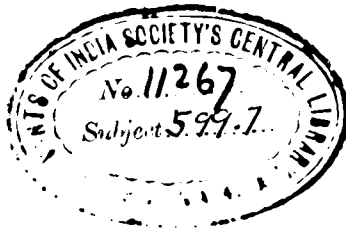


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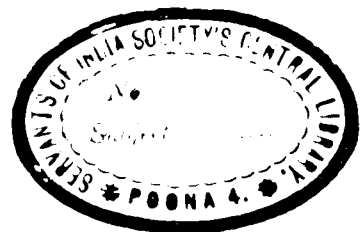
The Imperial Council of Agricultural Research, India

**Investigations on the Course and Distribution of the Nerves
supplying Levator anguli scapuli and Rhomboideus
muscles and the formation of the Phrenic Nerve
in the Ox, with Observations on certain
Anatomical Deviations.**

BY

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CONTENTS.

Section I.

	PAGE.
Introduction	1
Subject No. 1	2
" 2	3
" 3	5
" 4	6
" 5	8
" 6	10
" 7	13
" 8	14
" 9	15
" 10	17
" 11	19
" 12	20
" 13 (Adult bullock)	23
Discussion	25
Summary	29
References	30

Section II.

1. Undue development of the nodule on the coracoid process of the scapula	32
2. An independent nerve to coraco-humeralis	32
3. Nerve to levator anguli scapuli and rhomboideus	32
4. Anastomosis of the pre-humeral artery with a branch of one of the largest muscular branches of the brachial artery	33
5. Variation in the number of branches of the deep humeral artery	33
6. Peculiar origin of the ulnar artery	34
7. Variation in the number of branches of the large metacarpal artery	34
8. Branch from the small metacarpal artery helping the formation of the supra-carpal or the superficial palmar arch	35
9. Want of the usual collateral branches of the large metacarpal artery	35
10. An additional branch on the digital artery	35
11. Variation in the origin of the circumflex iliac artery	36
12. Variation in the origin of some of the intra-thoracic branches of the axillary artery	36
13. Three of the intra-thoracic branches of the left axillary artery wanting	37
14. Ursachus	37
15. Posterior radial artery and its terminal branches	40
16(a) Internal and external thoracic arteries	41
16(b) Inferior or descending branches of the inferior cervical artery	42
17. The formation of the supra and sub-carpal arches and the disposition of their branches	43
18. Presence of ursachus in a two-year old bull-calf	45
19. Bronchial and œsophageal vessels of the aorta	45
20. Variation in the origin of the middle sacral artery of the ox	46

Section II—*contd.*

	PAGE.
21. Variation in the distribution of one of the branches of the internal iliac artery in the ox	46
22. Variation in the origin of the prepubic artery of the ox	47
23. Further variation in the origin of the artery of the cord (ox)	47
24. Additional blood vessel to semitendinosus in the ox	48
25. Absence of one of the extra thoracic branches of the axillary artery—ox	48
26. Deviation in the disposition of the internal and external Jugulars—ox	48
27. Additional nerve to superficial flexor of the fore limb—ox	49
28. Nerve to brachialis anticus muscle—ox	49
29. Nerve to coraco—radialis—ox	49
30. Nerve to pectineus—ox	49
31. Nerve to obturator internus muscle—ox	49
32. Nerve to tensor vaginae femoris (Tensor fasciae latae)—ox	50
33. Articular branch (nerve) to stifle—ox	50
34. Peroneal cutaneous wanting in two subjects—ox	50
35. Additional nerve to superficial flexor of the fore limb—ox	50
36. Nerves forming the lumbo—sacral plexus in the horse and ox	50
37. Deviation in the disposition of the terminal branches of the median and the ulnar nerves—ox	51
38. Additional nerve to pectineus muscle—ox	52
39. Additional nerve to obturator internus muscle—ox	52
40. Nerve to brachialis anticus—ox	53
41. Nerve to obturator internus (ox)—A further peculiarity	53
42. Deviation in the disposition of the first four sacral nerves and their branches—ox	54
43(1) Yet another variation in the origin of the artery of the cord	55
43(2) Two unusual branches of the deep femoral (Profunda) artery	56
44(1) Independent branch (nerve) to coraco—brachialis	56
44(2) Additional nerve to latissimus dorsi	57
44(3 & 4) Nerve to sterno-thyro-hyoideus—ox	57
45. Variation in the origin and distribution of the inferior cervical arteries	57
46. Unusual behaviour of the anterior and posterior common digital arteries in a hind limb—ox	58
47(1) Further peculiarity in the disposition of the bronchial and œsophageal arteries—ox	58
47(2) Deviation in the origin of the intercostal arteries	60

SECTION I

**Investigations on the Course and Distribution of the Nerves
supplying Levator anguli scapuli and Rhomboideus muscles
and the formation of the Phrenic nerve in the Ox.**

ERRATA.

Page 28, line 24 from bottom, for 'Rhombodeus' read '*Rhomboideus*'.

Page 38, line 3, for 'centum' read '*centrum*'.

Page 42, third line from bottom, for 'Royal Dick (Veterinary) College' read 'Royal
(*Dick*) Veterinary College'.

Page 53, line 15, for 'author with' read 'author *met* with'.

I.—INVESTIGATIONS ON THE COURSE AND DISTRIBUTION
OF THE NERVES SUPPLYING LEVATOR ANGULI
SCAPULI AND RHOMBOIDEUS MUSCLES
AND THE FORMATION OF THE
PHRENIC NERVE IN THE OX.

BY

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INTRODUCTION.

None of the available books on veterinary anatomy deals with the details of the nerve distribution to the muscles under reference and for some time it was imagined that there may be no important differences in the nerve supply to these muscles in the ox. Since 1931, the author began to find something different to what it is in the horse and to what he found in the previous dissections and for want of time an investigation into this had to be postponed. A series of subjects (ruminants) have been dissected this year (1935-36), with a view to get clear and definite ideas of the nerve distribution to these muscles. Though it is felt that the number of subjects on which this investigation has been conducted is small, it is found that the subjects of this type that have been examined so far present large differences in their details although they agree on broad points. It is interesting to note that no two subjects of this type examined so far agree in their details and further that no two sides of the same subject agree in the disposition of these nerves.

As the nerves, in the subjects dissected, show very frequent anastomosis and some of the nerves even go long distances crossing over a number of other nerves, it would be very difficult for one to follow them properly in a photograph. In order to facilitate one's study of the details of these nerves in the dissected parts (in the absence of such dissected parts), free-hand sketches of these dissections have been made, magnifying the nerves, giving more interspace between the nerves and showing out the anastomosis and the crossings more prominently. The dissected parts are also photographed for comparison. As each note is to be studied with the help of the text-figure appended to it, no separate key either to the text-figures or to the plates is made.

The following abbreviations are used in the Monograph :—

- L. A. S. : Levator anguli scapuli.
- C. Rhomb. : Cervical rhomboideus.
- D. Rhomb. : Dorsal rhomboideus.
- S. Mag. : Serratus magnus.

In all the dissections that will be referred to in the following pages, the superficial portions of the L. A. S. have been gradually removed and the deep portion of the muscle is thus dug into to show the nerves that were deeply placed in it.

The rhomboideus muscle has been reflected upwards in every case to show its deep face, the passage of the nerves backwards and the entrance of their branches into it.

SUBJECT NO. 1.

Left : (Plate I, fig. 1 and Pl. II.)

The branch from the 5th pierced the upper border of the Scalenus and proceeded upwards deep in the L. A. S., distributing branches to it. One of its branches, a little after its origin, was found entering the splenius. The branch from the 5th, after running up for about two inches, divided into two branches—(A) anterior and (B) posterior. The anterior emerged from under the L. A. S., ran on the surface of the splenius and entered the deep face of C. Rhomb. at its most anterior part. The branch B continued its course upwards placing itself deep in the L. A. S., distributing a number of twigs to this muscle. It then emerged from under the L. A. S., ran up for a short distance on the splenius, divided into branches on reaching the deep face of the middle part of C. Rhomb. and terminated in it.

The branch from the 6th, about half an inch after it emerged from under the scalenus, divided into two branches—(C) anterior and (D) posterior. Both these branches proceeded upwards placing themselves deep in the L. A. S. and distributing branches to it. The branch C emerging from under the L. A. S. reached the deep face of the most posterior part of the C. Rhomb. and proceeded backwards on it describing a curve and joined D. From the convexity of this arch there issued two branches which in their turn branched and were distributed to the posterior part of the C. Rhomb. The branch D of the 6th, after emerging from under the L. A. S. at its extreme upper part, reached the most anterior part of the deep face of D. Rhomb. and was joined there by the backward continuation of C. The common cord, thus formed by the union of C and D, then proceeded backwards in a flexuous manner and terminated at the most posterior part of D. Rhomb. A number of branches issued from the dorsal face of this common cord, entered the deep face of D. Rhomb. and terminated in it.

NOTE.—The branch from the 5th supplying the splenius is an unusual feature.

The branch F from the 7th detached a branch E at its origin and this branch E ran upwards in the L. A. S. and terminated in it. The branch F from the 7th then coursed backwards on the L. A. S.

