and first thoracic roots of the brachial plexus. It is a component of nerve "Group B".

It is so closely applied to the axillary and thoraco-dorsal nerves that the three of them appear to be one large nerve as they leave the plexus. It passes downward to the level of the brachial artery and continues distally in the axillary space along the dorsal aspect of the latter vessel. It inclines downward and backward between the subscapular artery laterally and the subscapular vein medially near the origins of the latter vessels. It continues over the deep surface of the distal part of the teres major muscle. On this part of its course it is related in front to the brachial vein which separates it from the ulnar nerve.
The nerve passes laterally through the posterior edge of the medial head of the triceps muscle near its origin. It spirals distally around the caudal aspect of the humerus. Continuing its spiraling course it becomes related deeply to the brachialis muscle and superficially to the lateral head of the triceps muscle. It divides into "the dorsal cutaneous nerve of the forearm" and muscular branches near the cranial border of the above-mentioned triceps muscle which are distributed below the elbow. Several branches are detached along the course of the nerve which are distributed as follows:

1. A large branch is detached on the medial face of the teres major muscle which continues in the same direction as the parent trunk to the ventral border of the latter muscle. At this point it further divides into two branches: the large branch enters the long head of the triceps muscle at this level and is distributed proximally in the latter muscle; the small branch continues distally in the limb for a short distance and also enters the long head of the triceps where it is distributed distally. A nerve is detached from the small (distal) branch which curves dorsally on the medial surface of the long head of the triceps muscle covered by the deep fascia of the muscle and enters the tensor fasciae antebrachii muscle near its origin.

The parent nerve detaches branches to the lateral and
medial heads of the triceps and anconeus muscles as it spirals distally in the arm.

The axillary nerve derives its fibers from the sixth, seventh and eighth cervical roots of the brachial plexus. It is a component of nerve "Group B".

The nerve is so closely applied to the radial and thoracodorsal nerves, to the level of the subscapular vessels, that the three of them appear to be one large nerve. It passes downward to the level of the brachial artery and continues distally in the axillary space along the dorsal aspect of the latter vessel related medially to the two previously mentioned nerves. The three nerves are lying side by side in a dorsoventral relationship at the level of the posterior border of the subscapularis muscle—the axillary nerve is in the middle.

The nerve dips between the subscapular artery and muscle just above the shoulder joint and passes laterally behind the joint detaching several small branches to it. It emerges between the acromial and scapular heads of the deltoideus muscle as the "lateral cutaneous nerve of the arm". It passes downward in the superficial fascia in the groove formed by the acromial part of the deltoideus and lateral head of the triceps muscles. It crosses the distal extremity of the brachiocephalicus muscle obliquely and ramifies in front of the elbow joint and adjoining area.
This cutaneous nerve furnishes sensory fibers from the shoulder to the elbow. Caudally they meet cutaneous fibers from the lateral thoracic and the intercostal nerves and cranially they meet cutaneous fibers from the cervical nerves.

The parent nerve detaches muscular branches along its course as follows:

1. A branch is detached near the brachial plexus. It joins the thoracodorsal nerve and runs, along with the latter, to the level of the teres major muscle where it is detached to enter the latter muscle.

2. Several small fibers are detached from the parent nerve as the latter turns laterally across the posterior border of the subscapularis muscle. They ramify in the posterior part of the latter muscle just above the shoulder joint.

3. A dorsal branch is detached shortly after the nerve turns laterally. This nerve innervates the scapular part of the deltoideus and teres minor muscles.

4. A second branch is detached from the dorsal aspect of the parent trunk a short distance distal to the previously-mentioned dorsal branch (3). This nerve continues laterally to innervate the acromial part of the deltoideus muscle.

5. The remaining branch passes craniolaterally, first between the teres minor and the acromial part of the
deltoideus muscles, then the latter muscle, on the one hand, and the interval between the lateral tuberosity and deltoid tuberosity of the humerus, on the other hand, and terminates in the brachiocephalic muscle.

The long thoracic nerve derives its fibers from the seventh and eighth cervical roots of the brachial plexus.

The branches from the above-named roots join shortly before emerging lateral to the scalenii muscles. The nerve does not enter the brachial plexus, it flattens out and courses caudally on the superficial surface of the serratus ventralis thoracis muscle in a gentle curve. The latter-mentioned curve is concave dorsally and is located on a line between the middle and distal one-thirds of the muscle. The nerve detaches small branches dorsally and ventrally along its course, and terminates in the above-named muscle.

The thoracodorsal nerve derives its fibers from the seventh and eighth cervical roots of the brachial plexus. It is a component of nerve "Group B".

The nerve is so closely applied to the radial and axillary nerves to the level of the subscapular vessels that the three of them appear to be one large nerve. It descends to the level of the brachial artery and continues distally in the axillary space separated from the latter vessel by the radial nerve and related laterally to the axillary nerve. The three nerves are lying side by side in a dorsoventral
relationship at the level of the posterior border of the subscapularis muscle; the thoracodorsal nerve is the dorsal one. It continues upward and backward across the deep face of the teres major muscle, crosses the deep face of the thoracodorsal artery and ramifies in the latissimus dorsi muscle.

A branch is detached from the axillary nerve near the brachial plexus. It joins the thoracodorsal nerve and runs along with the latter to the level of the teres major muscle where it is detached to enter the latter muscle.

The external thoracic nerve derives its fibers from the eighth cervical and first thoracic roots of the brachial plexus. It is a component of nerve "Group C".

This nerve, medially, and the trunk of the median and ulnar nerves, laterally, form the posterior border of the brachial plexus. This relationship to the median-ulnar trunk continues down the limb to the level of the brachial artery. It begins to curve posteriorly at the level of the above-mentioned vessel and divides into two main branches a short distance ventral to it. The latter mentioned main branches are distributed as follows:

1. The dorsal main branch, in most areas, passes across the medial face of the brachial vein in close proximity to its mate. It diverges dorsally from the latter a short distance after traversing the above-mentioned vein. It
passes along the medial surface of the lateral edge of the posterior deep pectoral muscle and beyond the latter muscle to the level of the prepuce. Its collateral branches are:

a. Two branches to the posterior two-thirds of the posterior deep pectoral muscle.

b. A variable number of branches (mostly four) which pass between the posterior deep pectoral and the cutaneous trunci muscles innervating the latter muscle and the skin to the level of the ventral mid-line.

c. A relatively large branch is detached in the area ventral to the axillary lymph node. It passes upward and backward along the ventroposterior border of the latissimus dorsi muscle. It soon passes between the latter muscle and the cutaneous trunci. It innervates the latter muscle and the skin on the lateral thoracic wall.

d. Several branches are detached which pass backward between the cutaneous trunci muscle and the skin in the mid-thoracic region, continuing caudally in the abdominal region to the flank.

2. The ventral main branch divides into several branches which are distributed to the posterior deep pectoral muscle.

The dorsal branch is joined by cutaneous branches of the intercostal nerves from the second intercostal nerve caudally for a variable distance.
Cattle

Table 3, Figures 26 through 36

The suprascapular nerve derives its fibers from the sixth and seventh cervical roots of the brachial plexus. It courses ventrally along the anterior border of the plexus for a short distance in company with the anterior branch of the subscapular nerve, then turns caudodorsally and passes across the lateral face of the plexus to the interstice between the supraspinatus and subscapular muscles between the middle and distal one thirds of the scapula. Soon after turning laterally in the above-mentioned interstice the nerve divides into several branches (3 to 5): all but one of the latter branches are distributed in the supraspinatus muscle; the remaining branch (often the largest, but not necessarily so) passes across the lateral surface of the scapula distal to the spine and enters the infraspinatus muscle where it terminates.

The subscapular nerves occur as two trunks:

1. The anterior trunk derives its fibers from the sixth and seventh roots of the brachial plexus. It accompanies the suprascapular nerve caudodorsally for a short distance as the latter crosses the lateral surface of the plexus being detached from it on the anterior part of the medial surface of the subscapular muscle and enters the latter muscle almost immediately (in some specimens it enters as a single
large branch, in others it divides into two branches of nearly equal size before entering the muscle). This trunk appears to innervate at least two thirds of the subscapularis muscle.

2. The posterior trunk derives its fibers from the seventh cervical root of the brachial plexus. It courses ventrally from the plexus for a short distance, crosses the medial face of the subscapular muscle near its insertion and passes along the caudal border of the latter muscle for a short distance. It appears to innervate the caudal one-third of the muscle.

The anterior thoracic or pectoral nerves derive their fibers from the seventh and eighth cervical roots and the first thoracic root of the brachial plexus. The courses of the nerves are variable, they are as follows:

1. The nerve from the seventh cervical root passes ventrally across the lateral face of the brachial artery and is disposed as follows:
   a. It receives a branch from the eighth cervical root ventral to the brachial artery and courses ventrally to innervate the anterior superficial pectoral muscle.
   b. It receives a branch from the eighth cervical root and courses ventrally to innervate the anterior superficial pectoral muscle as described in a. It continues caudally on the deep face of the latter muscle to the deep face of the
posterior superficial pectoral muscle to which it gives numerous fibers. Numerous fibers are also detached to the opposing surface of the posterior deep pectoral muscle.

c. Courses ventrally to innervate the anterior superficial pectoral muscle without receiving any fibers from the eighth cervical root.

2. The nerve from the eighth cervical root passes ventrally across the medial face of the brachial artery and is disposed as follows (a fiber from the first thoracic root joined it in one specimen):

a. It detaches a branch to the seventh cervical root ventral to the brachial artery. The parent nerve continues to the ventromedial free edge (between the sternal and shoulder attachments) of the posterior deep pectoral muscle. It passes over the latter-mentioned free edge to the superficial surface of the muscle where it terminates after dividing into numerous branches.

b. The initial course is similar to the foregoing (a). It continues caudally on the superficial surface of the above-mentioned muscle (a) and detaches numerous fibers which pass to the opposing surface of the posterior superficial pectoral muscle.

c. Similar to the foregoing (b) except that it does not detach a branch to the seventh cervical root.

The musculocutaneous nerve derives its fibers from the
sixth, seventh and eighth cervical roots of the brachial plexus.

It descends across the lateral surface of the brachial artery below which it spirals medially to join the median nerve. In one specimen it was completely separable from the median nerve. In the remaining nine specimens it contributed fibers to the latter nerve.

It continues downward in the limb in company with the median nerve from which it is detached at the level of the distal insertion of the coracobrachialis muscle and inclines laterally in the interval between the insertion of the latter muscle and the biceps brachii muscle. In this area it divides into two branches: the large branch, the "distal muscular branch of the musculocutaneous", passes laterally and terminates in the brachialis muscle; the remaining small branch, the "medial cutaneous nerve of the forearm", continues downward and outward spiraling around the biceps brachii muscle near its insertion.

A large branch, the "proximal muscular branch of the musculocutaneous", is detached from the lateral surface of the parent nerve at the level of the shoulder joint. The latter branch passes downward and forward, dips between the two parts of the coracobrachialis muscle and continues to the biceps brachii muscle. It runs distally along the posterio-medial border of the latter muscle for a short distance then
dips into it where it terminates. Several twigs are detached to each of the two parts of the coracobrachialis muscle.

The median nerve derives its fibers from the eighth cervical and first and second thoracic roots of the brachial plexus.

It descends over the medial face of the brachial artery which it crosses obliquely and continues distally in the axillary space along the ventromedial border of the later vessel related dorsally to the ulnar nerve. The three structures remain in approximately the same relationship as they pass distally over the medial tuberosity of the humerus and the lateral face of the brachial vein. They cross the lateral surface of the posterior deep pectoral muscle and continue distally on the medial surface of the posterior superficial pectoral muscle.

The median nerve, along with the musculocutaneous nerve anteriorly and the ulnar nerve posteriorly, is posterior to the brachial artery in the region of the emergence of the subscapular artery from the latter vessel. The median and musculocutaneous nerves incline anteriorly as they course distally in the arm. They gain the anterior border of the brachial artery at the level of the middle and distal one-thirds of the arm. The median nerve continues distally to the elbow joint in this relationship. It lies directly on the medial surface of the vessel as it passes deep to the
pronator teres muscle.

Near its origin it is in a common sheath with the ulnar nerve. It is joined by the musculocutaneous nerve after it crosses the medial face of the brachial artery. The latter nerve spirals around the anterioventral aspect of the vessel to join the median. In one specimen the musculocutaneous nerve was completely separable from the median nerve. In the remaining nine specimens the musculocutaneous nerve detached fibers to the median nerve in the arm region.

The ulnar nerve derives its fibers from the eighth cervical root and first and second thoracic roots of the brachial plexus.

It descends to the deep face of the brachial artery in company with the median nerve and continues distally in the axillary space related laterally to the vessel and anterioventrally to the median nerve.

In the region of the emergence of the subscapular artery from its parent trunk the ulnar nerve lies posterior to the brachial artery, separated from the latter by the median and musculocutaneous nerves. The latter two nerves diverge anteriorly from the ulnar in the arm region. The latter nerve inclines posteriorly as it passes distally in the arm. It divides into a small anterior and larger posterior branch in the middle of the arm region which are distributed below the elbow.
The radial nerve derives its fibers from the seventh and eighth cervical and first thoracic roots of the brachial plexus.

It descends from the plexus for a short distance in a common trunk with the axillary, thoracodorsal and posterior subscapular nerves, passes downward to the level of the brachial artery and continues distally in the axillary space along the dorsal aspect of the latter vessel. It inclines downward and backward between the subscapular artery laterally and subscapular vein medially and continues over the deep surface of the distal part of the teres major muscle related, in front, to the brachial vein which separates it from the ulnar nerve.

The nerve passes laterally in the interval between the teres major, long and medial heads of the triceps muscle, and spirals around the lateral aspect of the limb related deeply to the brachialis muscle and superficially to the lateral head of the triceps muscle. It divides into the "dorsal cutaneous nerve of the forearm" and muscular branches near the anterior border of the latter-mentioned triceps muscle, which are distributed below the elbow. Several branches are detached near the ventral border of the teres major muscle which are distributed as follows:

1. A large branch turns sharply dorsally, enters the long head of the triceps muscle and continues upwards and
backwards nearly to the proximal extremity of it.

2. A large branch enters the anterior border of the long head of the triceps muscle and ramifies in its middle and distal extremity.

3. A small branch passes backward on the deep face of the long head of the triceps muscle, covered by the deep fasciae of the muscle, and enters the tensor fasciae antebrachii muscle below its middle.

4. A small branch to the anconeus muscle.

The axillary nerve derives its fibers from the sixth and seventh cervical roots of the brachial plexus.

It descends from the plexus for a short distance in a common trunk with the radial, thoracodorsal and posterior subscapular nerves related ventrally to the radial nerve as it courses distally in the axillary space.