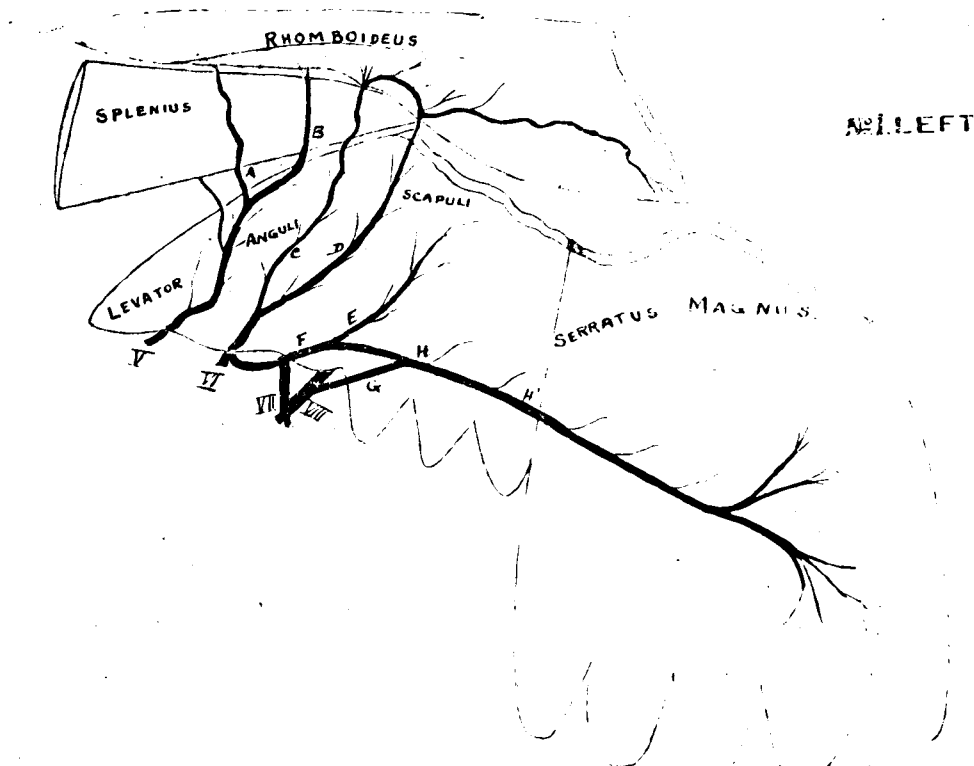
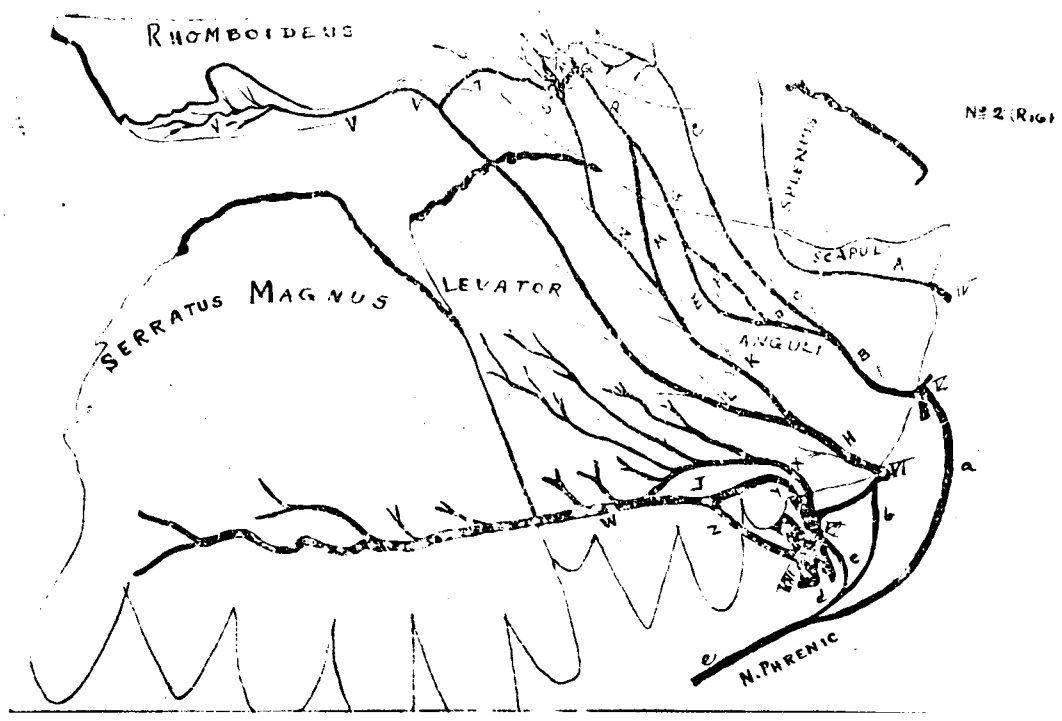
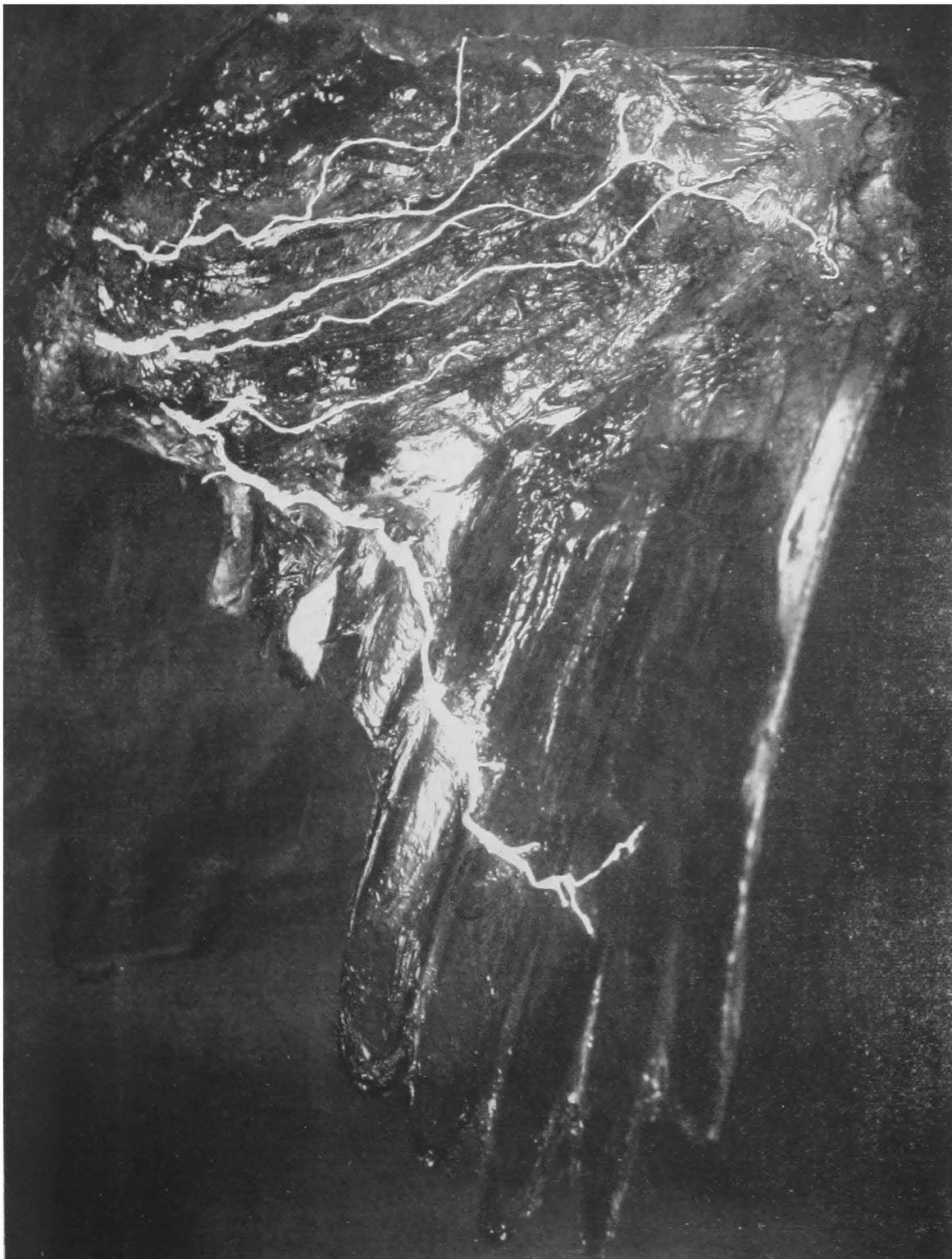
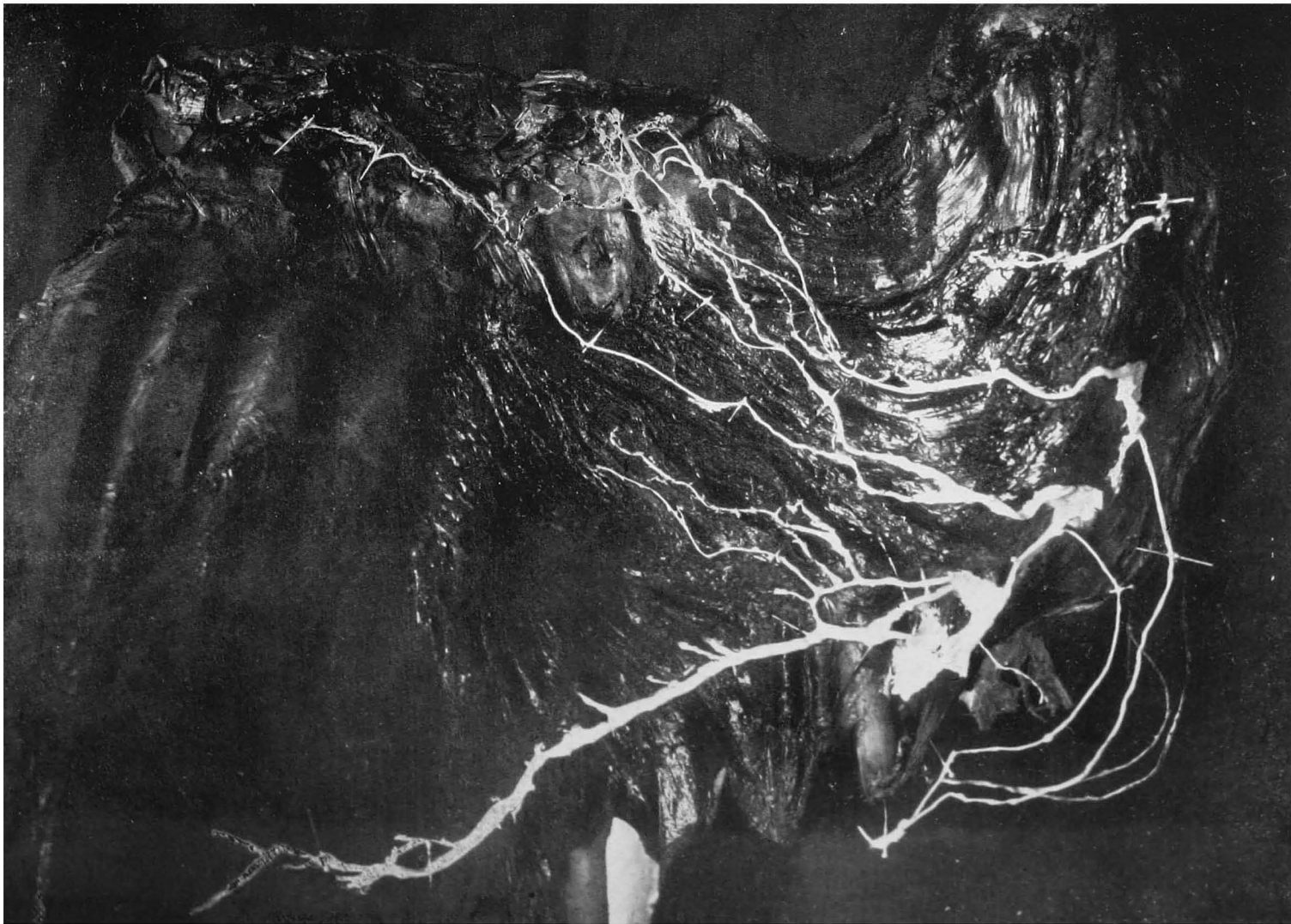


FIG. 1.





SUBJECT NO. I.—LEFT.



SUBJECT No. II.—RIGHT.

and joined a branch G from the 8th. The common nerve H thus formed was broad and as it proceeded backwards on the surface of the L. A. S. detached a number of branches from its dorsal face to this part of the L. A. S. and then reached the S. Mag.

SUMMARY.

The nerve supply to L. A. S. is from the 5th, 6th, 7th and 8th.

The nerve supply to Rhomboideus is from the 5th and 6th nerves.

SUBJECT NO. 2.

Right: (Plate I, fig. 2 and Pl. III.)

The branch A from the 4th ran up superficially on the anterior-most part of the L. A. S. for about two inches and then went up deep in the L. A. S. distributing branches to it. It then emerged from under the L. A. S. and the slender continuation of this placed itself on the splenius and terminated on the deep face of C. Rhomb. at its anterior-most part.

The branch B from the 5th, after running deep and distributing branches to the L. A. S. for about three inches, divided into two—C and D. The C continued its course upwards supplying the L. A. S., emerged from under it, ran on the splenius, gained the anterior part of the deep face of C. Rhomb. and ran backwards under it in a curved manner and joined P to form Q. This C gave off a number of branches to C. Rhomb., and one of its branches again joined the main nerve C before the latter joined P.

The branch D divided immediately after its origin into E and F. Both E and F after distributing some branches to L. A. S. re-united to form a common cord G, which was after a further course upwards joined by M of the 6th nerve. The nerve P resulting from the union of G and M, emerged from under the L. A. S., gained the deep face of C. Rhomb. and there was met by C of the 5th and the two together gave rise to a flat fasciculus Q from the dorsal face of which a thick branch came off and terminated in C. Rhomb.

The branch H from the 6th, after a short course upwards deep in the L. A. S., divided into two—K and L. The branch K running up and supplying L. A. S., divided into two branches—M and N. The branch M joined the branch G of the 5th to form P as already said; while the branch N, after supplying L. A. S., united with a short thick nerve R arising from Q and formed with it a broad flat fasciculus S. A number of branches started off from the dorsal face of this fasciculus to supply the posterior part of C. Rhomb. and these branches and those of Q formed communications among themselves before entering the Rhomb. The branch L of the 6th, proceeded upwards in the L. A. S., giving off a number of branches to this muscle, finally emerged from under this, gained the deep face of D. Rhomb. and was there joined by a branch T—the backward continuation from S. This final nerve V then proceeded backwards, ramified and was distributed to the rest of D. Rhomb.

Two branches X and Y were given off by the 7th. These two were found very close each other at their origin but X soon diverged from Y and took an upward and backward course forming a distinct curve. From the convexity of this curve there arose four branches all of which proceeding upwards terminated in the L. A. S. The branch Y joined the branch Z from the 8th and formed a broad nerve J. The branch X after detaching branches to L. A. S. continued backwards and joined this broad nerve J. The nerve W resulting from the union of X and J proceeded backwards on the L. A. S. supplying it and then reached the S. Mag.

Phrenic nerve.—A branch (*a*) from the 5th—the thickest root of this nerve placed itself on the deep face of the scalenus and entered the thorax; while the root from the 6th (*b*) and the 7th (*c*) united together to form a cord (*d*) on the outer surface of the scalenus, entered the thorax and joined the branch from the 5th (*a*) behind the level of the first rib and formed the phrenic nerve (*e*).

SUMMARY.

Rhomb. of this side was supplied by 4th, 5th and 6th.

L. A. S. of this side was supplied by 4th, 5th, 6th, 7th and 8th.

Phrenic nerve was formed by 5th, 6th and 7th.

Left: (Plate IV, fig. 1 and Pl. V.)

The branch A from the 4th behaved in a manner similar to that on the right side.

The branch B from the 5th proceeded upwards deep in the L. A. S. detaching branches to it and divided after a distance of about two inches into two branches—C and D—and both these C and D gave off branches to L. A. S. in their upward course. A communicating branch E coming off from D joined C. The branch C, after supplying L. A. S. emerged from underneath that muscle, ran up on the splenius and terminated on the anterior part of C. Rhomb. on its deep face. The branch D supplying L. A. S. emerged from under this muscle, gained the posterior part of C. Rhomb., gave off a branch here to this part of Rhomb., then proceeded backwards and joined a branch G of the 6th.

The branch F from the 6th about an inch after its origin proceeded upwards deep in the L. A. S. and divided into two branches—G and H. Both G and H ran up in the L. A. S. distributing branches to it. The branch H after a course of about two inches divided in its turn into two branches—K and L. Of these the branch K anastomosed with G and the branch L after a further course in the L. A. S., divided into two branches—M and N. These branches M and N detached twigs to L. A. S. and again united to form a single nerve Q, and Q joined the backward continuation of P to form T. The branch G after its union with K proceeded upwards in the L. A. S. supplying it, then emerged from under the L. A. S., reached the deep face of C. Rhomb. and was joined by the branch D of the 5th with which it formed a broad many-sided fasciculus P and then continued its course backwards in an arched

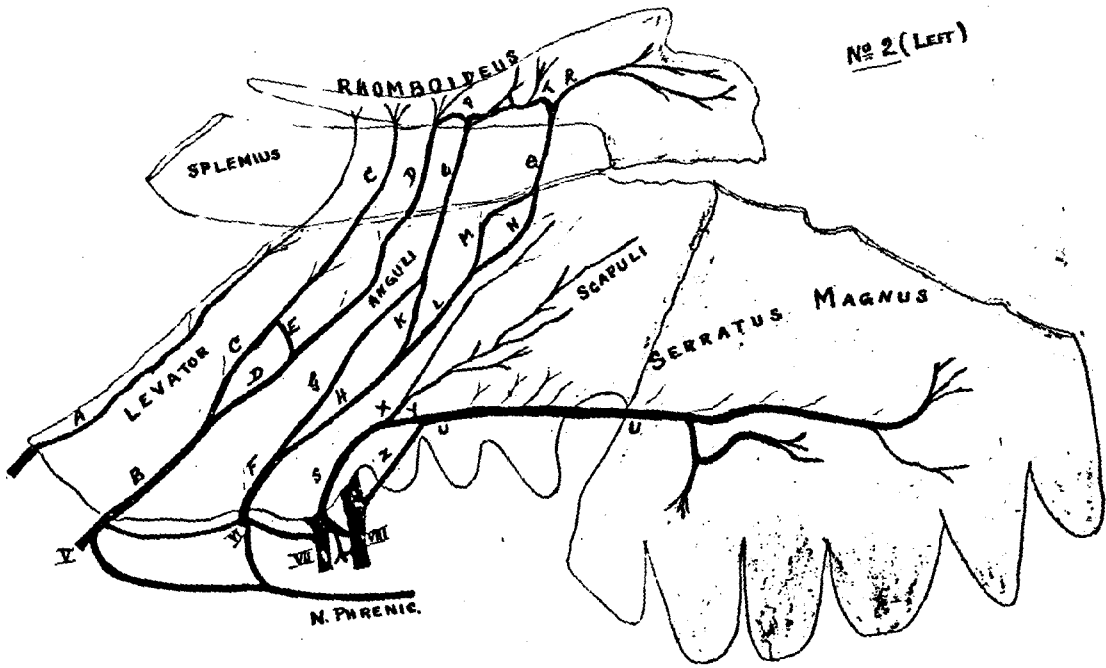
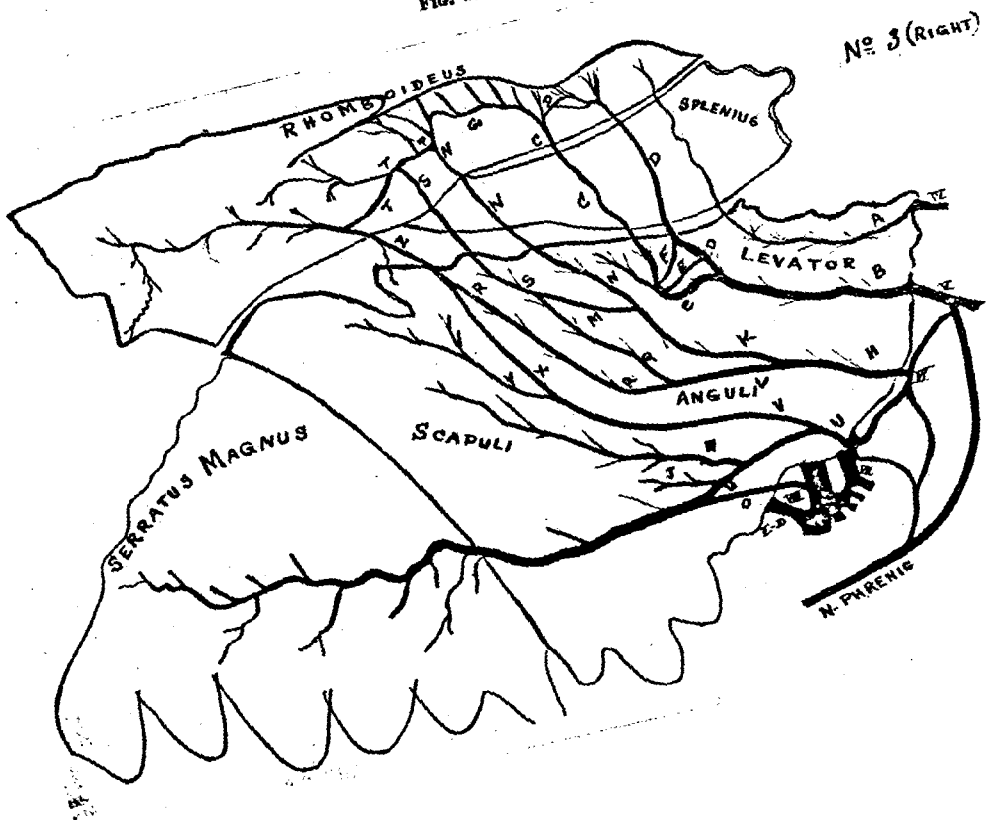
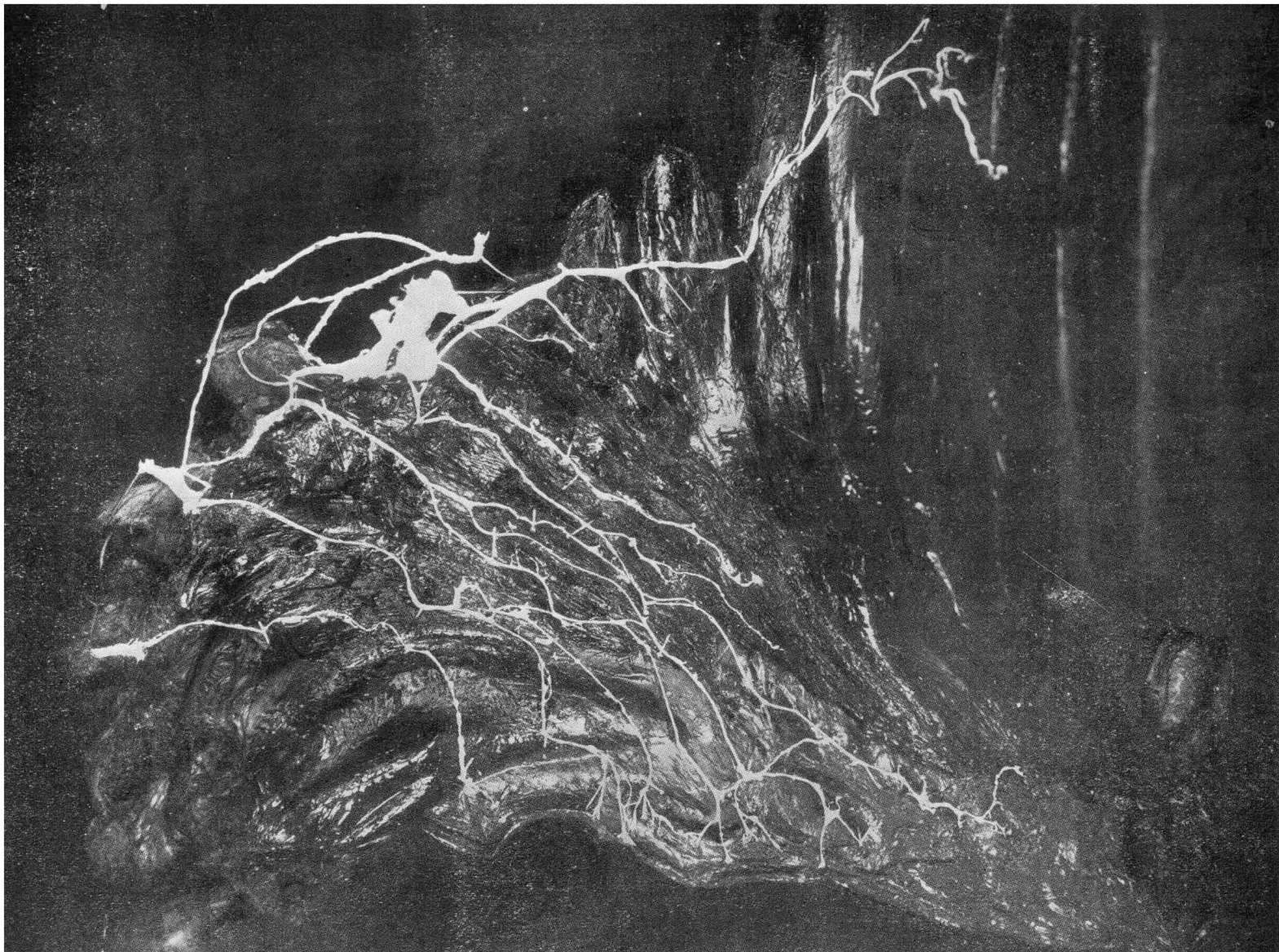


FIG. 1.





SUBJECT No. 3.—RIGHT.

manner and joined Q forming with it a broad triangular fasciculus—T. This nervous arch between P and T detached a number of branches from its dorsal face and these further ramified and entered the anterior portion of the deep face of D. Rhomb. A branch coming from P and a branch from the arch united and subsequently divided to distribute themselves to D. Rhomb. A thick nerve R continued its backward course from T on the deep face of D. Rhomb. and supplied the rest of the extent of this muscle.

The branch S from the 7th after running up in the L. A. S. for about an inch divided into X and Y of which X proceeded up in the L. A. S., ramified and terminated in it; while the Y joined a branch Z from the 8th, forming with it a broad nerve U, which proceeded backwards on the L. A. S. and detached branches to this part of the muscle mostly from its dorsal face. This then continued backwards to supply S. Mag.

The phrenic nerve of this side of this subject was found formed by the roots from the 5th and 6th only.

SUMMARY.

L. A. S. was supplied by 4th, 5th, 6th, 7th and 8th.

Rhomboideus was supplied by 4th, 5th and 6th.

Phrenic was formed by the roots from the 5th and 6th.

SUBJECT NO. 3.

Right: (Plate IV, fig. 2 and Pl. VI.)

Branch A from the 4th after supplying the L. A. S. terminated on the deep face of the anterior-most part of C. Rhomb. Its behaviour was found similar to that met with in subject No. 2.

Branch B from the 5th, after running deep in the L. A. S. supplying that muscle for about three inches, divided into two—C and D and both C and D detached branches to L. A. S. Branch C detached a communicating branch E which joined D and branch D gave off a communicating branch F which joined C. Branch D after giving F to C emerged from under the L. A. S., ran upwards on the splenius, gained the deep face of C. Rhomb. and then ran backwards with a curve. It detached here a number of branches from its dorsal face to C. Rhomb. and one of its branches united with the parent D before the latter joined the upward continuation of C. The branch C after detaching a connecting branch E to D and a long branch to L. A. S., reached the deep face of C. Rhomb. and joined the backward continuation of D as already said. The united nerve G proceeded further backwards on the deep face of C. Rhomb. and joined a branch N from the 6th. This nerve G detached from its dorsal face a number of branches to C. Rhomb.

Branch H from the 6th after running up deep in the L. A. S., divided into two—K and L. The branch K supplied L. A. S. and divided into two—M and N. The branch N further supplied L. A. S., emerged from under this muscle and joined the nerve G on the deep face of C. Rhomb. forming with it a flat fasciculus P. A number of branches were given off from the dorsal face of this P to C. Rhomb. The branch M joined Q of L and the resulting nerve S from this union, met the backward continuation of the nerve from the fasciculus P on the deep face of D. Rhomb. and united with it. The nerve T formed by the union of the nerve from P with S ran backwards and united in its turn with the nerve Z. The nerve T detached from its dorsal face some branches to D. Rhomb. The branch L also divided into two—Q and R. The branch Q as already stated united with M and formed S. The branch R after supplying L. A. S., joined a branch X from the 7th and the common nerve Z thus resulting from this union gained the deep face of D. Rhomb. and united with the backward continuation of T. The final nerve formed by the union of T and Z then ran back on the deep face of D. Rhomb. and distributed itself to it.

Branch U from the 7th after a short course, divided into three—V, W and J. Of these the branch V ran up deep in the L. A. S. supplying it and then divided into two—X and Y. The branch X joined R of the 6th as already said. The branch Y of this V as also the branches W and J, all spent themselves entirely in the L. A. S. The branch U after detaching these branches (V, W and J) ran back and was joined by a branch O from the 8th. The broad nerve resulting from the union of U and O ran backwards on the L. A. S. detaching branches to it from its dorsal face and finally reached S. Mag.

The phrenic nerve in this subject was formed by the roots from the 5th, 6th and 7th.

SUMMARY.

Rhomboideus was supplied from the 4th, 5th, 6th and 7th cervical nerves.
L. A. S. was supplied from the 4th, 5th, 6th, 7th and 8th.
Phrenic nerve was formed by roots from 5th, 6th and 7th.

SUBJECT NO. 4.

Right: (Plate VII, fig. 1 and Pl. VIII.)

The branch A from the 4th behaved in a manner similar to that in the previous subjects but differed from the same nerve on the left side of this subject in not having any communicating branch from the 5th.