The nerve dips between the subscapular artery and muscle just above the shoulder joint and passes laterally behind the above-mentioned joint. It emerges between the acromial and scapular heads of the deltoideus muscle and passes downward in the superficial fascia in the groove formed by the acromial part of the deltoid and the lateral head of the triceps muscles. It crosses the distal extremity of the brachiocephalicus muscle obliquely as it gradually inclines toward the cranial aspect of the limb, passes deep to the cephalic vein and terminates medial to the extensor
carpi radialis muscle on the anteriomedial aspect of the elbow. Several cutaneous and muscular branches are detached along the course of the nerve which are distributed as follows:

1. A small branch is detached in the plexus which joins the thoracodorsal nerve. It continues with the latter nerve to the level of the teres major muscle then enters the latter muscle.

2. A small branch to the posterior part of the subscapularis muscle.

3. Several small twigs to the shoulder joint as the parent nerve passes laterally across the posterior border of the latter-mentioned joint.

4. A small branch turns dorsally shortly after the parent nerve turns laterally behind the subscapular muscle. It is distributed in the teres minor muscle.

5. A larger branch is detached at the same level as the above-described nerve (4), and just ventral to it, continues laterally on a near-horizontal plane and is distributed in the scapular part of the deltoideus muscle.

6. A large branch (nearly twice the diameter of the foregoing nerve (5)), and lying just ventral to it is detached at the same level as the last two above-described nerves (4 and 5). This branch passes craniocaudally, first between the teres minor and acromial part of the deltoideus muscles (detaching fibers to the latter), then between the latter muscle and the interval between the lateral and deltoid
tuberosities of the humerus. It turns down the limb related superficially to the brachiocephalic muscle and enters the latter muscle at the level of the distal extremity of the deltoid tuberosity.

There are two nerves innervating the teres major muscle: a small one which is detached from the thorcodorsal nerve as described previously (1); a larger one which is included with the posterior branch of the subscapular nerve in a common trunk. Functionally it should be classed as a branch of the axillary nerve even though it was not detached from the latter. It originates independently from the seventh and eighth cervical roots of the brachial plexus.

The long thoracic nerve derives its fibers from the seventh and eighth cervical roots of the brachial plexus.

The branches join shortly after being detached from the above-named roots. The nerve does not enter the brachial plexus. It detaches fibers to the serratus ventralis cervicis muscle as it passes to the lateral surface of the serratus ventralis thoracis muscle, flattens out and courses caudally along the upper edge of the middle scalenus muscle. It assumes the shape of a gentle curve as it courses caudally. The latter mentioned curve is concave dorsally and is located on a line between the middle and distal one thirds of the muscle. Small branches are detached dorsally and ventrally along its course in the serratus ventralis thoracis.
muscle where it terminates.

The thoracodorsal nerve derives its fibers from the seventh and eighth cervical roots and the first thoracic root of the brachial plexus.

It descends from the plexus for a very short distance in a common trunk with the radial, axillary and posterior subscapular nerves. It is interposed between the last two above-mentioned nerves as it courses distally in the axillary space. It continues upward and backward across the deep face of the teres major muscle; crosses the deep face of the thoracodorsal artery and ramifies in the latissimus dorsi muscle.

A small branch is detached from it at the level of the teres major muscle which enters the latter muscle. This branch originates from the axillary nerve as previously described (axillary nerve, l).

The external thoracic nerve derives its fibers from the eighth cervical and first and second thoracic roots of the brachial plexus.

This nerve forms the posterio-medial border of the plexus. It descends across the medial face of the brachial vein in the axillary space then inclines posteriorly in a gentle curve. It divides into a dorsal and ventral branch at the level of the afore-mentioned vein which are distributed as follows:
1. The dorsal branch divides into two branches:
   a. The dorsal branch passes caudally to the interval between the thoracodorsal and deep pectoral muscles. It is distributed to the cutaneous trunci muscle and skin to the region of the flank. Small branches are detached which pass dorsolaterally to the latissimus dorsi muscle. Twigs from the latter small branches curve forward and are distributed in the subcutaneous tissue along the posterior part of shoulder.
   
   b. The ventral branch passes posteriorly along the lateral edge of the posterior deep pectoral muscle (on its deep surface). It detaches small branches to the posterior one-fourth of the muscle. The parent branches continue to the ventral mid-line and posteriorly to the prepuce.

2. The ventral branch is distributed to the anterior three-fourths of the posterior deep pectoral muscle.

The dorsal branch is joined by cutaneous branches of the intercostal nerves from the second intercostal nerve caudally for a variable distance.

Porcine

Table 4, Figures 37 through 45

The suprascapular nerve derives its fibers from the fifth, sixth and seventh cervical roots of the brachial plexus.
This nerve emerges from the anterior aspect of the above-named plexus. It courses ventrally for a short distance then turns laterally and dorsally 360 degrees and courses in a dorsocaudal direction to the level of the ventral edge of the plexus. It then turns laterally at the interstice between the supraspinatus and subscapularis muscles. (The exact relationship varies according to the position of the limb). Several branches to the supraspinatus muscle are detached soon after the nerve enters the interstice previously mentioned. The parent nerve continues caudally, it passes caudally, distal to the scapular spine and terminates in the infraspinatus muscle.

The subscapular nerve derives its fibers from the sixth and seventh cervical roots of the brachial plexus. There were two variations:

1. In seven of ten specimens it occurred as a single trunk which was detached from the lateral aspect of the plexus, caudal to the emergence of the suprascapular nerve. It turned caudally immediately after emergence from the plexus. It divided into two branches of nearly equal size on the lateral face of the plexus. The above-named branches subdivided into several smaller branches which fanned out and entered the subscapular muscle in its distal one-third. Its branches ramified throughout the latter muscle.

2. In three of ten specimens there were two nerves:
one nerve was detached just caudal to the suprascapular nerve (as in 1) and innervated the anterior part of the subscapular muscle; the other nerve emerged from the plexus in company with the axillary nerve. It soon diverged dorsally from the latter nerve and entered the posterior part of the subscapular muscle.

The anterior thoracic or pectoral nerves derive their fibers from the sixth, seventh and eighth cervical roots of the brachial plexus. The disposition of the nerves are as follows:

1. The nerve innervating the anterior deep pectoral muscle is derived from fibers from the sixth and seventh cervical roots. The latter fibers are detached from the anteromedial surface of the plexus. They join a short distance distal to their point of detachment. The trunk continues its ventral course inclining slightly craniad. It divides into two branches of nearly equal size and enters the anterior deep pectoral muscle along its caudal border near its origin.

2. The main anterior pectoral nerve derives its fibers from the seventh and eighth cervical roots of the brachial plexus. In eight of the ten specimens a common trunk was formed shortly after the fibers were detached from the medial aspect of the plexus. The above-mentioned trunk coursed ventrally across the medial face of the brachial artery and
the lateral face of the brachial vein. Shortly after passing ventral to the above-named vein it divided into several branches (5 to 9). The latter branches terminated in the posterior superficial, anterior superficial and the anterior one third of the posterior deep pectoral muscles. (In two specimens the fibers which were detached from the plexus formed two ventrally coursing nerves instead of a common trunk).

The musculocutaneous nerve derives its fibers from the sixth and seventh roots of the brachial plexus.

It descends across the lateral surface of the brachial artery below which it spirals medially to join the median nerve.

It continues downward in the limb in company with the median nerve, first related dorsocaudally to the latter nerve (in the axillary space), then caudally to it (in the region of the arm). It is detached from the median nerve at the level of the distal insertion of the coracobrachialis muscle and passes downward and laterally in the interval between the insertion of the latter muscle and the biceps brachii muscle. In this area it divides into two branches: the "distal muscular branch of the musculocutaneous nerve" passes laterally and terminates in the brachialis muscle; the remaining branch, the "medial cutaneous nerve of the forearm" inclines downward and outward spiraling around the
biceps brachii near its insertion.

It detaches a large branch at the level of the shoulder joint, "proximal muscular branch of the musculocutaneous nerve" which courses ventrally and passes between the coracobrachialis muscle medially and the medial head of the triceps muscle laterally at the level of the caudal border of the subscapularis muscle. It detaches several small branches to the coracobrachialis muscle as it crosses its lateral face and terminates in the biceps brachii muscle. In six of the ten specimens fibers were detached below the elbow which joined the median nerve.

The median nerve derives its fibers from the seventh and eighth cervical roots and the first thoracic root of the brachial plexus.

It descends to the medial face of the brachial artery and continues distally in the axillary space related laterally to the above-mentioned vessel and dorsocaudally to the ulnar nerve. It continues down the arm, first across the lateral surface of the posterior deep pectoral muscle, then on the deep face of the posterior superficial pectoral muscle. Finally it is covered by skin and fascia until it dips under the pronator teres muscle on its continuing course distally in the limb.

It is joined by the main branch of the musculocutaneous nerve as the latter nerve spirals around the ventral aspect
of the brachial artery in the axillary region. The above-
mentioned branch remains applied to the anterior surface of
the median nerve to the level of the coracobrachialis muscle.
In six of ten specimens smaller fibers from the branch just
described joined the median nerve.

The median nerve is related laterally to the brachial
artery and caudally to the ulnar nerve in the proximal one-
third of the arm. The latter nerve then diverges caudally
from it and the brachial artery bounds its caudal border.
Shortly before passing deep to the pronator teres muscle it
inclines caudally and again becomes related laterally to the
brachial artery.

It forms the cranial border of the large trunk in the
area of the emergence of the subscapular artery. The other
elements making up the trunk are the ulnar nerve, in the
middle, and the radial nerve forming the caudal border of
the trunk.

The ulnar nerve derives its fibers from the eighth
cervical root and first thoracic root of the brachial plexus.

It descends to the level of the brachial artery in the
axillary region and continues distally interposed between
the median nerve craniocentrally and the radial nerve
caudodorsally. The brachial artery and vein bound it
laterally. Its relationship to the accompanying nerves
remains the same in the proximal one-third of the arm.
The radial nerve then turns laterad. The ulnar nerve divides into two branches: 1. the smaller sensory branch continues distally along the caudal border of the brachial artery and ramifies subcutaneously on the medial volar aspect of the proximal third of the forearm, 2. the larger muscular branch diverges caudally from the sensory branch and courses under the two heads of the flexor carpi ulnaris muscle.

The radial nerve derives its fibers from the seventh and eighth cervical roots and the first thoracic root of the brachial plexus.

It approximates the caudodorsal border of the ulnar nerve in the axillary region, then the caudal border of the latter nerve in the proximal one-third of the arm.

The nerve passes laterally in the interval between the common tendon of the latissimus dorsi and teres major muscles and the long and medial heads of the triceps muscle. It spirals around the lateral aspect of the limb related deeply to the brachialis muscle and superficially to the lateral head of the triceps muscle. It emerges between the tendon of insertion of the brachialis muscle and the extensor carpi radialis muscle and terminates as the "dorsal cutaneous nerve of the forearm" and muscular branches which are distributed below the elbow. Its collateral branches are as follows:

1. Three medium-sized branches are detached as the
parent trunk turns laterally to enter the previously-mentioned interval. They may be detached as one large nerve; or as one branch detached cranially and the remaining two in a common trunk coursing caudally; or all being detached separately.

a. The first branch courses cranially for a very short distance (one centimeter) and is dispersed in the medial head of the triceps muscle.

b. The second branch courses caudally (two centimeters) and is dispersed in the long head of the triceps muscle from the point of entry distally toward its insertion.

c. The third branch passes caudoventrally over the medial surface of the long head of the triceps muscle (deep to the deep fascia of the latter muscle) and is dispersed in the tensor fasciae antebrae muscle.

2. A large branch is detached at the level of the ventral edge of the common tendon of the teres major and latissimus dorsi muscles. It turns dorsally for a short distance before entering the long head of the triceps muscle. It is dispersed from the level of entry, dorsally toward the scapular attachment.

3. A medium branch is detached at the same level as the nerve just described (2). It spirals distolaterally around the limb with the continuing parent trunk and is dispersed in the lateral head of the triceps muscle.
4. A medium to small branch is detached from the parent trunk as the latter spirals around the caudal part of the limb. It is dispersed in the anconeus muscle.

5. A sensory branch is detached as the parent trunk becomes related caudolaterally to the lateral head of the triceps muscle. It diverges dorsally from the latter-mentioned parent trunk, emerges between the lateral head of the triceps and the brachialis muscles, and ramifies in the subcutaneous tissue on the anterior surface and adjacent area of the elbow joint.

Additional smaller twigs are given off from the parent trunk throughout its course.

The axillary nerve derives its fibers from the fifth, sixth and seventh roots of the brachial plexus.

The nerve is detached from the medial aspect of the brachial plexus caudal to the subscapular nerve. (In three specimens a subscapular branch was detached from the plexus in company with it.) It passes downward to the level of the brachial vein and continues distally in the axillary space along the dorsal aspect of the latter vessel. It detaches fibers to the joint capsule as it crosses the caudal border of the subscapular muscle a short distance above the shoulder joint (at the confluence of the subscapular vein). It emerges between the acromial and scapular heads of the deltoideus muscle as the "lateral cutaneous nerve of the
arm". It passes downward in the superficial fascia in the groove formed by the acromial head of the deltoideus and lateral head of the triceps muscles. It crosses the distal extremity of the brachiocephalicus muscle and ramifies on the front of the elbow joint and adjoining area.

The parent nerve detaches muscular branches along its course as follows:

1. In three of ten specimens a subscapular branch is detached as previously described.

2. A branch is detached at the level of the deep face of the subscapular muscle. It continues caudally across the above-named muscle and terminates in the teres major muscle.

3. A branch is given off shortly after the parent nerve enters the interstice between the subscapular and teres major muscles. The branch diverges dorsally as it continues laterally and terminates in the teres minor muscle.

4. A branch is detached from the parent trunk as the latter approximates the deep face of the deltoid muscle. The branch subdivides into several twigs which ramify in the two parts of the deltoideus muscle.

5. A branch is detached from the parent trunk at the same site as branch "4". It passes craniolaterally, first between the teres minor and acromial head of the deltoideus muscles, then the latter muscle, on the one hand, and the interval between the lateral and deltoid tuberosities of
the humerus, on the other hand, and terminates in the brachiocephalicus muscle.

The **long thoracic nerve** derives its fibers from the seventh cervical root of the brachial plexus.

The nerve does not enter the brachial plexus. It passes caudally over the lateral surface of the serratus ventralis thoracis muscle just above the middle scalenus muscle. It flattens out as it courses posteriorly in a gentle curve. The latter-mentioned curve is concave dorsally and is located on a line between the middle and distal one-thirds of the serratus ventralis thoracis muscle. It detaches small branches dorsally and ventrally along its course and terminates in the above-named muscle.

The **thoracodorsal nerve** derives its fibers from the seventh and eighth cervical roots of the brachial plexus.