Branch B from the 5th, after supplying L. A. S. for a short distance, divided into two—C and D. Branch D after supplying L. A. S. emerged from under it, ran on the splenius and just here it detached a branch E which in its turn divided into two—F and J—of which the branch F ran down to supply L. A. S., while the branch

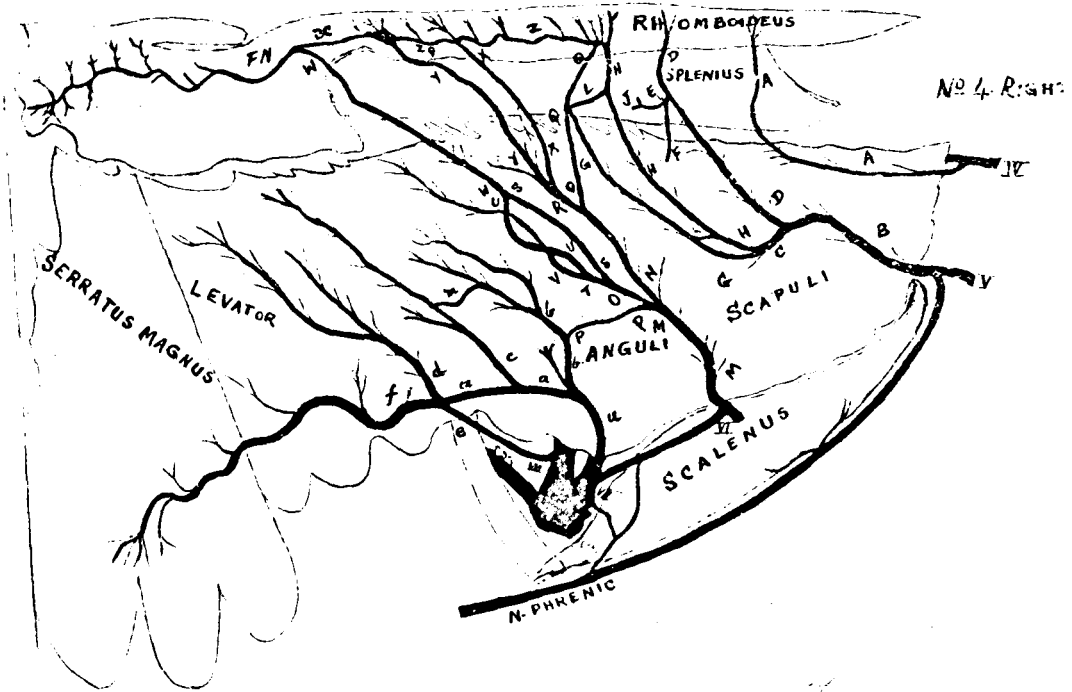


FIG. 1.

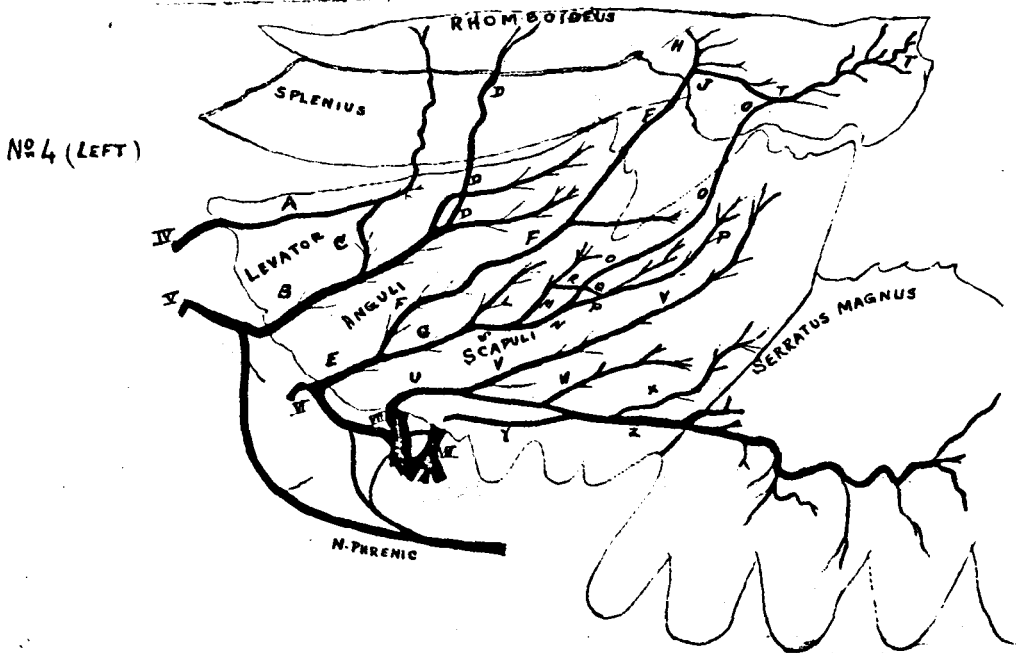


FIG. 2.

J terminated in the splenius. The branch D after detaching E terminated in C. Rhomb. The branch C divided into G and H and after a short course the branches G and H were connected by an anastomotic branch K. The branch H after supplying L. A. S. emerged from under it, detached a communicating branch L to Q of the 6th, gained the deep face of C. Rhomb., ran backwards in a curved manner and was joined by Q of the 6th. It detached a number of twigs from its dorsal face to C. Rhomb. The branch G after supplying L. A. S. joined Q of the 6th.

Branch M of the 6th running up deep in the L. A. S. divided into two—N and O—but before doing so it received a communicating branch P from (b) of the 7th nerve. The branch N after a further course and supply in the L. A. S. divided into two—R and Q. Branch Q, after it was joined by G and L, gained the deep face of C. Rhomb. and joined the backward continuation of H and a nerve Z continued from this union of H and Q backwards. The branch R in its turn divided into two—X and Y. Both X and Y after supplying L. A. S. reached the deep face of C. Rhomb. X joined the backward continuation Z from which union, there resulted a nerve ZQ which in its turn was joined by Y. A broad flat fasciculus was formed by ZQ and Y. This union of ZQ and Y was continued backwards by the nerve BC. The nerve Z and ZQ detached a number of branches from their dorsal face to C. Rhomb. The branch O of M divided into two—S and T. Branch T again divided into V and U. The branch V was first superficial to U and then got deep crossing under it and terminated in L. A. S. The branch U joined S and gave rise to a nerve W. This branch W after supplying L. A. S. reached the deep face of D. Rhomb. and joined the backward continuation BC. The nerve FN resulting from the union of BC and W ran backwards on the deep face of D. Rhomb. and distributed itself to it.

Branch (a) from the 7th ran back on the L. A. S. forming an arch and detached from the convexity of this arch branches (b) and (c) both of which terminated in the L. A. S. The branch (b) detached a communicating branch P to M of the 6th. One of the branches (m) of (b) communicated with a branch of (c). The branch (a) was then joined by a branch (e) from the 8th and just from the dorsal face of this union a long thick branch (d) was given off to the L. A. S. The union of (a) and (e) resulted in a thick broad nerve (f) and this proceeded backwards supplying a number of branches to L. A. S. and then reached S. Mag.

The phrenic nerve of this side was formed by the roots from the 5th, 6th and 7th cervical nerves.

SUMMARY.

Rhomboideus was supplied by the 4th, 5th, 6th and 7th.

L. A. S. was supplied by the 4th, 5th, 6th, 7th and 8th.

Phrenic was formed by roots from 5th, 6th and 7th.

NOTE.—A branch from the 5th is again seen in this subject supplying the splenius.

Left: (Plate VII, fig. 2 and Pl. IX.)

The branch A from the 4th behaved similar to that on the right side, but after a course of about two inches from its origin it was joined by a branch C from the 5th.

The branch B from the 5th placed itself deep in the L. A. S. and after a short upward course it detached a communicating branch C to the 4th and then after a further course in the muscle divided into three branches—two slender and one thick. The two slender ones ran variable distances in the L. A. S. supplying and terminating in it. The thick branch ran upwards and terminated in C. Rhomb.

The branch E from the 6th ran up deep in the L. A. S. and divided into two—F and G. The branch F after distributing itself to the L. A. S., emerged from under the muscle, gained the deep face of D. Rhomb. and divided into two—H and J. The branch H spent itself in D. Rhomb. here, while the branch J continued backwards and joined the nerve O from G. The branch G of the 6th in its upward course detached a number of short branches to L. A. S. and divided into L and S of which L terminated in L. A. S., while the branch S further divided into M and N. The branch N again divided into P and O. The branch M after sending a communicating branch R to O terminated in L. A. S. Branches P and O were further connected by an anastomotic branch Q. The branch P terminated in L. A. S., while the branch O, after furnishing branches to this muscle emerged from under it, gained the deep face of D. Rhomb. and joined J of F. The united nerve T thus formed by J and O crossed backwards on the deep face of D Rhomb., detaching along its course a number of branches to this portion of the muscle.

The branch U from the 7th ran backwards in a curved manner on the L. A. S. giving off: (1) a long slender branch V which proceeded a long distance up the L. A. S., (2) a short thick branch W and (3) another slender branch X—all three of which distributed themselves to the L. A. S. The branch U was then joined by a branch Y from the 8th to form a broad nerve Z. This Z then continued its course backwards detaching a number of twigs to L. A. S. and then reached S. Mag.

Phrenic nerve of this side was formed by roots from the 5th, 6th and 7th.

SUMMARY.

Rhomboideus was supplied by 4th, 5th and 6th cervical nerves.

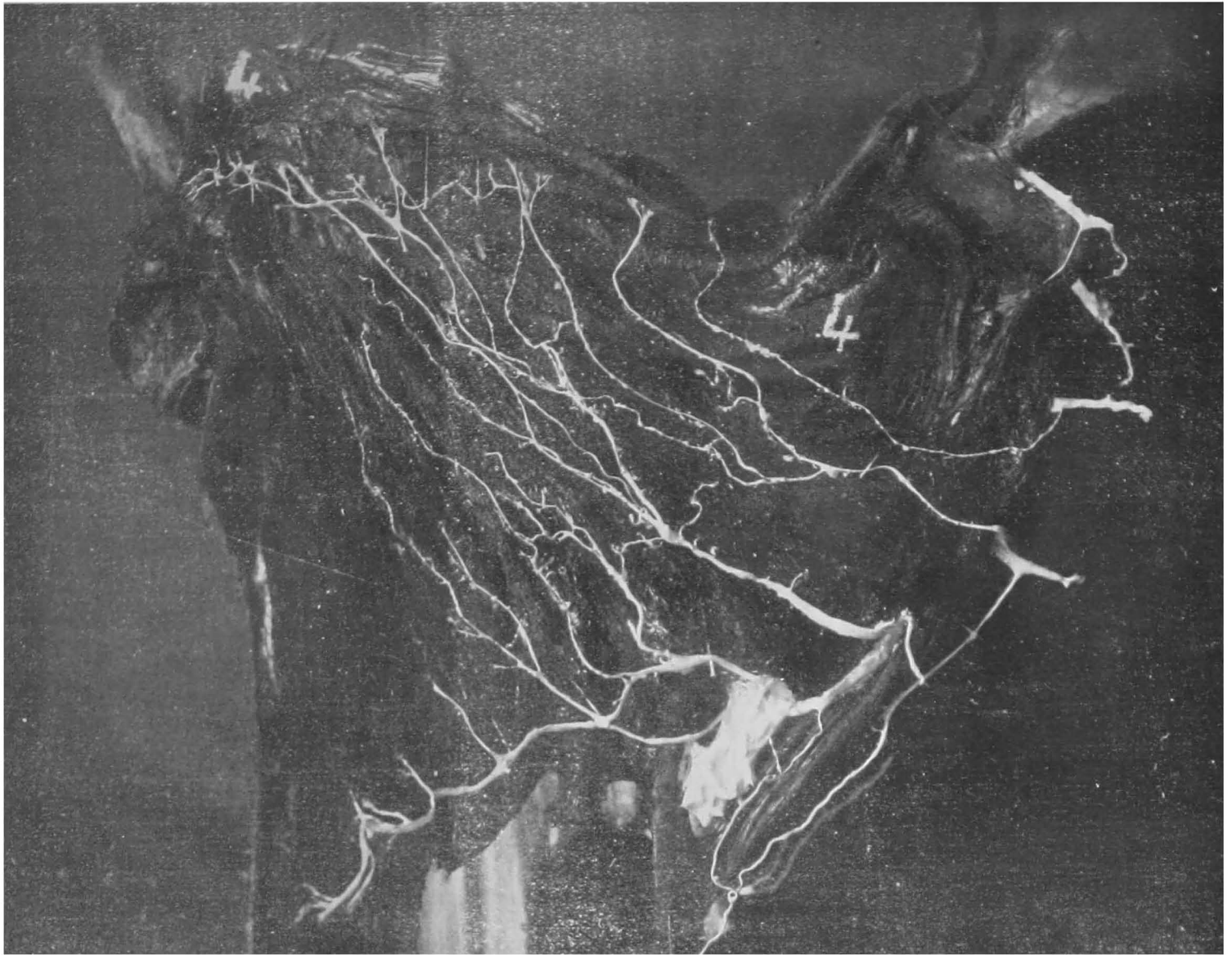
L. A. S. was supplied by 4th, 5th, 6th, 7th and 8th.

Phrenic was formed by the roots from 5th, 6th and 7th.

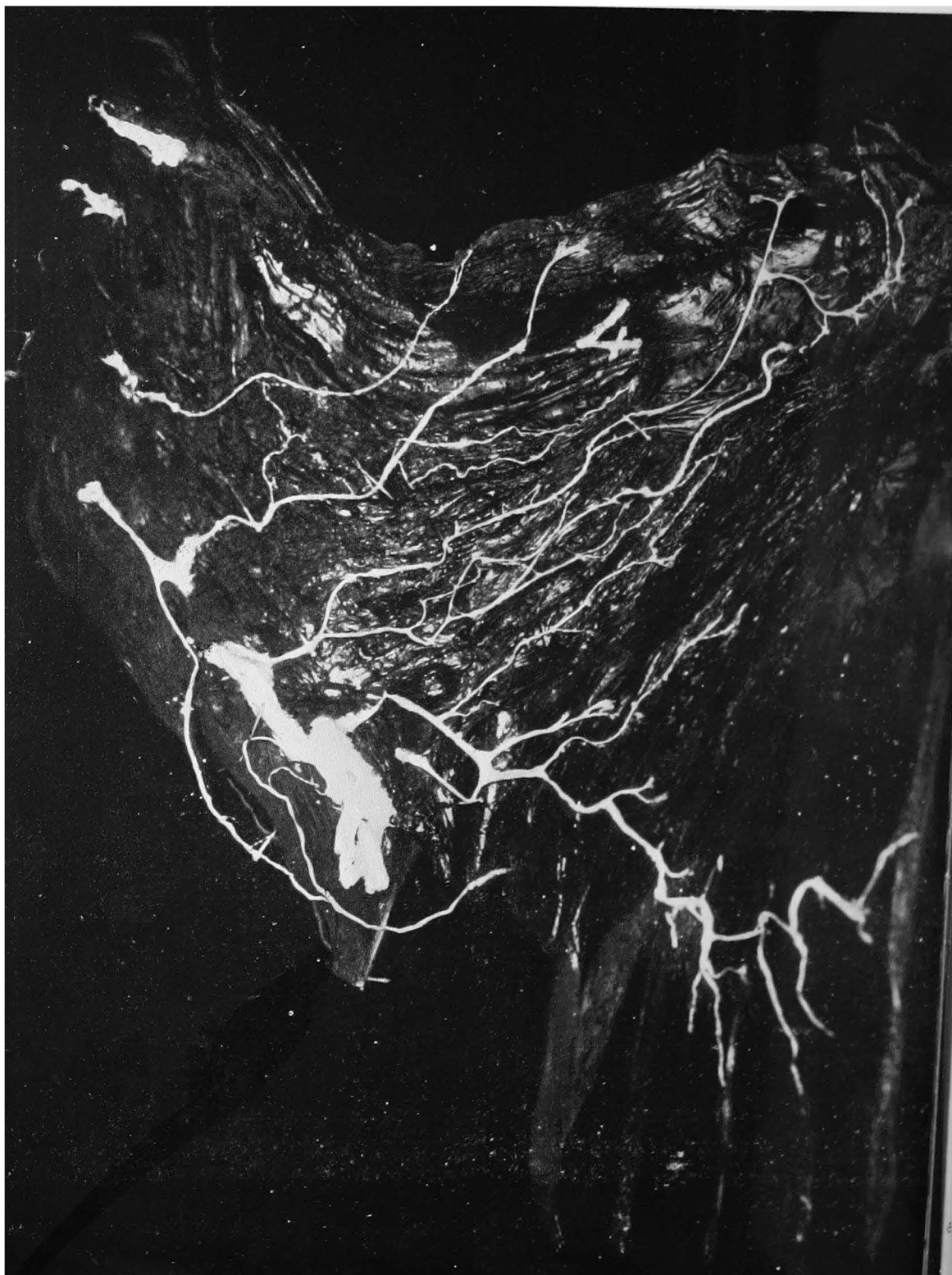
SUBJECT NO. 5.

Right: (Plate X, fig. 1 and Pl. XI.)

Branch A from the 5th divided after a course in the L. A. S. into three branches—B, C and D of which C and D united together after a short course.



SUBJECT No. 4.—RIGHT.



SUBJECT NO. 4.—LEFT.

Nº 5. (RIGHT).

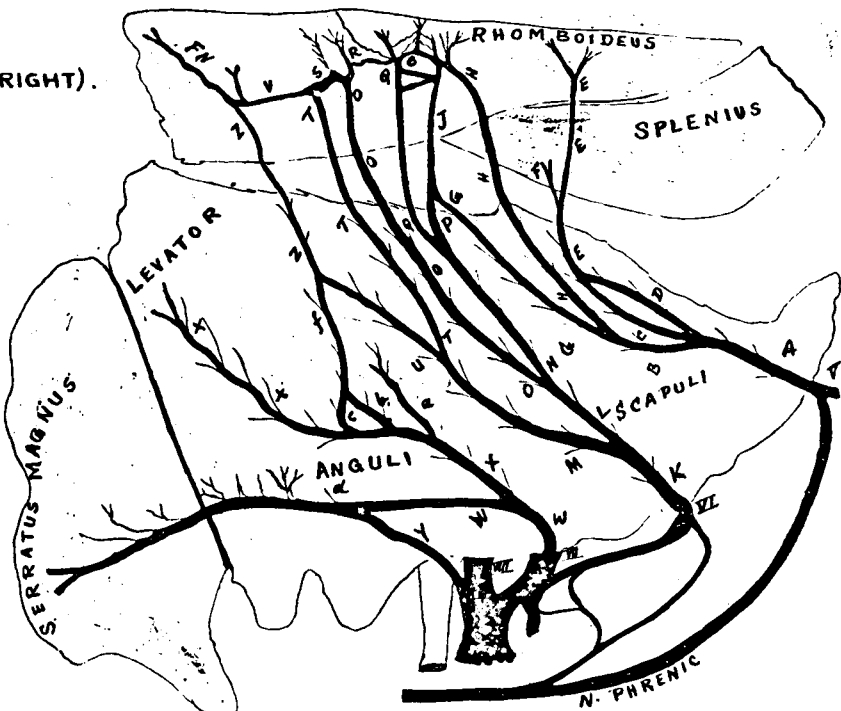
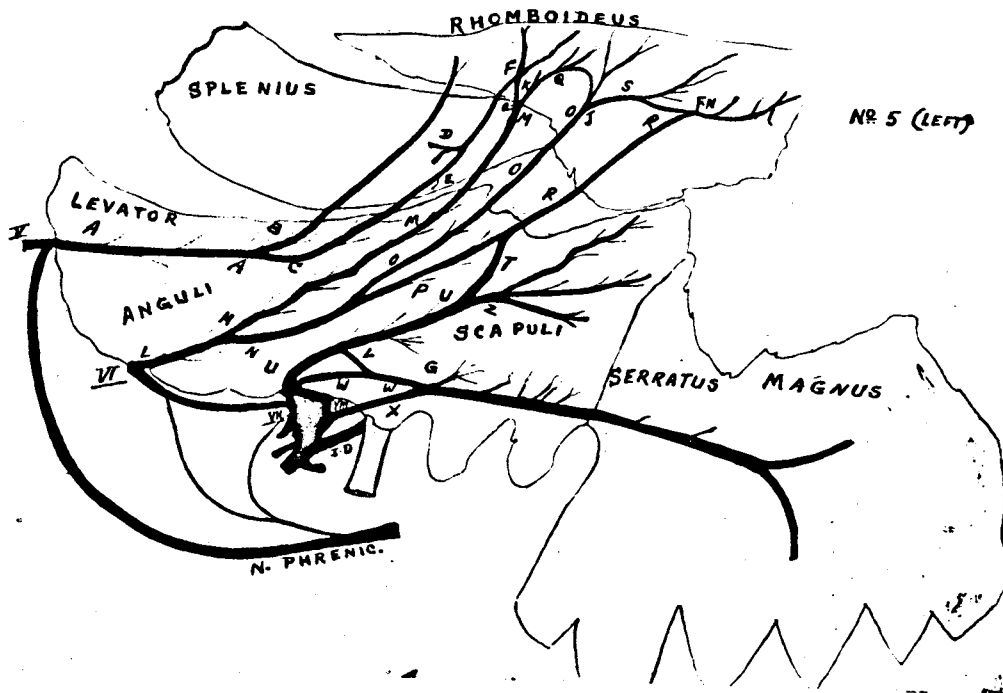


FIG. 1.



Nº 5 (LEFT)



SUBJECT No. 4.—LEFT.

Nº 5. (RIGHT).

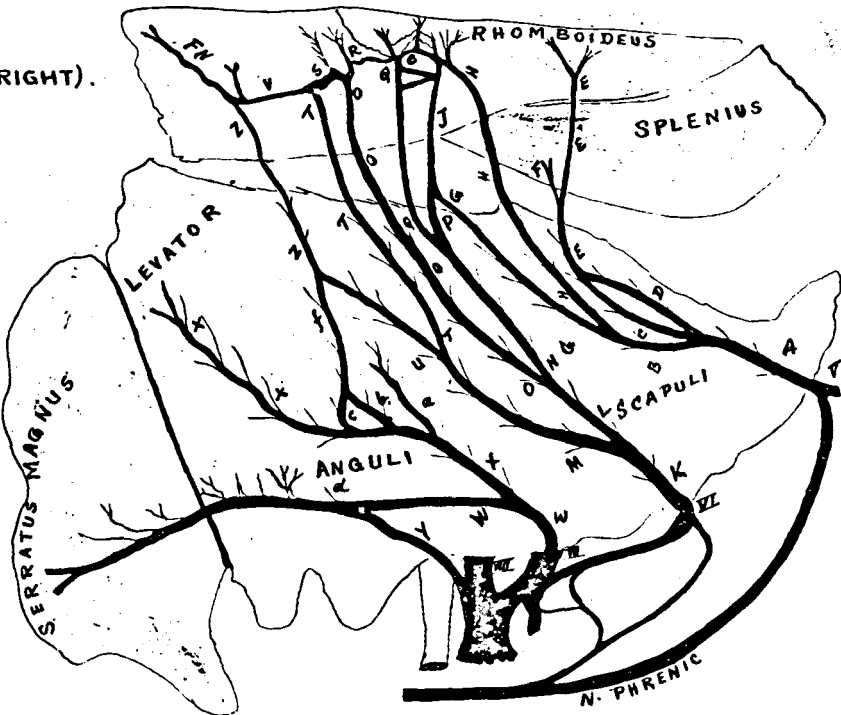
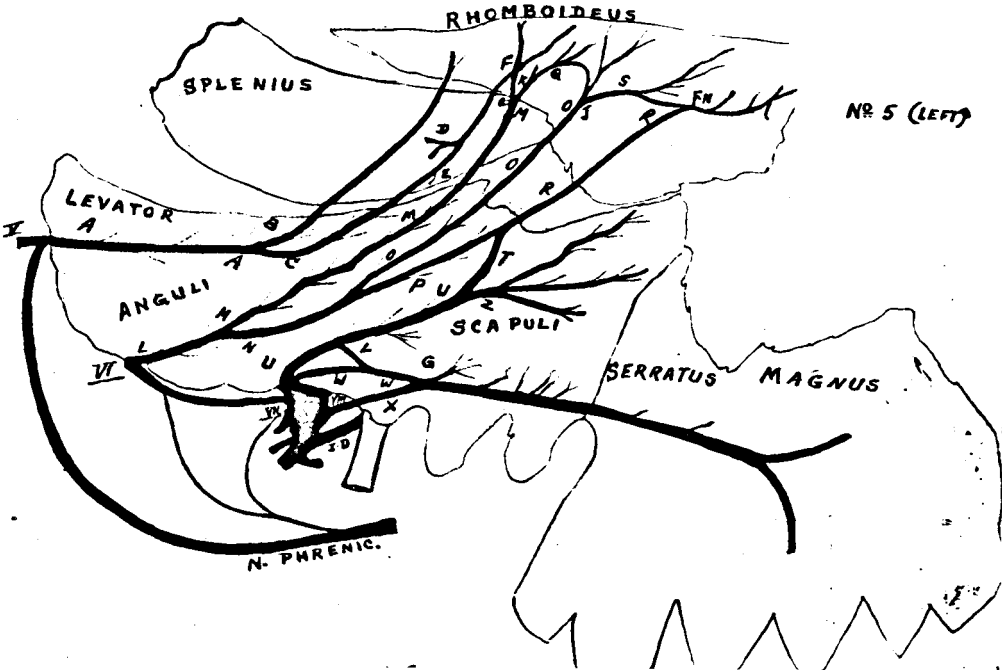


FIG. 1.



NR 5 (LEFT)

supplying L. A. S. and the nerve E resulting from this union ran up on the splenius, detached a branch F to splenius and on gaining the deep face of C. Rhomb. terminated in it. Branch B divided into G and H and both these supplied short branches to L. A. S. and then H gaining the deep face of C. Rhomb. curved backwards and detached a number of twigs to C. Rhomb. from its dorsal face; while the branch G united with P of the 6th.

Branch K from the 6th divided into two—L and M. The branch L again divided into two—N and O. The branch N after reaching the upper part of the L. A. S. divided into P and Q of which P joined G of the 5th. The resulting nerve J of the union of P and G gained the deep face of D. Rhomb. and, after detaching communicating branches to Q, was joined by H of the 5th. A nerve (e) continued from this union backwards. The branch Q after receiving anastomotic branches from J joined (e). A nerve R continued backwards from this union. The branch O after supplying L. A. S. joined R. Both nerves (e) and R detached a number of branches from their dorsal face and these branches formed a number of connections and thus produced an appearance of a nerve plexus. A nerve S continued backwards from the union of O and R. The branch M after a course divided into U and T of which T joined S and U joined (f) of the 7th. The nerve V continued backwards from the union of S and T.

Branch W from the 7th curved backwards and detached from its dorsal face a branch X. This X ascended in the L. A. S. and gave off besides a number of short branches, three long branches—a, b and c. The continuation of X and the branch (a) terminated in L. A. S., while branches (b) and (c) united together and the nerve (f) resulting from this union in its turn united with U of the 6th nerve and formed a nerve Z. This Z after supplying L. A. S. and gaining the deep face of D. Rhomb. joined V. The backward continuations S and V in their turn detached from their dorsal face branches to D. Rhomb. Nerve FN resulting from Z and V ran back, ramified and terminated in D. Rhomb. The branch W, after detaching branch X, curved back and was joined by a branch Y from the 8th. The resulting nerve (d) from this ran back on L. A. S. supplying it and then reached S. Mag.