It forms the caudal border of the plexus where it is related medially to the external thoracic nerve. It courses caudodistally across the face of the teres major muscle between the middle and distal thirds of the latter muscle. It divides into two branches as it crosses the above-named muscle: one branch courses caudally and enters the distal one-third of the latissimus dorsi muscle near the ventral border; the second branch inclines dorsally on its caudal course and enters the distal one-third of the latter muscle near the dorsal border.
The external thoracic nerve derives its fibers from the eighth cervical and first thoracic roots of the brachial plexus.

It forms the caudomedial border of the plexus where it is related laterally to the thoracodorsal nerve. It descends ventrocaudally in the axillary space to the medial edge of the lateral border of the posterior deep pectoral muscle. It courses caudally along the above-mentioned border of the latter muscle giving several branches to the posterior two-thirds of the muscle.

Sensory branches pass over the dorsal border of the muscle and ramify in the subcutaneous tissue in the ventral one-third of the body wall extending caudally to the flank.

Cutaneous branches of the intercostal nerves (second to the sixth inclusive) join the nerve in a variable manner (Gandhi, 1966).

Equine

Table 5, Figures 46 through 54

The suprascapular nerve derives its fibers from the sixth and seventh cervical roots of the branchial plexus.

It courses ventrally along the anterior border of the plexus for a short distance, turns caudodorsally and passes across the lateral face of the plexus to the interstice between the supraspinatus and subscapular muscles near a
line between the middle and distal one-thirds of the scapula. Soon after turning laterally in the above-mentioned interstice the nerve divides into several small branches and one large branch:

1. The small branches are distributed to the supraspinatus muscle;

2. The large branch courses posteriorly between the scapula and the supraspinatus muscle. It continues posteriorly across the scapula ventral to the spine of the latter bone and terminates in the infraspinatus muscle.

The subscapular nerves derive their fibers from the seventh cervical root of the brachial plexus.

It usually occurs as two trunks: one is detached from the lateral aspect of the plexus near the anterior border (lateral to the common trunk of the musculocutaneous and anterior thoracic nerves, courses ventrally to the level of the subscapular muscle then turns caudodorsally and enters the anterior part of the latter muscle. At the junction of the middle and distal one thirds; the remaining trunk runs caudally, for a distance, in close proximity to the thoracodorsal or axillary nerve (or both), and finally enters the posterior part of the subscapularis muscle.

The anterior thoracic or pectoral nerves derive their fibers from the seventh and eighth cervical roots and the first thoracic root of the brachial plexus. The courses of
the nerves are as follows:

1. The branch to the anterior deep pectoral muscle is detached from the seventh and eighth cervical roots of the plexus. It may arise independently or may be in a common trunk with the musculocutaneous nerve and other anterior pectoral branches. It divides into several branches just before entering the muscle. Entry is made on the deep face of the muscle in its middle one-third.

2. The branch to the anterior superficial pectoral muscle is derived mainly from the seventh cervical root. It passes ventrally in company with the musculocutaneous nerve to the level of the brachial artery. It is detached from the accompanying nerve as it crosses the lateral face of the above-described artery (may be detached midway between the plexus and artery), receives a branch from the pectoral nerve which crosses the medial face of the artery (from the eighth cervical root) and continues ventrally between the posterior deep pectoral muscle medially and the anterior deep pectoral muscle laterally. Continuing its ventral course it crosses the anterior edge of the posterior superficial pectoral muscle (In one specimen it passed through the latter muscle one centimeter posterior to the anterior edge.) and divides into several branches which terminate in the anterior superficial pectoral muscle. One to three twigs are detached as the nerve passes the posterior
superficial pectoral muscle and enter the latter muscle.

3. The branch to the posterior superficial pectoral muscle is derived from the eighth cervical root. It passes ventrally across the medial face of the brachial artery where it detaches fibers to the seventh root which form a loop under the latter artery. The parent nerve inclines caudally on a continuing ventral course passing between the posterior deep pectoral muscle medially and the anterior deep pectoral muscle laterally. It then divides into several branches which terminate in the posterior superficial pectoral muscle.

4. The branch to the posterior deep pectoral muscle is derived from the eighth cervical root. There are several variations in the course of this nerve:

a. Accompanies its previously described mate from the eighth cervical root (3) across the medial face of the brachial artery and continues ventrally to be detached from the aforementioned mate on the medial surface of the posterior deep pectoral muscle. It divides into several branches which terminate in the one-third of the latter muscle nearest to the humeral insertion.

b. Accompanies its mate as described in "a" except that it passes across the medial face of the brachial vein. Its divisions and terminations are not significantly different from "a".

c. Accompanies the external thoracic nerve ventrally
(the distance varies from the ventral edge of the plexus to the brachial vein). It continues ventrally across the medial face of the brachial vein as the external thoracic nerve curves caudally away from it. Its divisions and terminations are not significantly different from "a" and "b".

d. Two nerves: 1. one nerve distributed as in "a"; 2. one nerve distributed as in "c" except that it crosses the medial surface of the brachial artery with its mate.

The musculocutaneous nerve derives its fibers from the seventh and eighth cervical roots of the brachial plexus.

It descends across the lateral face of the brachial artery in company with the anterior pectoral nerve which originates from the seventh cervical root. It spirals around the anterior ventral surface of the brachial artery and joins the median nerve. In two instances it exchanged fibers with the median; in the remaining eight specimens it contributed fibers to the median but did not receive any. Its relationship to the median nerve is described under the heading of the latter.

The nerve is detached from the median nerve at the level of the tendon of insertion of the superficial head of the coracobrachialis muscle, and inclines laterally between the humerus posteriorly and the biceps brachii anteriorly on its distally continuing course in the limb. It divides into two branches of nearly equal size soon after being
detached from the median nerve, which are distributed as follows:

1. The dorsal branch "medial cutaneous branch of the forearm" passes distolaterally, spiraling around the biceps brachii in the subcutaneous tissue. It first passes along the lateral aspect of the lacertus fibrosus, then disto-medially across its anterior free edge and along the medial aspect of the latter as it continues down the limb.

2. The ventral branch "distal muscular branch of the musculocutaneous nerve" passes laterally to the brachialis muscle in which it terminates.

A large, and one or two smaller, branches "proximal muscular branches of the musculocutaneous nerve" are detached from the parent trunk near the shoulder joint. They are distributed as follows:

1. The large branch is the most proximal one. It passes disto-anteriorly to the interval between the two heads of the coracobrachialis muscle, detaches twigs to the deep head of the coracobrachialis muscle and continues disto-anteriorly to the biceps brachii muscle in which it terminates.

2. One or two small branches are detached distally to the previously described nerve (1). They course disto-anteriorly to the superficial head of the coracobrachialis muscle where they terminate.
The median nerve derives its fibers from the seventh and eighth cervical roots and the first and second thoracic roots of the brachial plexus.

It descends to the medial face of the brachial artery where it is joined by the musculocutaneous nerve. (The median nerve does not enter into the formation of a loop with the musculocutaneous nerve in the usual sense. It remains on the medial aspect of the vessel where it is joined by the latter nerve.) It courses on the medial aspect of the vessel to the origin of the subscapular artery. The nerve then inclines anteriorly and continues distally in the arm related posteriorly to the brachial artery. The relationship to the latter vessel continues nearly to the elbow joint. It then inclines posteriorly to lie on the medial surface of the median artery at the elbow joint. It is related anteriorly, first to the coracobrachialis muscle and then to the biceps brachii muscle in the arm region. It crosses the deep face of the medial cubital vein.

The musculocutaneous nerve is attached to the anterioventral edge of the median nerve in the axillary space and along the anterior edge of the same nerve in the arm region. It is detached from the median nerve at the level of the tendon of insertion of the superficial head of the corocobrachialis muscle. In two of the ten specimens there was an exchange of fibers between the musculocutaneous and median
nerves. In the remaining eight specimens the median received fibers from the musculocutaneous nerve.

The **ulnar nerve** derives its fibers from the first and second thoracic roots of the brachial plexus.

It descends in the axillary space to the posteriordorsal surface of the brachial artery related posteriorly to the radial nerve. It courses distally in the above-mentioned space interposed between the artery and nerve. It diverges caudally from the artery in the region of the shoulder and passes between the subscapular artery and vein still related posteriorly to the radial nerve. (The nerves passed across the lateral face of the artery in one specimen. The ulnar nerve was interposed between the brachial artery anteriorly and the radial nerve posteriorly.) The two nerves remain in the same relationship to one another as they spiral around the posterior border of the brachial vein to the deep surface of the latter vessel. The ulnar nerve inclines anteriorly to the posterior border of the brachial artery. It is interposed between the latter artery anteriorly and the satellite vein posteriorly for a short distance. The nerve then diverges caudally from the afore-mentioned artery, crosses the deep face of the satellite vein and continues on a distoposterior course along the deep surface of the tensor fasciae antebrachii muscle and is distributed to the flexor muscles of the carpus and digit.
A sensory branch is detached in the middle of the arm. It passes over the superficial surface of the brachial vein and continues distoposteriorly on the superficial surface of the tensor fasciae antebrachii muscle covered by the posterior superficial pectoral muscle. It crosses the medial aspect of the elbow joint and is distributed to the posterior aspect of the lower limb.

The radial nerve derives its fibers from the seventh and eighth cervical roots and the first thoracic root of the brachial plexus.

It descends to the posteriordorsal surface of the axillary artery and courses distally, separated from the artery by the ulnar nerve. It diverges caudally from the artery in the region of the shoulder and crosses the deep face of the subscapular artery and vein still related anteriorly to the ulnar nerve. The two nerves remain in the same relationship to one another as they spiral around the posterior border of the brachial vein to the deep surface of the latter vessel.

The radial nerve turns laterally in the interval between the teres major and the long and medial heads of the triceps muscle. It spirals around the lateral aspect of the arm either directly on the humerus and bounded by the brachialis and lateral head of the triceps muscles; or between the brachialis muscle deeply and the lateral head of the triceps
muscle superficially. It is distributed in the extensor muscles of the digit as well as in the ulnaris lateralis muscle.

Several muscular and cutaneous branches are detached from the parent nerve. They are distributed as follows:

1. A branch to the tensor fasciae antebrachii muscle is detached from the medial face of the parent nerve before the latter turns laterally away from the brachial vein. The branch passes distally along the posterior border of the brachial vein to the muscle where it terminates.

Several fibers were detached which entered the long head of the triceps in one specimen.

The nerve was made up of branches of nearly equal size from the ulnar and radial nerves, in one specimen.

2. A branch to the medial head of the triceps is detached at the same level as the previously described nerve (1). It passes distally on the deep face of the brachial vein and terminates in the muscle.

3. A large branch, equal in size to the parent trunk is detached near the ventral edge of the teres major muscle. It divides into several branches which immediately enter the long head of the triceps muscle.

4. A branch which includes the fibers to the lateral head of the triceps muscle and the "dorsal cutaneous nerve of the forearm" is detached at variable points along the
spiraling course of the parent nerve. The muscular branches enter the lateral head of the triceps muscle. The cutaneous branch is distributed below the elbow.

5. A small branch is detached to the anconeus muscle.

6. A small branch to the brachialis muscle in one out of ten cases.

The axillary nerve derives its fibers from the sixth, seventh and eighth cervical roots of the brachial plexus.

It passes distoposteriorly in the axillary space and crosses the medial surface of the subscapularis muscle bordered dorsally by the thoracodorsal and ventrally by the lateral thoracic nerves. It turns laterally in the interstice between the posterior edge of the subscapular muscle and artery. The nerve continues laterally behind the shoulder joint and teres minor muscle detaching several small branches to the joint. It continues to the deep surface of the scapular portion of the deltoid muscle where it divides into four branches which are distributed as follows:

1. The largest branch is detached from the dorsal border of the parent nerve. It enters the deltoideus muscle almost immediately.

2. The second largest branch appears to be the continuation of the parent nerve. It inclines distoanteriorly between the teres minor muscle deeply and the scapular and spinous portions of the deltoideus muscle superficially then
crosses the lateral surface of the humerus in the interval between the lateral and deltoid tuberosities. The nerve continues to the deep surface of the brachiocephalicus muscle, turns distally for a short distance and enters the latter muscle. Several twigs are detached to the spinous portion of the deltoideus muscle.

3. A small branch is detached medial to the preceding nerve (2). It curves medially and enters the teres minor muscle almost immediately.

4. A branch is detached from the ventral border of the parent trunk which passes through the lateral head of the triceps muscle for a variable distance finally emerging onto the lateral surface of the latter muscle. It continues between the latter muscle and the distal extremity of the deltoideus muscle. Finally it passes distally beyond the latter muscle and is distributed in the subcutaneous tissue on the anterior surface of the elbow joint.

Two collateral branches are detached from the parent trunk proximal to its termination. They are distributed as follows:

1. A large branch is detached in the axillary space. It soon divides into two branches of nearly equal size which continue posteriorly and terminate in the teres major muscle; or a large branch is detached in the axillary space which passes posteriorly to the teres major muscle without dividing.
A small branch is detached from the parent nerve just as the latter turns laterally between the subscapular artery and muscle which continues posteriorly to the teres major muscle.

2. A large branch is detached at the posterior border of the subscapular muscle. It is distributed to the latter muscle.

The long thoracic nerve derives its fibers chiefly from the seventh and eighth cervical roots of the brachial plexus. The branches do not enter the brachial plexus.

The branch from the seventh cervical root emerges between the ventral and middle scalenus muscles. It inclines dorsally over the superficial surface of the middle scalenus muscle as it passes caudally. It joins the eighth cervical root soon after the two nerves pass onto the superficial surface of the serratus ventralis thoracis muscle.

The branch from the eighth cervical root is the larger. It emerges between the dorsal and middle scalenus muscles. It turns caudally over the superficial surface of the serratus ventralis thoracis muscle and is joined by the seventh cervical root soon after the two nerves pass onto the latter muscle. The nerve flattens out and courses caudally on the superficial surface of the muscle in a gentle curve which is concave dorsally and is located in the middle of the muscle. The nerve detaches small branches dorsally and ventrally along its course and terminates in the above-named muscle.
The **thoracodorsal nerve** derives its fibers from the eighth cervical and first thoracic roots of the brachial plexus.

It turns posteriorly almost immediately after being detached from the plexus and passes across the subscapular and teres major muscles on a near horizontal plane. It divides into several branches at the level of the teres major muscle. The latter branches continue posteriorly to the latissimus dorsi muscle where they terminate.

The **external thoracic nerve** derives its fibers from the eighth cervical root and the first and second thoracic roots of the brachial plexus. It is distributed to the cutaneous trunci muscle.

This nerve forms the posterior border of the brachial plexus. It divides into three or four main branches in the axillary space which are distributed as follows:

1. The most anterior branch is inconstant (when present there are four main branches). It is described with the anterior thoracic (or pectoral) nerves.

2. The second most anterior branch descends posterior-ventrally in the axillary space. It passes across either the medial surface of the brachial vein or the common trunk of the external thoracic and thoracodorsal veins. It continues to the deep surface of the middle one third of the posterior deep pectoral muscle where it divides into several
branches and terminates.

3. A branch diverges posteriorly from the previously described branch (2). It crosses the deep surface of the thoracodorsal vein and continues posterioventrally along the upper border of the external thoracic vein. It detaches a branch from its ventral border which crosses the latter vein and divides into several branches which terminate in the posterior one-third of the posterior deep pectoral muscle. A branch is also detached from its dorsal border which is distributed in the cutaneous trunci in the region of the lateral thoracic wall. The parent nerve continues its caudoventral course with the external thoracic vein, gaining the ventral midline posterior to the above-mentioned pectoral muscle.

4. The posterior-most branch diverges posteriorly from the previously-described branch (3). It is related laterally, first to the distal one-third of the teres major muscle, then to the tendon of insertion of the latissimus dorsi muscle, then to the medial tendon of the cutaneous trunci muscle. It continues posteriorly on the deep surface of the latter muscle. Several branches are detached in the interval between the latissimus dorsi muscle and the posterior deep pectoral muscle. The dorsal branches pass lateral to the latissimus dorsi muscle. The middle branches continue posteriorly on a near horizontal plane. The ventral
branches are distributed in the region of the lateral body wall.

Cutaneous branches of the intercostal nerves from the second intercostal nerve, caudally for a variable distance, join the external thoracic nerve in a variable manner.
DISCUSSION

There are species differences in the relationship of nerves to each other and adjacent structures. There are also, according to other workers in this area, differences within the species which, when compared with each other in the light of new dissections, prove to be a difference in interpretation or nomenclature.

The species differences, to a large degree, seem to be due to: the relationship of the scapula and humerus and their associated structures to the thoracic wall; and the degree of torsion that occurred in the brachial plexus as a result of the limb assuming its definitive position. The greatest amount of torsion is seen in the plexus of the sheep and goat, being less in the bovine, but still quite evident. The torsion in the plexus of the horse is less well defined than in the ruminant while, in the pig, it is difficult to see. In the ruminants, the torsion was almost effaced by a clockwise rotation of the nerve roots going into the plexus one hundred and eighty degrees; no significant reduction was accomplished in the pig and horse. The spinal roots which contributed to the nerves emanating from the plexus were somewhat variable. The variation, however, was within acceptable limits so as to consider the findings in this study to be in agreement with most other workers.
The suprascapular nerve in all species, entered the interstice between the supraspinatus and subscapular muscles and innervated the supraspinatus and infraspinatus muscles. The area where the nerve passed between the former muscles was located posterior to the plexus in the sheep and goat, anterior to it in cattle and the pig, and lateral to it in the horse.

The number of main branches into which the subscapular nerve divides is not dependent upon whether it originates from one or two cervical nerves. They terminate in the subscapular muscle: the anterior branch runs to the anterior part of the muscle alone, or in company with the suprascapular nerve; the posterior branch runs to the posterior part of the muscle alone, or in company with the axillary branch to the teres major muscle and the thoracodorsal nerve. Bruni and Zimmerl (1951), in cattle, describe the inferior subscapular (posterior branch) as the nerve to the teres major muscle, stating further that it arises from the thoracodorsal and axillary nerves. This does appear to be the case in the intact plexus. When the nerves are separated, however, this nerve is seen to be more closely allied to the anterior branch. Koch (1965) stated that, in the horse, these nerves supply all of the subscapular muscle except a narrow caudal area which is supplied by the axillary. Gross dissection was the only method employed to determine the distribution
of nerves in this study, therefore it was not possible to determine precisely, the extent to which the axillary nerve innervated the muscle.

The cranial pectoral nerves seem to present, on cursory examination, many variations, which proved to be mostly differences in interpretation or nomenclature. Reimers (1925b), in the sheep and goat, stated that the lateral branch arises from the musculocutaneous and the medial with the ventral and lateral thoracic nerves. May (1964), in the sheep, states that one arises from the median and external thoracic and the other from the external thoracic nerves. The nerves are so closely bound together by connective tissue in this area that it would not be unreasonable for authors to describe relationships in slightly different terms while at the same time, seeing a similar morphological arrangement. Reimers (1925b) describes a third cranial pectoral nerve which arises with the external thoracic by a common trunk. Bruni and Zimmerl (1951) describe the ventral thoracic or pectoral nerves as usually consisting of five, the last three of which are detached from the external thoracic nerve. According to these workers, the pectoral nerves arising with the external thoracic or ulnar nerves innervate the pectoralis ascendens muscle. Sisson and Grossman (1953) describe these nerves as muscular branches of the external thoracic nerve. There is an argument for all three of these
viewpoints. Reimers and McLeod have named the nerves according to their final distribution, that is, all nerves innervating pectoral muscles are called pectoral nerves. Sisson and Grossman, on the other hand, have named the nerves more on the basis of their morphological relationships in the plexus. The criteria, employed in this study, to determine whether a nerve should be named as an individual nerve or a branch of another was to note, after pulling the nerves apart in the plexus, how the fibers were disposed from the cord, down through the plexus, and in the nerves emanating from the plexus. Inasmuch as the nerves in question seemed to be a part of the external thoracic nerve all of the way to the spinal cord, this author agrees with Sisson and Grossman that they should be designated "pectoral branches of the external thoracic nerve." Some authors state that some of the nerves which form the cranial pectoral nerves join to form a loop under the axillary artery (Reimers, 1925b); other authors describe a loop around the brachial artery (McLeod, 1958). This is due to a difference in interpretation: Reimers describes the axillary artery as extending from the first rib to the tendon of insertion of the teres major muscle; while McLeod states that the brachial artery arises just inside the first rib, traverses the axillary space and continues distally in the limb. Sisson and Grossman (1953) and Bradley (1920), in the horse, state that these nerves
detach branches to the brachiocephalic muscle. These branches could not be demonstrated in this study.

The musculocutaneous and median nerves are so closely related that it is difficult to discuss one without the other. The relationship of these two nerves to each other, as well as the relationship of the musculocutaneous to the pectoral nerves have been described in many ways. Some workers state that the musculocutaneous detaches a branch to the pectoral nerves (Bruni and Zimmerl, 1951; Sisson and Grossman, 1953; May, 1964), while others do not. Here it is a case of whether one wishes to say that: it is actually a branch of the musculocutaneous nerve; or it is a separate nerve coming off of the spinal cord and running along with the musculocutaneous nerve for a distance. McLeod (1958), in cattle, states that it gives a large branch to the median nerve then terminates in the biceps brachii muscle; Bruni and Zimmerl (1951), in the horse, state that it receives a large branch from the median and terminates in the latter muscle. There are three seemingly valid reasons for describing the musculocutaneous nerve as giving off branches to the coracobrachialis and biceps brachii muscles and continuing down the limb in company with the median nerve: first, it is quite clear that the musculocutaneous nerve innervates the biceps brachii muscle which is a flexor of the elbow, it is logical that this nerve would give fibers to the brachialis muscle.
which is also a flexor of the elbow; secondly, the name indicates that this nerve has a cutaneous branch, however, if it terminates in the biceps brachii muscle there is no cutaneous branch and the name is a misnomer; thirdly, in this study the musculocutaneous nerve was completely separable from the median in two cases (one each in goat and pig) and in these the musculocutaneous nerve innervated the brachialis muscle and continued as the medial cutaneous nerve of the forearm. The latter reason should not be taken as conclusive evidence that the median nerve never takes part in the formation of the latter mentioned cutaneous nerve. It is possible that, in many cases, there is a cutaneous branch of the median nerve. Other methods of study (electrophysiological) would be necessary to definitely answer this question. The exchange of fibers between the musculocutaneous and median nerves, as described by the workers in the past, varied from: a reciprocal exchange from one nerve to the other; the median nerve contributing fibers to the musculocutaneous; and the musculocutaneous nerve contributing fibers to the median. Many variations were found in this study. In the goat, the median nerve detached fibers to the musculocutaneous nerve and, in one case, the nerves were completely separable; while, in the sheep, there was an exchange of fibers between the two nerves and the musculocutaneous detached fibers to the median nerve. The extent of fiber exchange, or the lack
of it, might depend upon the level of exit of the fibers from the spinal cord. For instance, if a fiber destined for the coracobrachialis muscle came off the cord at a level which caused it to be incorporated in the median nerve, it might cross to the musculocutaneous nerve in, or distal to, the loop. Conversely, if a nerve destined for the carpal or digital flexors came off the cord at a level which caused it to be incorporated in the musculocutaneous nerve, it might cross to the median nerve.

The ulnar nerve is well described and all of the authors reviewed were in agreement on the disposition of it except Bruni and Zimmerl (1951). The latter authors state that it detaches a branch to the thick extensor of the forearm which was thought to be the long head of the triceps muscle. No such branch could be demonstrated in any of the species in this study.

The radial nerve conformed, with two main exceptions, to findings of other workers. Reimers (1925b), Nickel (1941) and Koch (1965) state that it derives its fibers from the seventh and eighth cervical and first thoracic nerves. The findings in this study agreed with them in all animals (goat, sheep, cattle and pig) except the horse (only one was in agreement, the remaining nine derived their fibers from the eighth cervical and first thoracic nerves). The branch to the brachialis muscle could not be demonstrated in this study.
Other authors state that it is not constant (Sisson and Grossman, 1953; Koch, 1965). This branch to the brachialis muscle may appear to be an exception to the rule that the radial nerve innervates the extensors of the limb below the shoulder. This is not true, however, because the branch in question innervates the brachioradialis muscle, when present, which is a rotator of the radius. The latter muscle, in the species included in this study, is fused with the brachialis and has completely lost its identity. The branch of the radial nerve which innervated it is then seen to innervate the brachialis muscle (Nickel, 1941; Koch, 1965). Reimers (1925b), in the pig, states that there is an anastomotic branch between the brachialis twig and the musculocutaneous nerve. This anastomotic branch could not be demonstrated. According to this, fibers from the radial nerve would innervate a flexor of the elbow by way of the musculocutaneous nerve; or continue with the terminal branch of the latter nerve as sensory branches to the forearm. Inasmuch as the radial nerve also gives sensory branches to this area it is possible that the anastomotic twig under discussion is sensory.

The axillary nerve is considered to supply the flexors of the shoulder joint. The subscapularis muscle, although not considered to be a true flexor of the joint, does assist in maintaining flexion that has been accomplished (Miller,
Christensen and Evans, 1964). The innervation of the brachiocephalic muscle by the axillary nerve, does not seem to agree with the initial statement. Romer (1962) states, however, that the cleidobrachialis portion of the brachiocephalic muscle was part of the deltoideus muscle which became fused with the cleidomastoideus muscle as a result of reduction of the clavicle. It also detaches a branch which runs with the thoracodorsal nerve to the level of the teres major muscle where it diverges from the nerve to enter the latter muscle.

The long thoracic nerve, in a strict sense, is not a part of the brachial plexus. In all cases the contributing fibers to this nerve were detached from the main trunks before the latter entered the plexus. It might be considered as a part of the plexus on the basis that: it is detached from the ventral branches of the nerves which enter the plexus; and it innervates a muscle which is attached to the limb. Neither of the latter statements will stand alone in determining whether a nerve should be considered as a part of the plexus.

The thoracodorsal nerve is considered to be totally distributed to the latissimus dorsi muscle by most workers. May (1964), in the sheep, however, states that in addition to innervating the latter muscle it detaches branches to the teres major and deep pectoral muscles. The branch to the
teres major, when separated from the thoracodorsal nerve proximally through the plexus, appeared to be originating from the axillary rather than the thoracodorsal nerve. Branches to the deep pectoral muscles could not be demonstrated.

The external thoracic nerve is discussed with the cranial pectoral nerves.
SUMMARY AND CONCLUSIONS

The brachial plexuses of the species studied present a twist between the roots of origin proximally, extending distally along the nerves emanating from the plexus for a variable distance. The twist is in a counter-clockwise direction and varies in extent according to the species—the goat presenting the most extensive and clearly defined twist and the sheep, ox, pig and horse presenting less definition, respectively.

The brachial plexus derives its fibers from the ventral branches of the sixth, seventh and eighth cervical and first thoracic nerves in the goat and sheep; from the sixth, seventh, eighth cervical and first and second thoracic nerves in the ox and the horse; and the fifth, sixth, seventh and eighth cervical and first thoracic nerves in the pig.

The branches emanating from the plexus are as follows:

1. The suprascapular nerve derives its fibers from the sixth and seventh cervical nerves in the goat, ox, cattle and horse (one goat only from the sixth); and from the fifth sixth and seventh cervical nerves in the pig. In the sheep and goat it passes across the lateral face of the plexus to the interstice between the supraspinatus and subscapular muscles. In the ox, pig and the horse the nerve enters the interstice between the latter muscles anterior to the plexus.
The nerve innervates the supraspinatus and infraspinatus muscles.

2. The subscapular nerves, usually two in number, usually derive their fibers from the sixth and seventh cervical nerves (sometimes only from the seventh). The anterior branch derives its fibers from the sixth and seventh cervical nerves, often is found closely attached to the suprascapular nerve, and finally enters the anterior part of the subscapularis muscle. The posterior branch derives its fibers from the seventh cervical nerve, often found closely attached to the thoracodorsal or axillary nerves (or both) for part of its course, and finally enters the posterior part of the subscapularis muscle.

3. The anterior thoracic (or pectoral) nerves derive their fibers chiefly from the seventh and eighth cervical nerves. There were two cases in the horse and one in the ox where an additional branch came from the first thoracic nerve, and one case in the goat where an additional branch came from the sixth cervical nerve. A separate nerve to the cleidascapularis muscle was found in the horse derived from the seventh and eighth cervical and in the pig from the sixth and seventh cervical nerves. The cervical branches may: join proximal to the brachial artery, cross the lateral, or medial, face of the latter vessel, and divide into anterior and posterior branches; join distal to the artery (forming a
loop under the vessel), run together for a short distance without exchanging fibers, and separate into anterior and posterior branches; or exchange fibers in the loop, run together for a short distance and divide into anterior and posterior branches. The afore-mentioned anterior and posterior branches innervate the pectoral muscles in a variable manner.

4. The musculocutaneous nerve derives its fibers from the sixth and seventh cervical nerves in the goat and pig; chiefly from the sixth and seventh in sheep; chiefly from the sixth, seventh and eighth in the ox and from the seventh and eighth in the horse. It crosses the lateral face of the brachial artery and joins the median nerve forming a loop under the latter vessel. It gives muscular branches to the biceps brachii and coracobrachialis muscles and continues down the limb in company with the median nerve. It terminates as the "distal muscular branch of the musculocutaneous nerve" to the brachialis muscle and the "medial cutaneous nerve of the forearm". In one case (in the horse) it was completely separable from the median nerve; in some cases it contributed fibers to the median nerve; and in other cases it exchanged fibers with the latter nerve.