Phrenic nerve of this side was formed by roots from the 5th, 6th and 7th. Two branches issued from the 6th—*anterior* and *posterior*. The branch from the 7th first joined the *posterior* of the 6th and the cord thus formed then united the *anterior* of the 6th. The final cord from the 6th and 7th then joined the 5th.

SUMMARY.

- Rhomboideus was supplied by 5th, 6th and 7th.
- L. A. S. was supplied by 5th, 6th, 7th and 8th.
- Phrenic was formed by 5th, 6th (two branches) and 7th.

NOTE.—1. A branch from the 5th is seen supplying the splenius.

- 2. Usually, a single branch from the 6th enters into the formation of the phrenic nerve. Two branches from the 6th are detached for this purpose on this side of this subject.

Left: (Plate X, fig. 2 and Pl. XII.)

Branch A from the 5th divided into two—B and C. Branch B emerging from under the L. A. S. ran on the splenius, gained the deep face of C. Rhomb. and terminated in it. Branch C emerging from under the L. A. S. ran on splenius but here detached two branches—D and E to the splenius, then proceeded to the deep face of C. Rhomb. and joined a flat fasciculus F. This fasciculus detached two branches from its dorsal face to C. Rhomb. and a third branch K, continuing backwards from this joined a branch M of the 6th.

Branch L from the 6th divided into M and N. The branch M after supplying L. A. S. was joined by K of F on the deep face of C. Rhomb. forming another flat fasciculus (*a*). From this union of K and M resulted a nerve Q which ran back with a curve from the dorsal face of which a number of branches were supplied to C. Rhomb. The branch N after a course in the L. A. S. divided into O and P. The branch O on reaching the deep face of D. Rhomb. was joined by Q forming another flat fasciculus J with it and a nerve S started from this J and continued backwards. The branch P after a short course in the L. A. S. was joined by a branch T of the 7th nerve and the nerve R resulting from this union of P and T on gaining the deep face of D. Rhomb. joined S. The nerve FN resulting from S and R ran back and distributed itself to D. Rhomb.

Two branches U and W started off very close each other from the 7th and they were connected by an anastomotic branch V. After this the branch U worked up in the L. A. S. and divided into T and Z of which the T joined P of the 6th and Z repeatedly branched and terminated in the L. A. S. Branch W joined a branch X from the 8th and formed a broad nerve G which running back on the L. A. S. detaching branches to it from its dorsal face finally reached S. Mag.

The phrenic nerve of this side was formed by the roots from the 5th, 6th and 7th.

SUMMARY.

Rhomboideus was supplied by 5th, 6th and 7th.

L. A. S. was supplied by 5th, 6th, 7th and 8th.

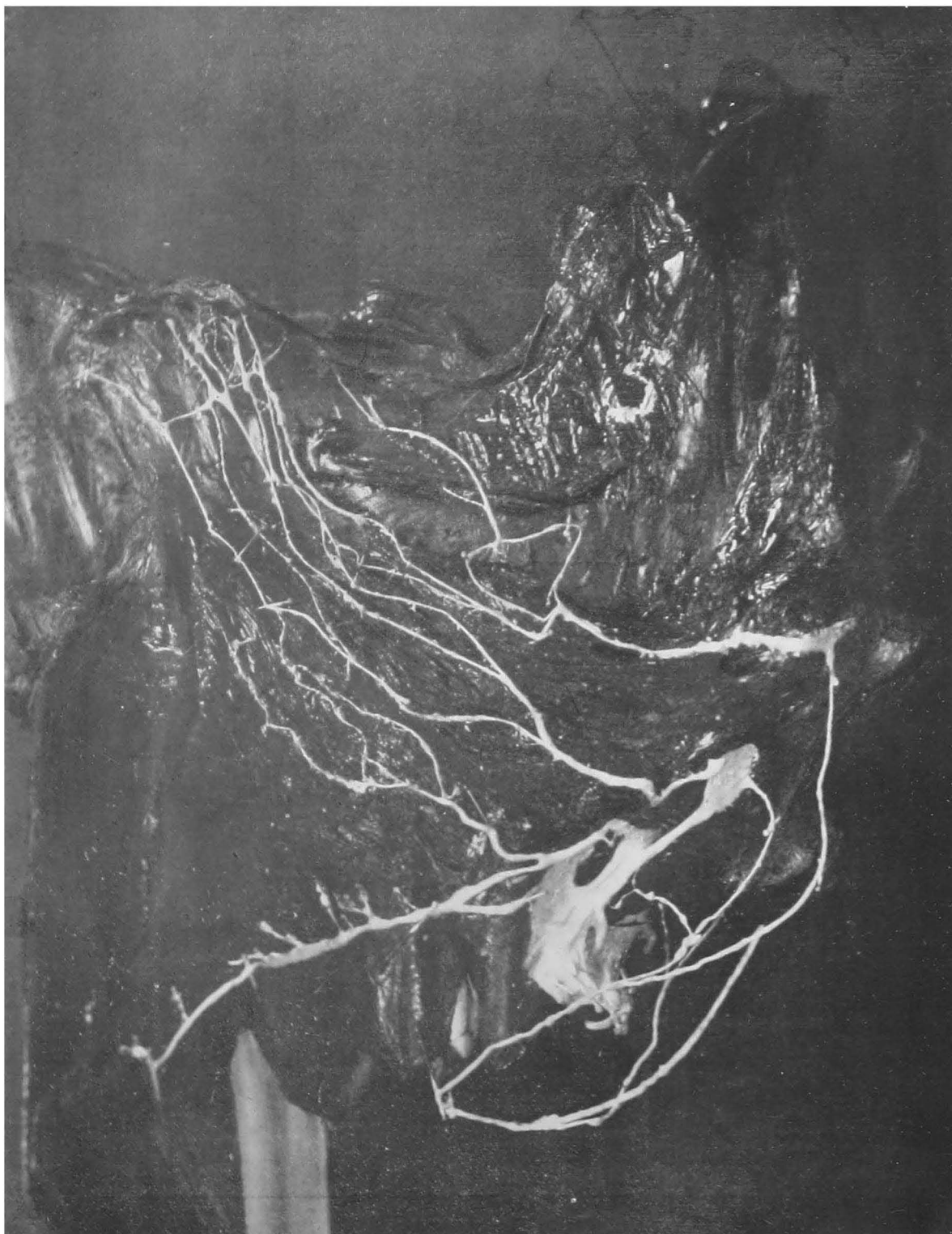
Phrenic nerve was formed by 5th, 6th and 7th.

SUBJECT NO. 6.

Right: (Plate XIII, fig. 1 and Pl. XIV.)

Branch A, from the 4th after supplying L. A. S., ran up on the splenius and terminated in C. Rhomb.

Branch B from the 5th divided into C and D. Branch C joined branch X of the 6th; the branch D divided into E and F. The branch E again divided into K and H and these two were connected by an anastomotic branch L after which K terminated in L. A. S. Then, H and F joined together and formed a short cord G and



SUBJECT NO. 5.—RIGHT.

PLATE XII.



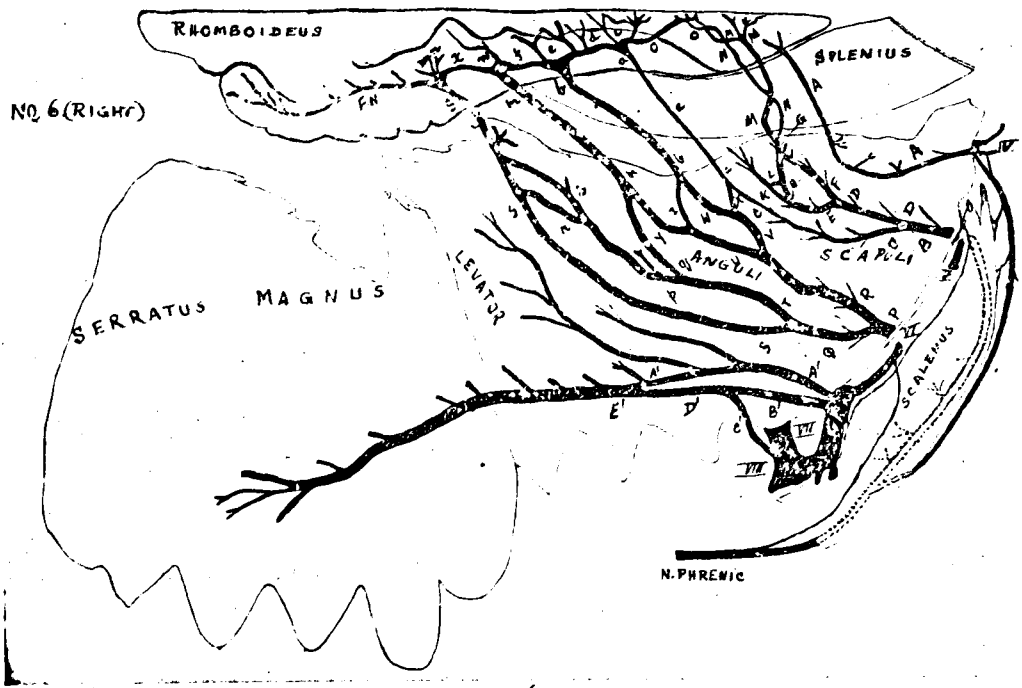
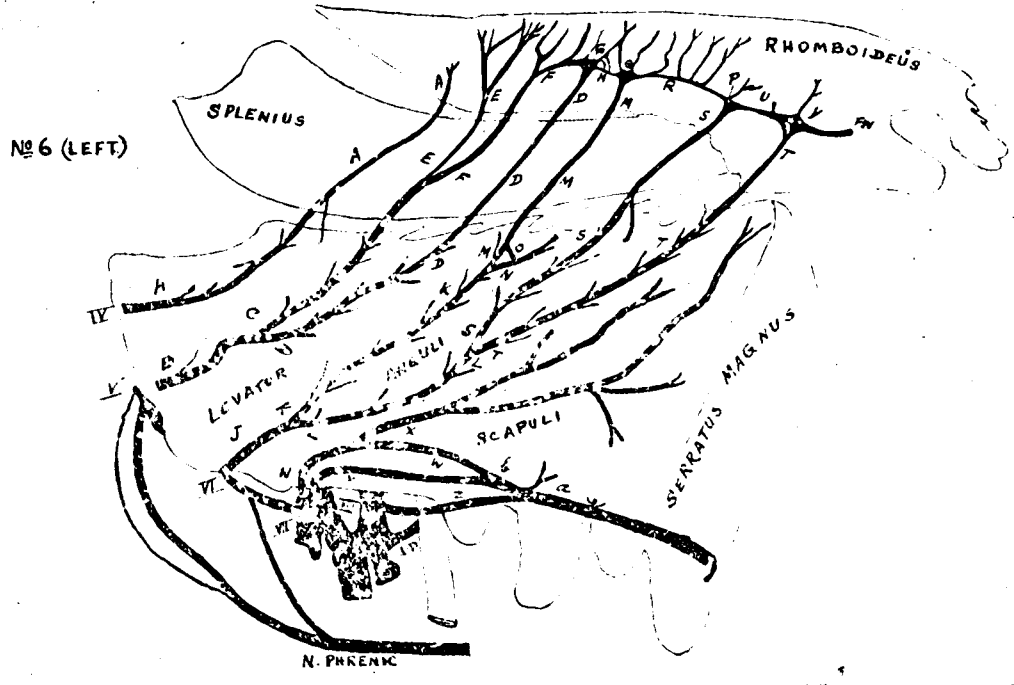


FIG. 1.





SUBJECT No. 5.—LEFT.

NO. 6 (RIGHT)

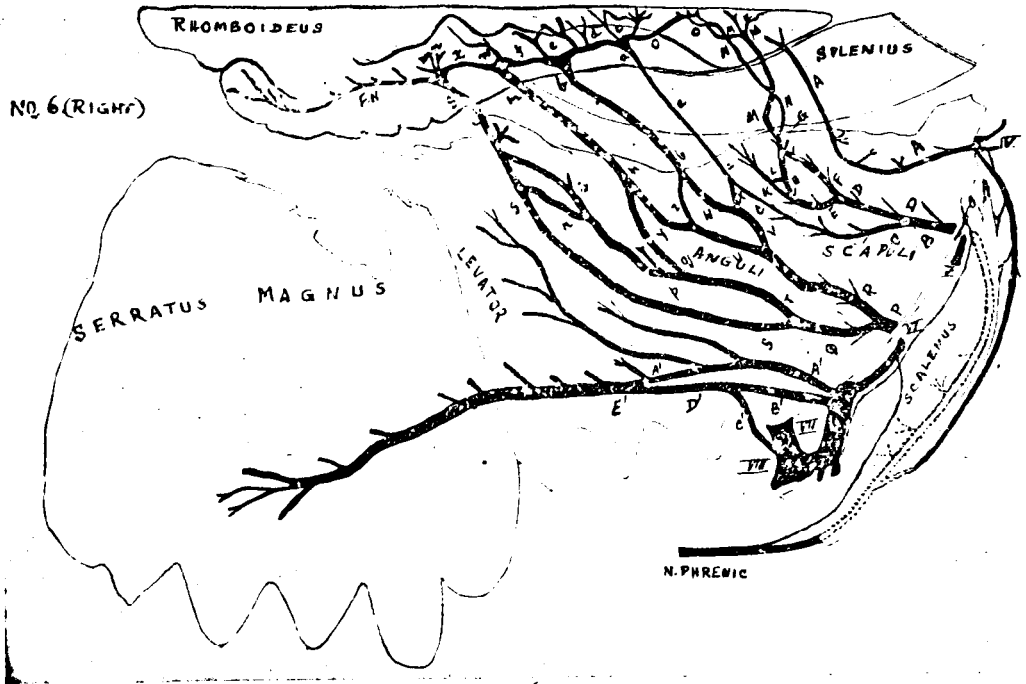


FIG. 1.