5. The median nerve derives its fibers from the eighth cervical and first thoracic nerves in the sheep and goat; the seventh, eighth cervical and first thoracic nerves in the
pig; and usually from the eighth cervical and first and second thoracic nerves in the ox and the horse (also received a branch from the seventh cervical in one case in the horse). It crosses the medial face of the brachial artery and forms a loop with the musculocutaneous nerve. It is separated from the brachial artery by the ulnar nerve as they all cross the lateral face of the brachial vein near the medial tuberosity of the humerus. It is related anteriorly, first to the coracobrachialis then to the biceps brachii muscles, as it descends in the limb. The interchange of fibers with the musculocutaneous nerve is discussed under the latter.

6. The ulnar nerve derives its fibers from the eighth cervical and first thoracic nerves in the sheep, goat and pig; from the eighth cervical and first and second thoracic nerves in the ox; and usually from the first and second thoracic nerves in the horse (only from the first thoracic nerve in one case). It descends over the deep face of the brachial artery in company with the median nerve. It begins to incline caudally just below the shoulder joint and crosses the medial face of the brachial artery again, and the caudally placed brachial vein, in the upper one-third of the arm region. After crossing the latter-mentioned vessels, it divides into muscular and cutaneous branches which are distributed below the elbow.

7. The radial nerve derives its fibers from the seventh
and eighth cervical and first thoracic nerves in the sheep, goat, ox and pig; and from the eighth cervical and first thoracic nerves in the horse (seventh, eighth cervicals and first thoracic in one specimen). It inclines downward and backward between the subscapular artery and vein to the interval between the teres major and long and medial heads of the triceps muscles. It passes laterally in this area to gain the musculo-spiral groove which it traverses. It divides, near the anterior border of the lateral head of the triceps muscle into the dorsal cutaneous nerve of the forearm and muscular branches which are distributed below the elbow. Along its course it detaches branches to the triceps, tensor fasciae antebrachii and anconeus muscles (in one case in the horse a branch was detached to the brachialis muscle).

8. The axillary nerve derives its fibers from the fifth, sixth and seventh cervical nerves in the pig (only from the sixth and seventh in one case); from the sixth and seventh cervical nerves in sheep and goat (in sheep: two cases from the sixth, seventh and eighth; one case from the seventh and eighth); from the seventh and eighth cervical nerves in the horse and the ox (in horse, one case from the sixth, seventh and eighth). It dips between the subscapular artery and muscle and passes laterally behind the shoulder joint to which it detaches several twigs. It gives branches to the
flexor muscles of the shoulder (including the posterior part of the subscapularis muscle) and the brachiocephalicus muscle. The terminal sensory branch "lateral cutaneous nerve of the arm" ramifies in front of the elbow joint and adjoining area.

9. The **long thoracic nerve** derives its fibers from the seventh and eighth cervical nerves (one case in the horse from the eighth cervical and first thoracic nerves). It does not enter into the plexus proper. It passes laterally between the three scalene muscles in a variable manner (depending on the species) sometimes before the roots have joined and sometimes after the roots have joined (depending on the species). It is distributed to the serratus ventralis thoracis muscle (also the serratus ventralis cervicis muscle in the goat).

10. The **thoracodorsal nerve** derives its fibers from the eighth cervical nerve in the sheep, goat and horse (one case in sheep from the seventh and eighth cervical and one case in horse from the eighth cervical and first thoracic nerves); from the seventh and eighth cervical nerves in the ox and the pig (one case in the ox from the eighth cervical and first thoracic nerves). It is distributed to the latissimus dorsi muscle.

11. The **external thoracic nerve** derives its fibers from the eighth cervical and first thoracic nerves in the sheep,
goat and pig; from the first and second thoracic nerves in the horse (eighth cervical and the thoracic nerves in two cases); and from the eighth cervical and first and second thoracic nerves in the ox (only from the eighth cervical and first thoracic in two cases). It is joined by cutaneous branches of the intercostal nerves along its caudal course. It innervates the skin on the lateral thoracic wall, extends to the mid-ventral line to the prepuce and along the lower abdominal region to the flank. It innervates the cutaneous trunci muscle and detaches several branches to the posterior deep pectoral muscle.

The morphological relationships of the components of the plexus in the various animals studied are somewhat variable. In the sheep and goat, they are enough similar so that the knowledge of one species could be applied to the other. There are enough differences in the other species, however, that one would experience difficulty in attempting to apply knowledge gained from the aforementioned species to the ox, pig or the horse. There are still many questions relative to the distribution of the individual nerve fibers; these can best be answered by electrophysiological studies.
BIBLIOGRAPHY


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APPENDIX A. TABLES
Examination of Table 1:

a - N. suprascapularis
b - Nn. subscapulares
c - Nn. pectorales craniales
d - N. musculocutaneus
e - N. medianus
f - N. ulnaris
g - N. radialis
h - N. axillaris
i - N. thoracalis longus
j - N. thoracodorsalis
k - N. thoracalis lateralis
6 - Ramus ventralis of n. spinalis cervicalis VI
7 - Ramus ventralis of n. spinalis cervicalis VII
8 - Ramus ventralis of n. spinalis cervicalis VIII
1 - Ramus ventralis of n. spinalis thoracalis I
Table 1. Origin of the nerves distal to the Plexus brachialis in Caprine

<table>
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<th>Goat no.</th>
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<th>b¹</th>
<th>c</th>
<th>d</th>
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<th>h</th>
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</table>

¹Anterior branch is derived from six and seven or seven; posterior branch is derived from seven.

²Does not enter the Plexus brachialis.
Explanation of Table 2:

a - N. suprascapularis  
b - Nn. subscapulares  
c - Nn. pectorales craniales  
d - N. musculocutaneus  
e - N. medianus  
f - N. ulnaris  
g - N. radialis  
h - N. axillaris  
i - N. thoracalis longus  
j - N. thoracodorsalis  
k - N. thoracalis lateralis  
6 - Ramus ventralis of n. spinalis cervicalis VI  
7 - Ramus ventralis of n. spinalis cervicalis VII  
8 - Ramus ventralis of n. spinalis cervicalis VIII  
l - Ramus ventralis of n. spinalis thoracalis I
Table 2. Origin of the nerves distal to the Plexus brachialis in Ovine Sheep

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<th>b(^1)</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
<th>g</th>
<th>h</th>
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</table>

\(^{1}\)Anterior branch is derived from six and seven or seven; posterior branch is derived from seven.

\(^{2}\)Does not enter the Plexus brachialis.
Explanation of Table 3:

a - N. suprascapularis
b - Nn. subscapulares
c - Nn. pectorales craniales
d - N. musculocutaneus
e - N. medianus
f - N. ulnaris
g - N. radialis
h - N. axillaris
i - N. thoracalis longus
j - N. thoracodorsalis
k - N. thoracalis lateralis
l - N. to M. teres major
6 - Ramus ventralis of n. spinalis cervicalis VI
7 - Ramus ventralis of n. spinalis cervicalis VII
8 - Ramus ventralis of n. spinalis cervicalis VIII
1 - Ramus ventralis of n. spinalis thoracalis I
2 - Ramus ventralis of n. spinalis thoracalis II
Table 3. Origin of the nerves distal to the Plexus brachialis in Bovine

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<th>Calf no.</th>
<th>Plexus</th>
<th>a</th>
<th>b&lt;sup&gt;1&lt;/sup&gt;</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
<th>g</th>
<th>h</th>
<th>i&lt;sup&gt;2&lt;/sup&gt;</th>
<th>j</th>
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<th>l&lt;sup&gt;3&lt;/sup&gt;</th>
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</table>

<sup>1</sup>Anterior branch is derived from six and seven; posterior branch is derived from seven.

<sup>2</sup>Does not enter the plexus brachialis.

<sup>3</sup>Found in close association with the posterior branch of N. subscapularis.
Explanation of Table 4:

a - N. suprascapularis
b - Nn. subscapulares
c' - N. to M. pectoralis cleidospinacapularis
c - Nn. pectorales craniales
d - N. musculocutaneus
e - N. medianus
f - N. ulnaris
g - N. radialis
h - N. axillaris
i - N. thoracalis longus
j - N. thoracodorsalis
k - N. thoracalis lateralis
5 - Ramus ventralis of n. spinalis cervicale V
6 - Ramus ventralis of n. spinalis cervicale VI
7 - Ramus ventralis of n. spinalis cervicale VII
8 - Ramus ventralis of n. spinalis cervicale VIII
1 - Ramus ventralis of n. spinalis thoracalis I
Table 4. Origin of the nerves distal to the Plexus brachialis in Swine

<table>
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<th>Pig no.</th>
<th>Plexus</th>
<th>a</th>
<th>b^1</th>
<th>c'</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
<th>g</th>
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^1Anterior branch is derived from six and seven; posterior branch is derived from seven.

^2Does not enter the Plexus brachialis.
Explaination of Table 5:

a - N. suprascapularis
b - Nn. subscapulares
c' - N. to M. pectoralis cleidoscapularis
c - Nn. pectorales craniales
d - N. musculocutaneus
e - N. medianus
f - N. ulnaris
g - N. radialis
h - N. axillaris
i - N. thoracalis longus
j - N. thoracodorsalis
k - N. thoracalis lateralis
6 - Ramus ventralis of n. spinalis cervicales VI
7 - Ramus ventralis of n. spinalis cervicales VII
8 - Ramus ventralis of n. spinalis cervicales VIII
1 - Ramus ventralis of n. spinalis thoracalis I
2 - Ramus ventralis of n. spinalis thoracalis II
### Table 5. Origin of the nerves distal to the plexus brachialis in Equine

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1. Anterior branch is derived from six and seven or seven; posterior branch is derived from seven.

2. Does not enter the Plexus brachialis.
Table 6. Animals used in the study

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APPENDIX B. FIGURES
Figure 1. The Plexus brachialis in Caprine (lateral view, schematic)

a - A. axillaris
b - Os costale I
c - M. scalenus dorsalis
d - M. scalenus medius
e - M. scalenus ventralis
f - V. axillaris
g - M. serratus ventralis cervicis
h - M. serratus ventralis thoracis
i - N. thoracalis longus

Group A
- N. suprascapularis
- N. subscapularis (cranial branch)
- N. subscapularis (caudal branch)
- N. radialis

Group B
- N. axillaris
- N. thoracodorsalis
- Nn. pectorales craniales
- N. musculocutaneus

Group C
- N. medianus
- N. ulnaris
- N. thoracalis lateralis
Figure 2. The Plexus brachialis in Caprine (lateral view)

- t - Ligamentum nuchae
- u' - M. scalenus medius
- u" - M. scalenus ventralis
- w' - M. serratus ventralis thoracis
- z - Processes transversum of vertebra cervicalis VII
- 9 - N. thoracalis longus
- 16 - Plexus brachialis

Figure 3. The Plexus brachialis in Caprine (lateral view, deep dissection)

- t - Ligamentum nuchae
- VI - Ramus ventralis of n. spinalis cervicalis VI
- VII - Ramus ventralis of n. spinalis cervicalis VII
- VIII - Ramus ventralis of n. spinalis cervicalis VIII
- I - Ramus ventralis of n. spinalis thoracalis I
- 9 - N. thoracalis longus
- 15 - Medulla spinalis
- 16 - Plexus brachialis
Figure 4. The Plexus brachialis in Caprine (medial view, schematic) (The forelimb is in the normal position and the thoracic wall has been removed)

a - A. axillaris
b - vertebra cervicalis VII
c - Os costale I
d - M. scalenus dorsalis
e - M. supraspinatus
f - M. subscapularis
g - M. teres major
h - M. latissimus dorsi
i - M. pectoralis ascendens
j - M. pectoralis cleidocapularis
k - M. pectoralis transversus
l - M. pectoralis descendens
n - Ln. axillaris
v - V. axillaris
VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis cervicalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
9 - N. thoracalis longus

Group A
1 - N. suprascapularis
2 - N. subscapularis (cranial branch)

2' - N. subscapularis (caudal branch)
7 - N. radialis

Group B
8 - N. axillaris
8' - N. axillaris (to M. teres major)
10 - N. thoracodorsalis

3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)

Group C
4 - N. musculocutaneus
4' - N. musculocutaneous (joining N. medianus)
5 - N. medianus
6 - N. ulnaris
11 - N. thoracalis lateralis
Figure 5. Variations of the Nn. pectorales craniales in caprine (schematic)

a - A. axillaris  
i - M. pectoralis ascendens  
j - M. pectoralis cleidascapularis  
k - M. pectoralis transversus  
l - M. pectoralis descendens  
3 - N. pectoralis cranialis (cranial branch)  
3' - N. pectoralis cranialis (caudal branch)  
4 - N. musculocutaneus  
4' - N. musculocutaneus (joining the N. medianus)  
5 - N. medianus  
6 - N. ulnaris  
11 - N. thoracalis lateralis
Figure 6. The brachium in caprine (medial view, schematic)

a - A. axillaris
b - M. teres major
c - M. pectoralis ascendens (most of muscle removed)
d - M. cleidoscapularis
e - M. pectoralis transversus
f - M. pectoralis descendens
g - M. tensor fasciae antebrachii
h - M. triceps brachii (caput longum)
i - M. triceps brachii (caput mediale)
j - M. coracobrachialis
k - M. biceps brachii
l - M. brachialis
m - M. brachialis
n - M. triceps brachii (caput longum)
o - M. triceps brachii (caput mediale)
p - M. coracobrachialis
q - M. biceps brachii
r - M. biceps brachii
s - M. biceps brachii

4 & 5 - Nn. musculocutaneus and medianus (common trunk)
4' - N. musculocutaneus (to Mm. coracobrachialis and biceps brachii)
4'' - N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii medialis S. dorsalis)
5 - N. medianus
6 - N. ulnaris
6' - N. ulnaris (muscular branch)
6'' - N. ulnaris (cutaneus antebrachii caudalis s. proprius)
7 - N. radialis
7' - N. radialis (part which lies in the musculo-spiral groove)
7'' - N. radialis (to M. triceps brachii, proximal part of caput longum)
7''' - N. radialis (to M. tensor fasciae antebrachii)
Figure 7. The plexus brachialis in Caprine (medial view) (The forelimb is in the normal position and the thoracic wall has been removed)

a - A. axillaris  
b - Vertebra cervicalis VII  
c - Os costale I  
e - M. supraspinatus  
f - M. subscapularis  
g - M. teres major  
v - V. axillaris

VI - Ramus ventralis of n. spinalis cervicalis VI  
VII - Ramus ventralis of n. spinalis cervicalis VII  
VIII - Ramus ventralis of n. spinalis cervicalis VIII  
I - Ramus ventralis of n. spinalis thoracalis I  
9 - N. thoracalis longus