NO. 6 (LEFT)

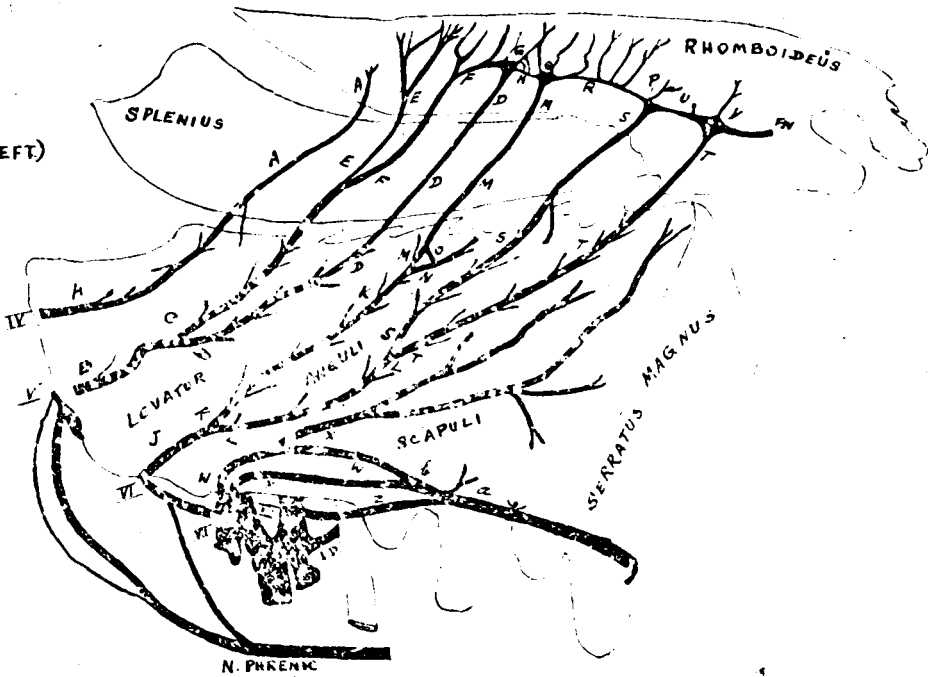
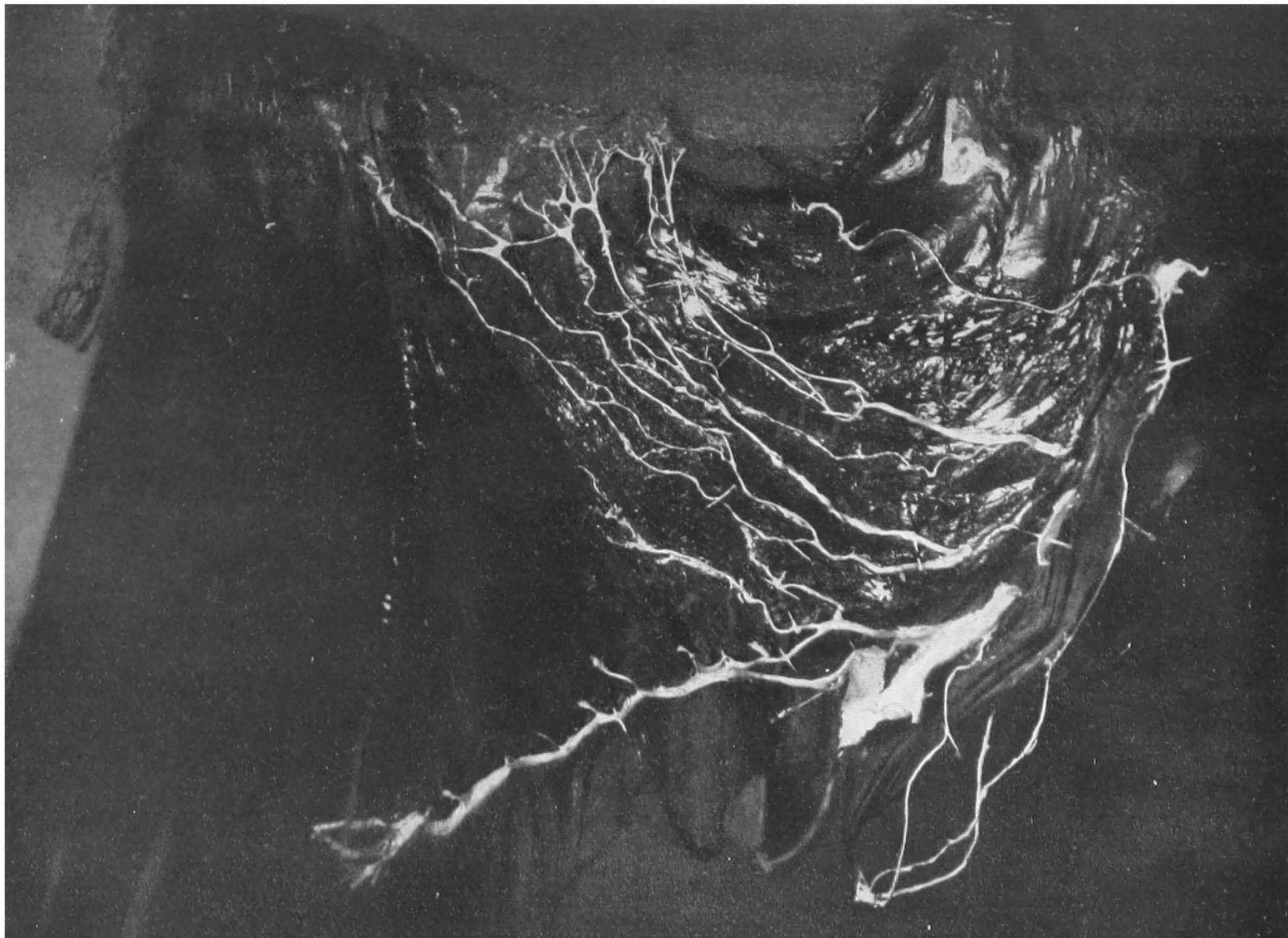


FIG. 2.



SUBJECT No. 6.—RIGHT.

this G again divided into M and N. The branch N crossed over M and gained the deep face of C. Rhomb., while the branch M passing under N also gained the deep face of C. Rhomb. in front of N, detached some twigs to C. Rhomb., then continued backwards and joined N. The nerve O resulting continued this union backwards and detached some branches from its dorsal face to C. Rhomb.

Branch P of the 6th divided into Q and R. Branch R after a course in the L. A. S. divided into V and U. Branch V again divided into W and X of which X united with C of the 5th and the nerve (*a*) resulting from this union gained the deep face of C. Rhomb. and joined O forming a triangular flat fasciculus (*c*). Nerve (*d*) continued from this fasciculus backwards. Both (*c*) and (*d*) detached branches from their dorsal face to C. Rhomb. The branch W was joined by a branch Z and the resulting nerve (*b*) joined (*d*) on the deep face of Rhomb. and formed another fasciculus (*e*). Nerve (*f*) continued (*e*) backwards. The branch U divided into Y and Z, of which Z joined W and Y joined (*g*) to form (*m*) which joined (*f*) on the deep face of D. Rhomb. and formed a large flat fasciculus (*n*). Branch (*x*) continued (*n*) backwards. (*e*), (*f*) and (*n*) all detached branches to C and D. Rhomb. Branch Q divided into S and T, and T in its turn divided into (*p*) and (*q*) of which (*q*) joined Y as already said; while (*p*) after a short course divided into (*r*) and (*s*) and both these joined S. The branch S after supplying L. A. S. and getting the addition of (*r*) and (*s*), continued upwards in the L. A. S. and joined (*x*) on the deep face of D. Rhomb. and formed a large flat fasciculus (*mn*). Branches issued from the dorsal face of (*mn*) into D. Rhomb. Nerve FN continued (*mn*) backwards, ramified and terminated in the rest of D. Rhomb.

Two branches A' and B' started side by side from the 7th of which B' joined a branch C' from the 8th and formed a cord D'; while A' after supplying some long branches to L. A. S. joined D' and formed a broad thick nerve E' and this after supplying L. A. S. reached S. Mag.

Phrenic nerve of this side:—A branch from the 4th ran down along the ventral border and close to the medial face of the scalenus for nearly seven inches, inclined to the deep face of the muscle and joined the branch from the 5th and formed a cord. The branch from the 6th ran on the superficial face of this muscle and united with the cord formed from the 4th and the 5th behind the first rib and formed the Phrenic nerve.

SUMMARY.

Rhomboideus was supplied by 4th, 5th and 6th.

L. A. S. was supplied by 4th, 5th, 6th, 7th and 8th.

Phrenic nerve was formed by 4th, 5th and 6th.

Left: (Plate XIII, fig. 2 and Pl. XV.)

Branch A from the 4th behaved similar to that on the right side.

Branch B from the 5th after a short course in the L. A. S. divided into C and D
Branch C supplied L. A. S. and on reaching the surface of the splenius divided into

E and F of which E gained the deep face of C. Rhomb. and was distributed to it, while branch F also reached the deep face of C. Rhomb. and divided into three branches two of which spent themselves in C. Rhomb. and the third continued F backwards, detached branches to C. Rhomb. and joined D forming with it a many-sided fasciculus G. Nerve H continued this fasciculus backwards. Branch D after supplying L. A. S. joined F as said above.

Branch J of the 6th divided into K and L of which K mounted up in the L. A. S. supplying it and at the upper part of the L. A. S. divided into M and N and then M and N were connected together by a communicating branch O. The branch M continued upwards and joined H to form a quadrilateral flat fasciculus Q with it. From the dorsal face of G and Q started a number of branches, united with each other, divided again and terminated in C. Rhomb. Two short branches given off by a branch arising from G joined H. Nerve R continued Q backwards. The branch L after a course and supply in L. A. S. divided into S and T of which S supplied L. A. S. and joined R forming with it a flat triangular fasciculus P. Nerve R detached from its dorsal face a number of branches to C. and D. Rhomb. Nerve U continued P backwards. The branch T after supplying L. A. S. joined U and formed a flat quadrilateral fasciculus V. U and V both detached branches to D. Rhomb. Nerve F N continued V backwards and ramified to supply the rest of D. Rhomb.

Two branches W and Y started off side by side from the 7th. Branch W detached a branch X from its dorsal face and this branch repeatedly branched and terminated in L. A. S. Branch W after detaching X joined Y and formed a short thick nerve (*b*) which in its turn was joined by a branch Z from the 8th nerve. The nerve (*a*) thus formed supplied a number of branches to L. A. S. and then reached S. Mag.

Phrenic nerve of this side was formed as follows:—

Two branches (one long and large and another short and narrow) started from the 5th. Both these supplied Scalenus. The narrow branch placed itself along the dorsal border of the scalenus, while the large one ran down the deep face of that muscle. The narrow one inclined to the deep face and joined the thick one there. This cord then joined the branch from the 6th (which placed itself on the external face of this muscle) behind the first rib.

SUMMARY.

Rhomboideus was supplied by 4th, 5th and 6th.

L. A. S. was supplied by 4th, 5th, 6th, 7th and 8th.

Phrenic nerve was formed by 5th (two branches) and 6th.

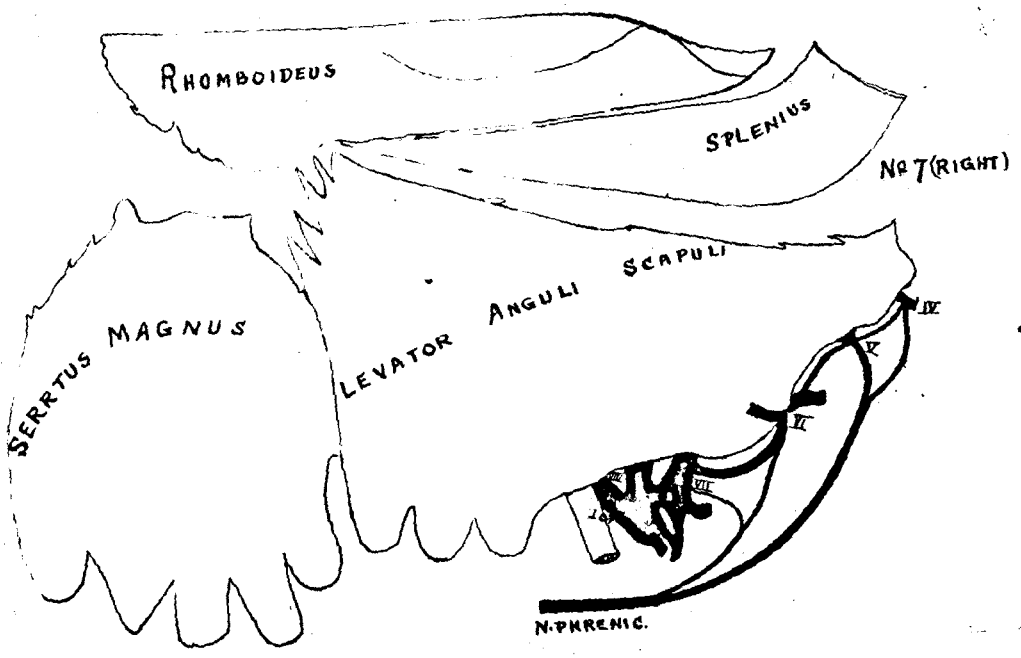


FIG. 1.