Group A  
1 - N. suprascapularis  
2 - N. subscapularis (cranial branch)  
2' - N. subscapularis (caudal branch)  
7 - N. radialis

Group B  
8 - N. axillaris  
8' - N. axillaris (to M. teres major)  
10 - N. thoracodorsalis

Group C  
3 - N. pectoralis cranialis (cranial branch)  
3' - N. pectoralis cranialis (caudal branch)  
4' - N. musculocutaneus (joining the N. medianus)  
5 - N. medianus  
6 - N. ulnaris  
11 - N. thoracalis lateralis
Figure 8. The Plexus brachialis in caprine (medial view): intact

a - A. axillaris
VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis cervicalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
9 - N. thoracalis longus (derivation from the ventral rami of the seventh and eighth spinal cervical roots)
12 - N. phrenicus (derivation from the ventral ramus of the sixth spinal cervical root)

1 - N. suprascapularis
Group A 2 - N. subscapularis (cranial branch)

2' - N. subscapularis (caudal branch)
7 - N. radialis
Group B 8 - N. axillaris
8' - N. axillaris (to M. teres major)
10 - N. thoracodorsalis

3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
4' - N. musculocutaneus (joining the N. medianus)
4" - N. musculocutaneus (to Mm. coracobrachialis and biceps brachii)
Group C 4"" - N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii mediialis S. dorsalis)
5 - N. medianus
6 - N. ulnaris
11 - N. thoracalis lateralis
Figure 9. The Plexus brachialis in caprine (medial view): partially pulled apart

a - A. axillaris

VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis cervicalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
9 - N. thoracalis longus (derivation from the ventral rami of the seventh and eighth spinal cervical roots)
12 - N. phrenicus (derivation from the ventral ramus of the sixth spinal cervical root)

1 - N. suprascapularis
Group A 2 - N. subscapularis (cranial branch)

2' - N. subscapularis (caudal branch)
7 - N. radialis
8 - N. axillaris

Group B 8' - N. axillaris (to M. teres major)
10 - N. thoracodorsalis

3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
4" - N. musculocutaneus (to Mm. coracobrachialis and biceps brachii)
4"" - N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii medialis S. dorsalis)

5 - N. medianus
6 - N. ulnaris
11 - N. thoracalis lateralis
13 - N. musculocutaneus (branch joining the N. medianus)
Figure 10. The Plexus brachialis in caprine (the same plexus as shown in preceding Figure 9 with the cervical and thoracic roots reversed)

VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis cervicalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
12 - N. phrenicus (derivation from the ventral ramus of the sixth spinal cervical root)

1 - N. suprascapularis
2 - N. subscapularis (cranial branch)
2' - N. subscapularis (caudal branch)
3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
4'' - N. musculocutaneus (to Mm. coracobrachialis and biceps brachii)
4''' - N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii medialis S. dorsalis)

5 - N. medianus
6 - N. ulnaris
7 - N. radialis
8 - N. axillaris
8' - N. axillaris (to M. teres major)
10 - N. thoracodorsalis
11 - N. thoracalis lateralis
13 - N. musculocutaneus (branch joining the N. medianus)
Figure 11. The Plexus brachialis in caprine (lateral view): intact

a - A. axillaris

VI - Ramus ventralis of n. spinalis cervicalis VI

VII - Ramus ventralis of n. spinalis cervicalis VII

VIII - Ramus ventralis of n. spinalis cervicalis VIII

I - Ramus ventralis of n. spinalis thoracalis I

9 - N. thoracalis longus

Group A
1 - N. suprascapularis
2 - N. subscapularis (cranial branch)

2' - N. subscapularis (caudal branch)

7 - N. radialis

Group B
8 - N. axillaris
8' - N. axillaris (to M. teres major)
10 - Nn. thoracodorsales

3 - N. pectoralis cranialis (cranial branch)

3' - N. pectoralis cranialis (caudal branch)

4' - N. musculocutaneus (joining the N. medianus)

4" - N. musculocutaneus (to Mm. coracobrachialis and biceps brachii)

Group C

4"" - N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii medialis S. dorsalis)

5 - N. medianus

6 - N. ulnaris

11 - N. thoracalis lateralis
Figure 12. The Plexus brachialis in caprine (lateral view): partially pulled apart

a - A. axillaris
VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis cervicalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
9 - N. thoracalis longus

Group A
1 - N. suprascapularis
2 - N. subscapularis (cranial branch)

2' - N. subscapularis (caudal branch)
7 - N. radialis
8 - N. axillaris

Group B
8' - N. axillaris (to M. teres major)
10 - Nn. thoracodorsales

3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
4" - N. musculocutaneus (to Mm. coracobrachialis and biceps brachii)

Group C
4" - N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii medialis S. dorsalis)
5 - N. medianus
6 - N. ulnaris
11 - N. thoracalis lateralis
Figure 13. The Plexus brachialis in caprine (the same plexus as shown in preceding Figure 13 with the cervical and thoracic roots reversed)

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VI</td>
<td>Ramus ventralis of n. spinalis cervicalis VI</td>
</tr>
<tr>
<td>VII</td>
<td>Ramus ventralis of n. spinalis cervicalis VII</td>
</tr>
<tr>
<td>VIII</td>
<td>Ramus ventralis of n. spinalis cervicalis VIII</td>
</tr>
<tr>
<td>I</td>
<td>Ramus ventralis of n. spinalis thoracalis I</td>
</tr>
<tr>
<td>9</td>
<td>N. thoracalis longus</td>
</tr>
<tr>
<td>1</td>
<td>N. suprascapularis</td>
</tr>
<tr>
<td>2</td>
<td>N. subscapularis (cranial branch)</td>
</tr>
<tr>
<td>2'</td>
<td>N. subscapularis (caudal branch)</td>
</tr>
<tr>
<td>3</td>
<td>N. pectoralis cranialis (cranial branch)</td>
</tr>
<tr>
<td>3'</td>
<td>N. pectoralis cranialis (caudal branch)</td>
</tr>
<tr>
<td>4''</td>
<td>N. musculocutaneus (to Mm. coracobrachialis and biceps brachii)</td>
</tr>
<tr>
<td>4'''</td>
<td>N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii medialis S. dorsalis)</td>
</tr>
<tr>
<td>5</td>
<td>N. medianus</td>
</tr>
<tr>
<td>6</td>
<td>N. ulnaris</td>
</tr>
<tr>
<td>7</td>
<td>N. radialis</td>
</tr>
<tr>
<td>8</td>
<td>N. axillaris</td>
</tr>
<tr>
<td>8'</td>
<td>N. axillaris (to M. teres major)</td>
</tr>
<tr>
<td>10</td>
<td>Nn. thoracodorsales</td>
</tr>
<tr>
<td>11</td>
<td>N. thoracalis lateralis</td>
</tr>
</tbody>
</table>
Figure 14. The Plexus brachialis in Ovine (lateral view, schematic)

a - A. axillaris  
c - Os costale I  
u - M. scalenus dorsalis  
u" - M. scalenus ventralis  
v - V. axillaris  
w - M. serratus ventralis cervicis  
w'- M. serratus ventralis thoracis  
9 - N. thoracalis longus

Group A
- N. suprascapularis  
- N. subscapularis (cranial branch)

Group B
- N. subscapularis (caudal branch)  
- N. radialis  
- N. axillaris  
- N. thoracodorsalis

Group C
- Nn. pectorales craniales  
- N. musculocutaneus  
- N. medianus  
- N. ulnaris  
- N. thoracalis lateralis
Figure 15. The Plexus brachialis in Ovine (lateral view)

- t - Ligamentum nuchae
- u - M. scalenus dorsalis
- u" - M. scalenus ventralis
- w - M. serratus ventralis cervicis
- w' - M. serratus ventralis thoracis
- 9 - N. thoracalis longus
- 16 - Plexus brachialis

Figure 16. The Plexus brachialis Ovine (lateral view, deep dissection)

- t - Ligamentum nuchae
- VI - Ramus ventralis of n. spinalis cervicalis VI
- VII - Ramus ventralis of n. spinalis cervicalis VII
- VIII - Ramus ventralis of n. spinalis cervicalis VIII
- I - Ramus ventralis of n. spinalis thoracalis I
- 9 - N. thoracalis longus
- 15 - Medulla spinalis
- 16 - Plexus brachialis
Figure 17. The Plexus brachialis in Ovine (medial view, schematic)

a - A. axillaris
b - M. supraspinatus
c - M. subscapularis
d - M. teres major
e - M. latissimus dorsi
f - M. pectoralis ascendens
g - M. tensor fasciae antebrachii
h - M. triceps brachii (caput longum)
i - M. triceps brachii (caput mediale)
j - M. coracobrachialis
k - M. biceps brachii
l - V. axillaris

VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis cervicalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
9 - N. thoracalis longus

1 - N. suprascapularis
2 - N. subscapularis (cranial branch)

2' - N. subscapularis (caudal branch)
7 - N. radialis
7' - N. radialis (part which lies in the musculo-spiral groove)
7'' - N. radialis (to M. triceps brachii, proximal part of caput longum)

Group B
7''' - N. radialis (to M. triceps brachii, distal part of caput longum)
8 - N. axillaris
8' - N. axillaris (to M. teres major)
10 - N. thoracodorsalis

3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
4 - N. musculocutaneus
4' - N. musculocutaneus (joining N. medianus)
4'' - N. musculocutaneus (to Mm. coracobrachialis and biceps brachii)

Group C
4''' - N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii medialis s. dorsalis)
5 - N. medianus
6 - N. ulnaris
6' - N. ulnaris (muscular branch)
6'' - N. ulnaris (cutaneus antebrachii caudalis s. proprius)
11 - N. thoracalis lateralis
Figure 18. The Plexus brachialis in Ovine (medial view) (The forelimb is in normal position and thoracic wall has been removed)

- a - A. axillaris
- b - vertebra cervicalis VII
- e - M. supraspinatus
- f - M. subscapularis
- g - M. teres Major
- h - M. latissimus dorsi
- i - M. pectoralis ascendens
- v - V. axillaris
- VI - Ramus ventralis of n. spinalis cervicalis VI
- VII - Ramus ventralis of n. spinalis cervicalis VII
- VIII - Ramus ventralis of n. spinalis cervicalis VIII
- I - Ramus ventralis of n. spinalis thoracalis I
- 9 - N. thoracalis longus

Group A

1 - N. suprascapularis
2 - N. subscapularis (cranial branch)
2' - N. subscapularis (caudal branch)
7 - N. radialis

Group B

8 - N. axillaris
8' - N. axillaris (to M. teres major)
10 - N. thoracodorsalis

Group C

3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
4' - N. musculocutaneus (joining the N. medianus)
5 - N. medianus
6 - N. ulnaris
11 - N. thoracalis lateralis
Figure 19. The Plexus brachialis in Ovine (viewed from a caudo-medial angle)

a - A. axillaris
b - Os costale I
c - M. subscapularis
d - M. teres major
e - M. latissimus dorsi

Group A
- N. suprascapularis
- N. subscapularis (cranial branch)

Group B
- N. subscapularis (caudal branch)
- N. radialis
- N. axillaris
- N. thoracodorsalis

Group C
- N. medianus
- N. ulnaris
- N. thoracalis lateralis
Figure 20. The Plexus brachialis in Ovine (medial view): intact

a - A. axillaris
a' - A. subscapularis
a" - A. brachialis
VI - Ramus ventralis of n. spinalis cervicale VI
VII - Ramus ventralis of n. spinalis cervicale VII
VIII - Ramus ventralis of n. spinalis cervicale VIII
I - Ramus ventralis of n. spinalis thoracalis I
9 - N. thoracalis longus
12 - N. phrenicus (origin from the ventral ramus of the sixth spinal cervical root)
14 - N. pectoralis cranialis (to M. pectoralis cleidospinalis)

Group A
1 - N. suprascapularis
2 - N. subscapularis (cranial branch)
2' - Nn. subscapulares (caudal branches)
7 - N. radialis

Group B
8 - N. axillaris
8' - N. axillaris (to M. teres major)
10 - N. thoracodorsalis

3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
4-5-6 - Nn. musculocutaneus, medianus and ulnaris
4' - N. musculocutaneus (joining the N. medianus)

Group C
4'' - Nn. musculocutanei (to Mm. coracobrachialis and biceps brachii)
4''' - N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii medialis S. dorsalis)
5 - N. medianus
6 - N. ulnaris
11 - Nn. thoracales laterales
Figure 21. The Plexus brachialis in Ovine (medial view); partially pulled apart

- a - A. axillaris
- a' - A. subscapularis
- a'' - A. brachialis
- VI - Ramus ventralis of n. spinalis cervicalis VI
- VII - Ramus ventralis of n. spinalis cervicalis VII
- V - Ramus ventralis of n. spinalis thoracalis I
- 9 - N. thoracalis longus
- 12 - N. phrenicus (origin from the ventral ramus of the sixth spinal cervical root)
- 14 - N. pectoralis cranialis (to M. pectoralis cleidascapularis)

Group A
- 1 - N. suprascapularis
- 2 - N. subscapularis (cranial branch)
- 2' - Nn. subscapulares (caudal branches)
- 3 - N. axillaris (to M. teres major)
- 7 - N. thoracodorsalis

Group B
- 8 - N. axillaris (to M. teres major)
- 8' - N. axillaris (to M. teres major)
- 10 - N. thoracodorsalis

Group C
- 3 - N. pectoralis cranialis (cranial branch)
- 3' - N. pectoralis cranialis (caudal branch)
- 4 - N. musculocutaneus
- 4' - N. musculocutaneus (joining N. medianus)
- 4'' - N. musculocutaneus (to M. brachialis and biceps brachii)
- 5 - N. medianus
- 6 - N. ulnaris
- 11 - N. thoracalis lateralis
Figure 22. The Plexus brachialis in Ovine. The same plexus as shown in previous Figure 21 with the cervical and thoracic roots reversed

VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis cervicalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
9 - N. thoracalis longus (branch from ventral ramus of eight cervical root not shown)
12 - N. phrenicus (origin from the ventral ramus of the sixth spinal cervical root)
1 - N. suprascapularis
2 - N. subscapularis (cranial branch)
2' - N. subscapularis (caudal branch)
3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
4'' - N. musculocutaneus (to Mm. coracobrachialis and biceps brachii)
4''' - N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii mediales s. dorsalis)
5 - N. medianus
6 - N. ulnaris
7 - N. radialis
8 - N. axillaris
8' - N. axillaris (to M. teres major)
10 - N. thoracodorsalis
11 - N. thoracalis lateralis
13 - Branch of the N. musculocutaneus joining the N. medianus
Figure 23. The Plexus brachialis in Ovine (lateral view):
intact

a - A. axillaris
a' - A. subscapularis
a" - A. brachialis
VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis cervicalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
9 - N. thoracalis longus
12 - N. phrenicus (origin from the ventral ramus of
the sixth spinal cervical root)

Group A
1 - N. suprascapularis
2 - N. subscapularis (cranial branch)
2' - N. subscapularis (caudal branch)
7 - N. radialis

Group B
8 - N. axillaris
8' - N. axillaris (to M. teres major)
10 - N. thoracodorsalis

3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
4' - N. musculocutaneus (joining the N. medianus)

Group C
4" - Nn. musculocutanei (to Mm. coracobrachialis
and biceps brachii)
4"" - N. musculocutaneus (to M. brachialis and
continues as the N. cutaneus antebrachii
medialis s. dorsalis)
5 - N. medianus
6 - N. ulnaris
11 - Nn. thoracales laterales
Figure 24. The Plexus brachialis in Ovine (lateral view): partially pulled apart

VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis cervicalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
9 - N. thoracalis longus
12 - N. phrenicus (origin from the ventral ramus of the sixth spinal cervical root)

Group A
1 - N. suprascapularis
2 - N. subscapularis (cranial branch)

2' - N. subscapularis (caudal branch)
7 - N. radialis

Group B
8 - N. axillaris
8' - N. axillaris (to M. teres major)
10 - N. thoracodorsalis

3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
4" - Nn. musculocutanei (to Mm. coracobrachialis and biceps brachii)

Group C
4"" - N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii medialis s. dorsalis)
5 - N. medianus
6 - N. ulnaris
11 - N. thoracalis lateralis
Figure 25. The Plexus brachialis in Ovine. The same plexus as shown in the preceding Figure 24 with the cervical and thoracic roots reversed.

VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis cervicalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
9 - N. thoracalis longus
12 - N. phrenicus (origin from the ventral ramus of the sixth spinal cervical root)

1 - N. suprascapularis
2 - N. subscapularis (cranial branch)
2' - N. subscapularis (caudal branch)
3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
4" - N. musculocutaneus (to Mm. coracobrachialis and biceps brachii)
4'" - N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii medialis s. dorsalis)

5 - N. medianus
6 - N. ulnaris
7 - N. radialis
8 - N. axillaris
8' - N. axillaris (to M. teres major)
10 - N. thoracodorsalis
11 - N. thoracalis lateralis
Figure 26. The Plexus brachialis in Bovine (lateral view, schematic)

- A. axillaris
- Os costale I
- M. scalenus medius
- M. scalenus ventralis
- V. axillaris
- M. serratus ventralis cervicis
- M. serratus ventralis thoracis
- N. thoracalis longus
- N. suprascapularis
- Nn. subscapulares
- Nn. pectorales craniales
- N. musculocutaneus
- N. medianus
- N. ulnaris
- N. radialis
- N. axillaris
- N. thoracodorsalis
- N. thoracalis lateralis
Figure 27. The Plexus brachialis in Bovine (lateral view)

- $t$ - Ligamentum nuchae
- $u'$ - M. scalenus medius
- $u''$ - M. scalenus ventralis
- $w$ - M. serratus ventralis cervicis
- $w'$ - M. serratus ventralis thoracis
- $y$ - Articulatio humeri
- $11$ - N. thoracalis lateralis
- $16$ - Plexus brachialis

Figure 28. The Plexus brachialis in Bovine (lateral view, deep dissection)

- $t$ - Ligamentum nuchae
- $x$ - Os scapula (cut end)
- $y$ - Articulatio humeri
- $VI$ - Ramus ventralis of n. spinalis cervicalis VI
- $VII$ - Ramus ventralis of n. spinalis cervicalis VII
- $VIII$ - Ramus ventralis of n. spinalis cervicalis VIII
- $I$ - Ramus ventralis of n. spinalis thoracalis I
- $II$ - Ramus ventralis of n. spinalis thoracalis II
- $9$ - N. thoracalis longus
- $11$ - N. thoracalis lateralis
- $12$ - N. phrenicus
- $15$ - Medulla spinalis
- $16$ - Plexus brachialis
Figure 29. The Plexus brachialis in Bovine (medial view, schematic)

- a - A. axillaris
- e - M. supraspinatus
- f - M. subscapularis
- g - M. teres major
- h - M. latissimus dorsi
- i - M. pectoralis ascendens
- o - M. tensor fasciae antebrachii
- p - M. triceps brachii (caput longum)
- q - M. triceps brachii (caput mediale)
- r - M. coracobrachialis
- s - M. biceps brachii
- v - V. axillaris
- VI - Ramus ventralis of n. spinalis cervicalis VI
- VII - Ramus ventralis of n. spinalis cervicalis VII
- VIII - Ramus ventralis of n. spinalis cervicalis VIII
- I - Ramus ventralis of n. spinalis thoracalis I
- II - Ramus ventralis of n. spinalis thoracalis II
- 1 - N. suprascapularis
- 2 - N. subscapularis (cranial branch)
- 2' - N. subscapularis (caudal branch)
- 3 - N. pectoralis cranialis (cranial branch)
- 3' - N. pectoralis cranialis (caudal branch)
- 4 - N. musculocutaneous
- 4'' - N. musculocutaneous (to Mm. coracobrachialis and biceps brachii)
- 4''' - N. musculocutaneous (to M. brachialis and continues as the N. cutaneus antebrachii s. dorsalis)
- 5 - N. medianus
- 6 - N. ulnaris
- 6' - N. ulnaris (muscular branch)
- 6'' - N. ulnaris (cutaneus antebrachii caudalis s. proprius)
- 7 - N. radialis
- 7' - N. radialis (part which lies in the musculo-spiral groove)
- 7'' - N. radialis (to M. triceps brachii, proximal part of caput longum)
- 7''' - N. radialis (to M. triceps brachii (distal part of caput longum) and M. tensor fasciae antebrachii)
- 8 - N. axillaris
- 8' - N. axillaris (to M. teres major)
- 9 - N. thoracalis longus
- 10 - N. thoracodorsalis
- 11 - N. thoracalis lateralis
Figure 30. The Plexus brachialis in Bovine (medial view) (The forelimb is in the normal position and the thoracic wall has been removed)

- A. axillaris
- Os costale I (caput)
- Os costale I
- M. subscapularis
- M. teres major
- M. latissimus dorsi
- M. pectoralis ascendens
- M. pectoralis descendens
- Ln. axillaris
- V. axillaris (at confluence of Vv. subscapularis and thoracodorsalis)

- VI - Ramus ventralis of n. spinalis cervicalis VI
- VII - Ramus ventralis of n. spinalis cervicalis VII
- VIII - Ramus ventralis of n. spinalis cervicalis VIII
- I - Ramus ventralis of n. spinalis thoracalis I
- II - Ramus ventralis of n. spinalis thoracalis II
- 9 - N. thoracalis longus
- 1 - N. suprascapularis
- 2' - N. subscapularis (caudal branch)
- 3 - Nn. pectorales craniales (cranial branches)
- 3' - Nn. pectorales caudales (caudal branches)
- 4' - N. musculocutaneus (joining the N. medianus)
- 5 - N. medianus
- 6 - N. ulnaris
- 7 - N. radialis
- 8 - N. axillaris
- 8' - N. axillaris (to M. teres major)
- 8'' - N. axillaris (to M. subscapularis)
- 10 - N. thoracodorsalis
- 11 - N. thoracalis lateralis
- 11' - N. thoracalis lateralis (to M. pectoralis ascendens)
Figure 31. The Plexus brachialis in Bovine (medial view): intact

a - A. axillaris
a" - A. brachialis
VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis cervicalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
II - Ramus ventralis of n. spinalis thoracalis II
9 - N. thoracalis longus
12 - N. phrenicus (origin from the ventral ramus of the sixth spinal cervical root)
1 - N. suprascapularis
2 - N. subscapularis (cranial branch)
2' - N. subscapularis (caudal branch)
3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
4' - N. musculocutaneus (joining the N. medianus)
4" - N. musculocutaneus (to Mm. coracobrachialis and biceps brachii)
4"" - N. musculocutaneus (to M. brachialis and continues as N. cutaneus antebrachii medialis s. dorsalis)
5 - N. medianus
6 - N. ulnaris
6' - N. ulnaris (cutaneous branches)
7 - N. radialis
8 - N. axillaris
8' - Nn. axillares (to M. teres major)
10 - N. thoracodorsalis
11 - N. thoracalis lateralis
Figure 32. The Plexus brachialis in Bovine (medial view): partially pulled apart

VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis cervicalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
II - Ramus ventralis of n. spinalis thoracalis II
9 - N. thoracalis longus
12 - N. phrenicus (origin from the ventral ramus of the sixth spinal cervical root)
1 - N. suprascapularis
2 - N. subscapularis (cranial branch)
2' - N. subscapularis (caudal branch)
3 - N. pectoralis cranialis (cranial branch)
3' - Nn. pectorales craniales (caudal branches)
4" - N. musculocutaneus (to Mm. coracobrachialis and biceps brachii)
4''' - N. pectoralis cranialis (to M. brachialis and continues as the N. cutaneus antebrachii medialis s. dorsalis)
5 - N. medianus
6 - N. ulnaris
6' - Nn. ulnares (cutaneous branches)
7 - N. radialis
8 - N. axillaris
8' - Nn. axillares (to M. teres major)
10 - N. thoracodorsalis
11 - N. thoracalis lateralis
Figure 33. The Plexus brachialis in Bovine. The same plexus as shown in the preceding Figure 32 with the cervical and thoracic roots reversed

VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis cervicalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
II - Ramus ventralis of n. spinalis thoracalis II
9 - N. thoracalis longus
12 - N. phrenicus (origin from the ventral ramus of the sixth spinal cervical root)
1 - N. suprascapularis
2 - N. subscapularis (cranial branch)
2' - N. subscapularis (caudal branch)
3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
4'' - N. musculocutaneus (to Mm. coracobrachialis and biceps brachii)
4''' - N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii medialis s. dorsalis)
5 - N. medianus
6 - N. ulnaris
6' - N. ulnaris (cutaneus branch)
7 - N. radialis
8 - N. axillaris
8' - Nn. axillares (to M. teres major)
10 - N. thoracodorsalis
11 - N. thoracalis lateralis
Figure 34. The Plexus brachialis in Bovine (lateral view):

intact

a - A. axillaris
a" - A. brachialis
VI - Ramus ventralis of n. spinales cervicalis VI
VII - Ramus ventralis of n. spinales cervicalis VII
VIII - Ramus ventralis of n. spinales cervicalis VIII
I - Ramus ventralis of n. spinales thoracalis I
II - Ramus ventralis of n. spinales thoracalis II
9 - N. thoracalis longus
12 - N. phrenicus (origin from the ventral ramus of
the sixth spinal cervical root)
1 - N. suprascapularis
2 - N. subscapularis (cranial branch)
2' - N. subscapularis (caudal branch)
3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
4' - N. musculocutaneus (joining the N. medianus)
4" - N. musculocutaneus (to the Mm. coracobrachialis
and biceps brachii)
5 - N. medianus
6 - N. ulnaris
6' - Nn. ulnares (cutaneus branches)
7 - N. radialis
8 - N. axillaris
8' - Nn. axillares (to M. teres major)
10 - N. thoracodorsalis
11 - N. thoracalis lateralis
Figure 35. The Plexus brachialis in Bovine (lateral view): partially pulled apart

VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis cervicalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
II - Ramus ventralis of n. spinalis thoracalis II
9 - N. thoracalis longus
12 - N. phrenicus (origin from the ventral ramus of the sixth spinal cervical root)
1 - N. suprascapularis
2 - N. subscapularis (cranial branch)
2' - N. subscapularis (caudal branch)
3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
4" - N. musculocutaneus (to Mm. coracobrachialis and biceps brachii)
4" - N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii medialis s. dorsalis)
5 - N. medianus
6 - N. ulnaris
6' - N. ulnaris (cutaneous branch)
7 - N. radialis
8 - N. axillaris
8' - Nn. axillares (to M. teres major)
10 - N. thoracodorsalis
11 - N. thoracalis lateralis
Figure 36. The Plexus brachialis in Bovine. The same plexus as shown in the preceding Figure 35 with the cervical and thoracic roots reversed

VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis cervicalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
II - Ramus ventralis of n. spinalis thoracalis II
9 - N. thoracalis longus
12 - N. phrenicus (origin from the ventral ramus of the sixth spinal cervical root)
1 - N. suprascapularis
2 - N. subscapularis (cranial branch)
2' - N. subscapularis (caudal branch)
3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
4'' - N. musculocutaneus (to Mm. coracobrachialis and biceps brachii)
4''' - N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii medialis s. dorsalis)
5 - N. medianus
6 - N. ulnaris
6' - N. ulnaris (cutaneus branch)
7 - N. radialis
8 - N. axillaris
8' - Nn. axillares (to M. teres major)
10 - N. thoracodorsalis
11 - N. thoracalis lateralis
Figure 37. The Plexus brachialis in Swine (lateral view, schematic)

- a - A. axillaris
- c - Os costale I
- u' - M. scalenus medius
- u" - M. scalenus ventralis
- v - V. axillaris
- w - M. serratus ventralis cervicis
- w' - M. serratus ventralis thoracis
- 9 - N. thoracalis longus

- N. suprascapularis
- Nn. subscapulares
- Nn. pectorales craniales
- N. musculocutaneus
- N. medianus
- N. ulnaris
- N. radialis
- N. axillaris
- N. thoracodorsalis
- N. thoracalis lateralis
Figure 38. The Plexus brachialis

- u' - M. scalenus medius
- u" - M. scalenus ventralis
- w - M. serratus ventralis cervicis
- w' - M. serratus ventralis thoracis
- y - caput humeri
- 9 - N. thoracalis longus
- 16 - Plexus brachialis

Figure 39. The Plexus brachialis in Swine (lateral view, deep dissection)

- c - Os costale II
- y - Caput humeri
- V - Ramus ventralis of n. spinalis cervicalis V
- VI - Ramus ventralis of n. spinalis cervicalis VI
- VII - Ramus ventralis of n. spinalis cervicalis VII
- VIII - Ramus ventralis of n. spinalis cervicalis VIII
- I - Ramus ventralis of n. spinalis thoracalis I
- 9 - N. thoracalis longus (origin removed)
- 15 - Medulla spinalis
- 16 - Plexus brachialis
Figure 40. The Plexus brachialis in Swine (medial view, schematic)

a - A. axillaris
e - M. supraspinatus
f - M. subscapularis
g - M. teres major
h - M. latissimus dorsi
i - M. pectoralis ascendens
j - M. pectoralis cleidocapularis
o - M. tensor fasciae antebrachii
p - M. triceps brachii (caput longum)
q - M. triceps brachii (caput mediale)
r - M. coracobrachialis
s - M. biceps brachii
v - V. axillaris
V - Ramus ventralis of n. spinalis cervicalis V
VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis cervicalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
1 - N. suprascapularis
2 - N. subscapularis (cranial branch)
2' - N. subscapularis (caudal branch)
3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
3'' - N. pectoralis cranialis (to M. pectoralis cleidocapularis)
4 - N. musculocutaneus
4'' - N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii medialis s. dorsalis)
5 - N. medianus
6 - N. ulnaris
6' - N. ulnaris (muscular branch)
6'' - N. ulnaris (cutaneus antebrachii caudalis s. proprius)
7 - N. radialis
7' - N. radialis (part which lies in the musculo-spiral groove)
7'' - N. radialis (to M. triceps brachii, proximal part of caput longum)
7''' - N. radialis (to M. tensor fasciae antebrachii)
8 - N. axillaris
8' - N. axillaris (to M. teres major)
9 - N. thoracalis longus
10 - N. thoracodorsalis
11 - N. thoracalis lateralis
11' - N. thoracalis lateralis (pectoral branches)
Figure 4.1. The Plexus brachialis in Swine (medial view) (The forelimb is in the normal position and the thoracic wall has been removed)

a - A. axillaris
b - vertebra cervicallis VII
e - M. supraspinatus
f - M. subscapularis
g - M. teres major
h - M. latissimus dorsi
i - M. pectoralis ascendens
j - M. pectoralis cleidocapularis
l - M. pectoralis descendens
v - V. axillaris
V - Ramus ventralis of n. spinalis cervicallis V
VI - Ramus ventralis of n. spinalis cervicallis VI
VII - Ramus ventralis of n. spinalis cervicallis VII
VIII - Ramus ventralis of n. spinalis cervicallis VIII
l - Ramus ventralis of n. spinalis thoracallis I
9 - N. thoracallis longus
1 - N. supraspinatus
2 - N. subscapularis (cranial branch)
2' - N. subscapularis (caudal branch)
3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
4' - N. musculocutaneus (joining the N. medianus)
5 - N. medianus
6 - N. ulnaris
7 - N. radialis
8 - N. axillaris
8' - N. axillaris (to M. teres major)
10 - N. thoracodorsalis
11 - N. thoracallis lateralis
11' - N. thoracallis lateralis (to M. pectoralis ascendens)
Figure 42. The Plexus brachialis in Swine (medial view):

intact

a - A. axillaris
a" - A. brachialis
V - Ramus ventralis of n. spinalis cervicallis V
VI - Ramus ventralis of n. spinalis cervicallis VI
VII - Ramus ventralis of n. spinalis cervicallis VII
VIII - Ramus ventralis of n. spinalis cervicallis VIII
I - Ramus ventralis of n. spinalis thoracalis I
9 - N. thoracalis longus
12 - N. phrenicus
1 - N. suprascapularis
2 - N. subscapularis (cranial branch)
2' - Nn. subscapulares (caudal branches)
3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
4' - N. musculocutaneus (joining the N. medianus)
4" - N. musculocutaneus (to Mm. coracobrachialis and biceps brachii)
4"" - N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii medialis s. dorsalis)
5 - N. medianus
6 - N. ulnaris
6' - Nn. ulnares (cutaneus branches)
7 - N. radialis
8 - N. axillaris
8' - N. axillaris (to M. teres major)
10 - N. thoracodorsalis
11 - N. thoracalis lateralis (one of several branches)
Figure 43. The Plexus brachialis in Swine (medial view): partially pulled apart

V - Ramus ventralis of n. spinalis cervicalis V
VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis cervicalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
9 - N. thoracalis longus (origin from the ventral ramus of the seventh cervical root)
12 - N. phrenicus
1 - N. suprascapularis
2 - N. subscapularis (cranial branch)
2' - N. subscapularis (caudal branch)
3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
4 - N. musculocutaneus
4'' - N. musculocutaneus (to Mm. coracobrachialis and biceps brachii)
4''' - N. musculocutaneus (to M. brachialis and continues as N. cutaneus antebrachii medialis s. dorsalis)
5 - N. medianus
6 - N. ulnaris
6' - Nn. ulnares (cutaneous branches)
7 - N. radialis
8 - N. axillaris
8' - N. axillaris (to M. teres major)
10 - N. thoracodorsalis
11 - N. thoracalis lateralis
Figure 44. The Plexus brachialis in Swine (lateral view)

a'" - A. brachialis
V - Ramus ventralis of n. spinalis cervicalis V
VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis cervicalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
9 - N. thoracalis longus
12 - N. phrenicus
1 - N. suprascapularis
2 - N. subscapularis (cranial branch)
2' - N. subscapularis (caudal branch)
3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
4" - N. musculocutaneus (to Mm. coracobrachialis and biceps brachii)
4.1" - N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii medialis s. dorsalis)
5 - N. medianus
6 - N. ulnaris
6' - N. ulnaris (cutaneous branch)
7 - N. radialis
8 - N. axillaris
8' - N. axillaris (to M. teres major)
10 - N. thoracodorsalis
11 - N. thoracalis lateralis (one of several branches)
Figure 45. The Plexus brachialis in Swine (lateral view): partially pulled apart

V - Ramus ventralis of n. spinalis cervicalis V
VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis cervicalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
9 - N. thoracalis longus
12 - N. phrenicus
1 - N. suprascapularis
2 - N. subscapularis (cranial branch)
2' - N. subscapularis (caudal branch)
3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
4" - N. musculocutaneus (to Mm. coracobrachialis and biceps brachii)
4''' - N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii medialis s. dorsalis)
5 - N. medianus
6 - N. ulnaris
6' - N. ulnaris (cutaneus branch)
7 - N. radialis
8 - N. axillaris
8' - N. axillaris (to M. teres major)
10 - N. thoracodorsalis
11 - N. thoracalis lateralis (one of several branches)
13 - Branch of the N. musculocutaneus joining the N. medianus
Figure 46. The Plexus brachialis in Equine (lateral view, schematic)

- **a** - A. axillaris
- **c** - Os costale I
- **u** - M. scalenus dorsalis
- **u'** - M. scalenus medius
- **u''** - M. scalenus ventralis
- **v** - V. axillaris
- **w** - M. serratus ventralis cervicis
- **w'** - M. serratus ventralis thoracis
- **9** - N. thoracalis longus

- N. suprascapularis
- Nn. subscapulares
- Nn. pectorales craniales
- N. musculocutaneus
- N. medianus
- N. ulnaris
- N. radialis
- N. N. axillaris
- N. thoracodorsalis
- N. thoracalis lateralis
Figure 47. The Plexus brachialis in Equine (lateral view)

- t - Ligamentum nuchae
- u - M. scalenus dorsalis
- u' - M. scalenus medius
- u" - M. scalenus ventralis
- w - M. serratus ventralis cervicis
- w' - M. serratus ventralis thoracis
- y - Caput humeri
- 9 - N. thoracalis longus
- 10 - N. thoracodorsalis
- 12 - N. phrenicus
- 16 - Plexus brachialis

Figure 48. The Plexus brachialis in Equine (lateral view, dissection)

- t - Ligamentum nuchae
- y - Caput humeri
- VI - Ramus ventralis of n. spinalis cervicalis VI
- VII - Ramus ventralis of n. spinalis cervicalis VII
- VIII - Ramus ventralis of n. spinalis cervicalis VIII
- I - Ramus ventralis of n. spinalis thoracalis I
- II - Ramus ventralis of n. spinalis thoracalis II
- 10 - N. thoracodorsalis
- 15 - Medulla spinalis
- 16 - Plexus brachialis
Figure 49. The Plexus brachialis in Equine (medial view, schematic)

- a - A. axillaris
- e - M. supraspinatus
- f - M. subscapularis
- g - M. teres major
- h - M. latissimus dorsi
- i - M. pectoralis ascendens
- j - M. pectoralis clavicularis
- o - M. tensor fasciae antebrachii
- r - M. coracobrachialis
- s - M. biceps brachii
- v - V. axillaris

VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis cervicalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
II - Ramus ventralis of n. spinalis thoracalis II
1 - N. suprascapularis
2 - N. subscapularis (cranial branch)
2' - N. subscapularis (caudal branch)
3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
3'' - N. pectoralis cranialis (to M. pectoralis clavicularis)
4 - N. musculocutaneus
4'' - N. musculocutaneus (to Mm. coracobrachialis and biceps brachii)
4''' - N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii medialis s. dorsalis)
5 - N. medianus
6 - N. ulnaris
6' - N. ulnaris (muscular branch)
6'' - N. ulnaris (cutaneous antebrachii caudalis s. proprius)
7 - N. radialis
7' - N. radialis (part which lies in the musculo-vascular groove)
7'' - N. radialis (to M. triceps brachii, proximal part of caput longum)
7''' - N. radialis (to M. triceps brachii (distal part of caput longum) and M. tensor fasciae antebrachii)
8 - N. axillaris
8' - N. axillaris (to M. teres major)
9 - N. thoracalis longus
10 - N. thoracodorsalis
11 - N. thoracalis lateralis
11' - N. thoracalis lateralis (pectoral branches)
Figure 50. The Plexus brachialis in Equine (medial view) (The forelimb is in the normal position and the thoracic wall has been removed)

a - A. axillaris
b - Vertebra cervicalis VII
c - Os costale I
e - M. supraspinatus
f - M. subscapularis
g - M. teres major
h - M. latissimus dorsi
i - M. pectoralis ascendens
j - M. pectoralis cleidomastoideus
k - M. pectoralis transversus
l - M. pectoralis descendens
m - V. axillaris
VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis cervicalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
II - Ramus ventralis of n. spinalis thoracalis II
9 - N. thoracalis longus
2 - Nn. subscapulares
3 - N. pectoralis cranialis (cranial branch)
3' - N. Pectoralis cranialis (caudal branch)
3'' - N. pectoralis cranialis (to M. pectoralis cleidomastoideus)
5 - N. medianus
6 - N. ulnaris
7 - N. radialis
8 - N. axillaris
8' - N. axillaris (to M. teres major)
10 - N. thoracodorsalis
11 - N. thoracalis lateralis
11' - N. thoracalis lateralis (to M. pectoralis ascendens)
Figure 51. The Plexus brachialis in Equine (medial view):
intact

\begin{itemize}
\item a - A. axillaris
\item a' - A. subscapularis
\item a'' - A. brachialis
\item a''' - A. thoracodorsalis
\item v - V. axillaris
\item VI - Ramus ventralis of n. spinalis cervicalis VI
\item VII - Ramus ventralis of n. spinalis cervicalis VII
\item VIII - Ramus ventralis of n. spinalis cervicalis VIII
\item I - Ramus ventralis of n. spinalis thoracalis I
\item II - Ramus ventralis of n. spinalis thoracalis II
\item 9 - N. thoracalis longus
\item 1 - N. suprascapularis
\item 2 - N. subscapularis (cranial branch)
\item 2' - N. subscapularis (caudal branch)
\item 3 - N. pectoralis cranialis (cranial branch)
\item 3' - N. pectoralis cranialis (caudal branch)
\item 3'' - N. pectoralis cranialis (to M. pectoralis
     cleidospinosus)
\item 4 - N. musculocutaneus
\item 4' - Nn. musculocutanei (to Mm. coracobrahialis
     and biceps brachii)
\item 4'' - N. musculocutaneus (to M. brachialis and
     continues as the N. cutaneus antebrachii
     medialis s. dorsalis)
\item 5 - N. medianus
\item 6 - N. ulnaris
\item 6' - N. ulnaris (cutaneous branch)
\item 7 - N. radialis
\item 8 - N. axillaris
\item 8' - Nn. axillares
\item 10 - N. thoracodorsalis
\item 11 - Nn. thoracales laterales
\item 11' - Nn. thoracales laterales (to M. pectoralis
     ascendens)
\end{itemize}
Figure 52. The Plexus brachialis in Equine (medial view): partially pulled apart

a - A. axillaris
\[a^m\] - A. brachialis
VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis thoracalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
II - Ramus ventralis of n. spinalis thoracalis II
9 - N. thoracalis longus
1 - N. suprascapularis
2 - N. subscapularis (cranial branch)
2' - N. subscapularis (caudal branch)
3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis cranialis (caudal branch)
3'' - N. pectoralis cranialis (to M. pectoralis cleidomastoideus)
4'' - Nn. musculocutanei (to Mm. coracobrachialis and biceps brachii)
4''' - N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii medialis s. dorsalis)
5 - N. medianus
6 - N. ulnaris
6' - N. ulnaris (cutaneous branch)
7 - N. radialis
8 - N. axillaris
8' - Nn. axillares (to M. teres major)
10 - N. thoracodorsalis
11 - N. thoracalis lateralis
11' - N. thoracalis lateralis (to M. pectoralis ascendens)
Figure 53. The Plexus brachialis in Equine (lateral view): intact

- A. axillaris
- A. subscapularis
- A. brachialis
- Ramus ventralis of n. spinalis cervicalis VI
- Ramus ventralis of n. spinalis cervicalis VII
- Ramus ventralis of n. spinalis cervicalis VIII
- Ramus ventralis of n. spinalis thoracalis I
- Ramus ventralis of n. spinalis thoracalis II
- N. thoracalis longus
- N. suprascapularis
- Nn. subscapulares
- N. pectoralis cranialis (cranial branch)
- N. pectoralis cranialis (caudal branch)
- Nn. pectorales craniales (to M. pectoralis cleidospinatalis)
- N. musculocutaneus (to M. coracobrachialis and biceps brachii)
- N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii medialis s. dorsalis)
- N. medianus
- N. ulnaris
- N. ulnaris (cutaneous branch)
- N. radialis
- N. axillaris
- Nn. axillares (to M. teres major)
- N. thoracodorsalis
- N. thoracalis lateralis
Figure 54. The Plexus brachialis in Equine (lateral view): partially pulled apart

VI - Ramus ventralis of n. spinalis cervicalis VI
VII - Ramus ventralis of n. spinalis cervicalis VII
VIII - Ramus ventralis of n. spinalis cervicalis VIII
I - Ramus ventralis of n. spinalis thoracalis I
II - Ramus ventralis of n. spinalis thoracalis II
9 - N. thoracalis longus
1 - N. suprascapularis
2 - Nn. subscapulares
3 - N. pectoralis cranialis (cranial branch)
3' - N. pectoralis craniales (caudal branch)
3" - Nn. pectorales craniales (to M. pectoralis cleidocapularis)
4" - N. musculocutaneus (to Mm. coracobrachialis and biceps brachii)
4"" - N. musculocutaneus (to M. brachialis and continues as the N. cutaneus antebrachii medialis s. dorsalis)
5 - N. medianus
6 - N. ulnaris
6' - N. ulnaris (cutaneous branch)
7 - N. radialis
8 - N. axillaris
8' - Nn. axillares (to M. teres major)
10 - N. thoracodorsalis
11 - N. thoracalis lateralis