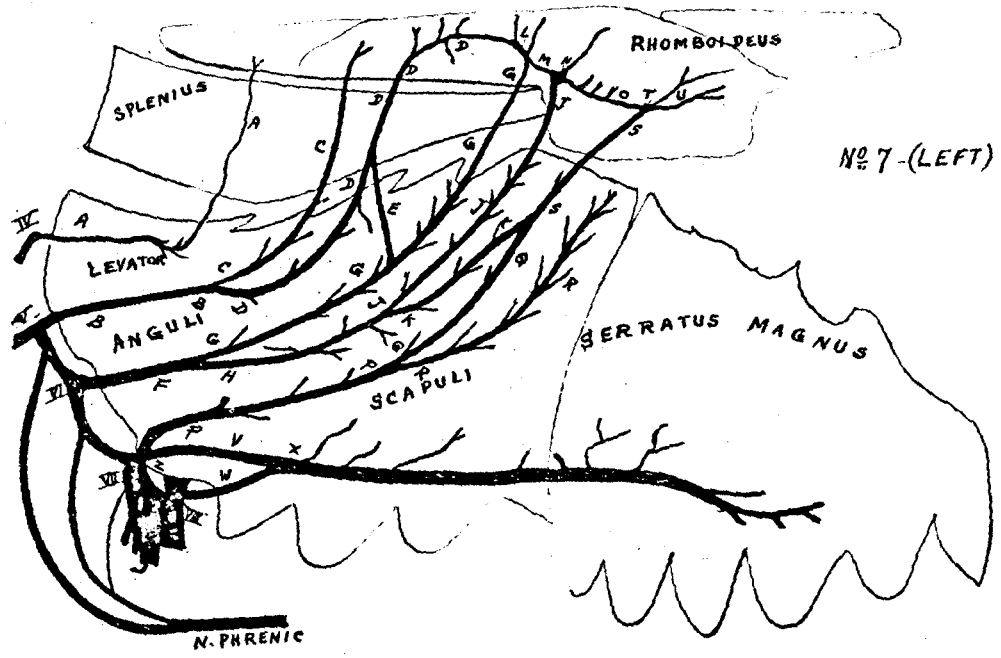
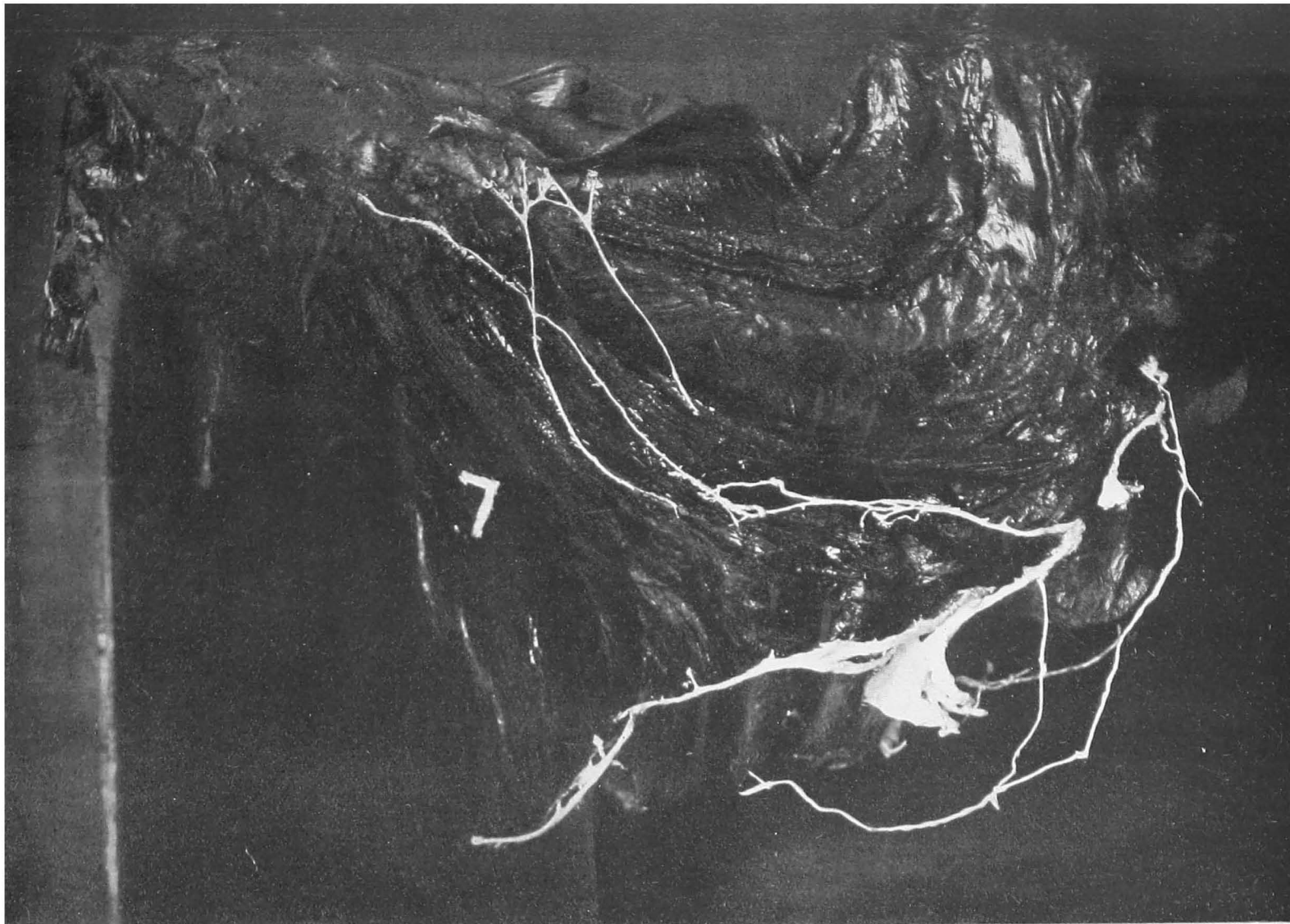
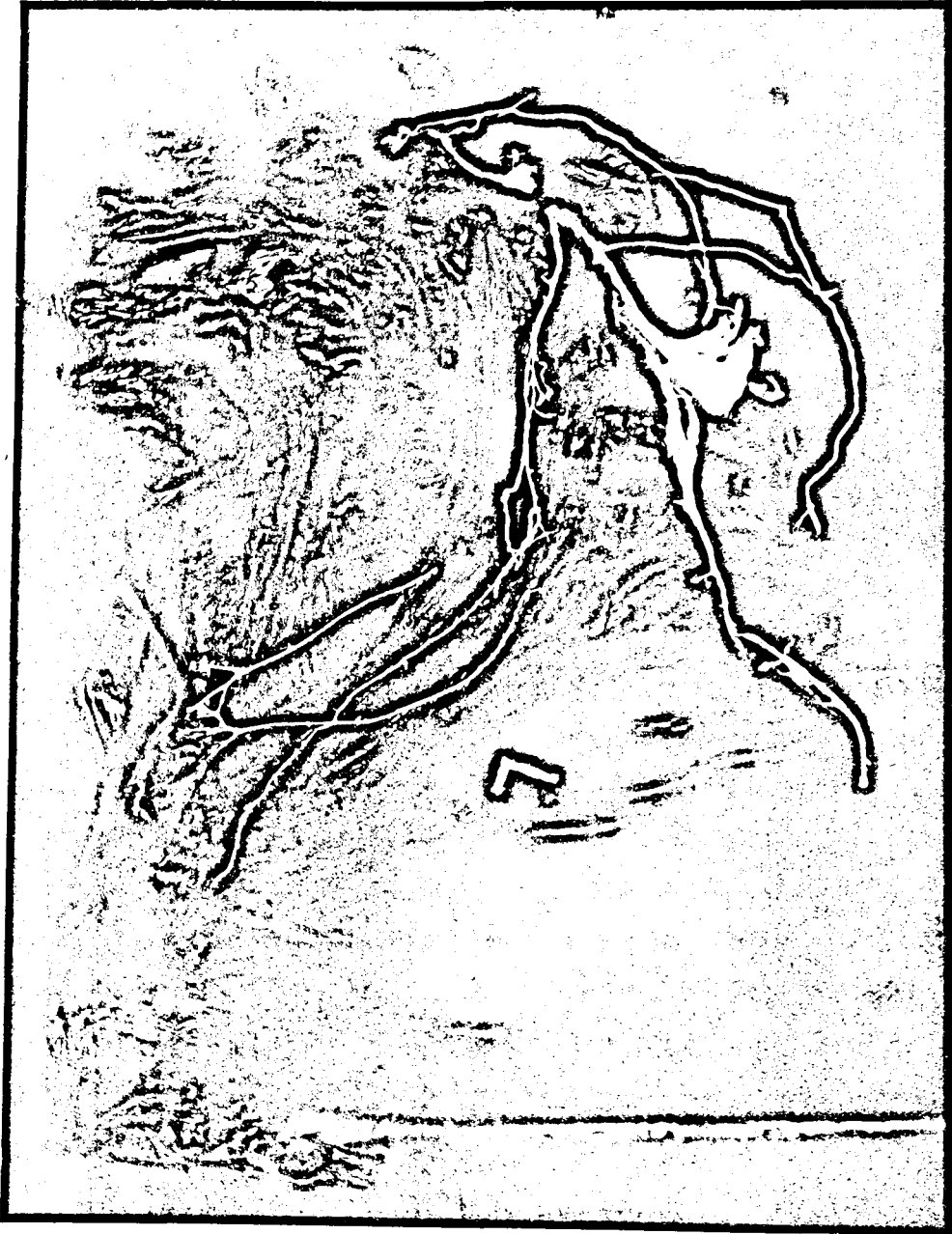


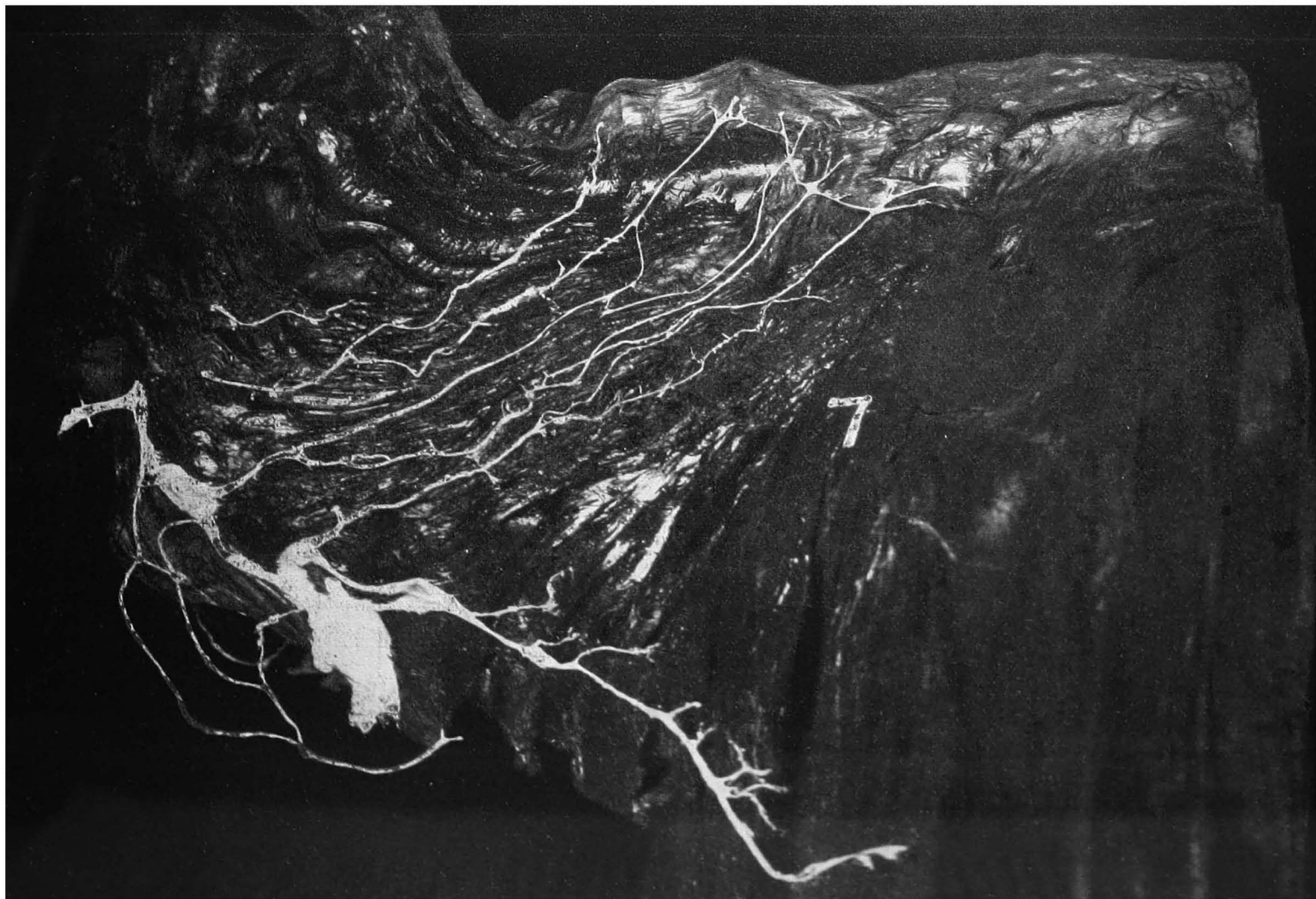
FIG. 2.



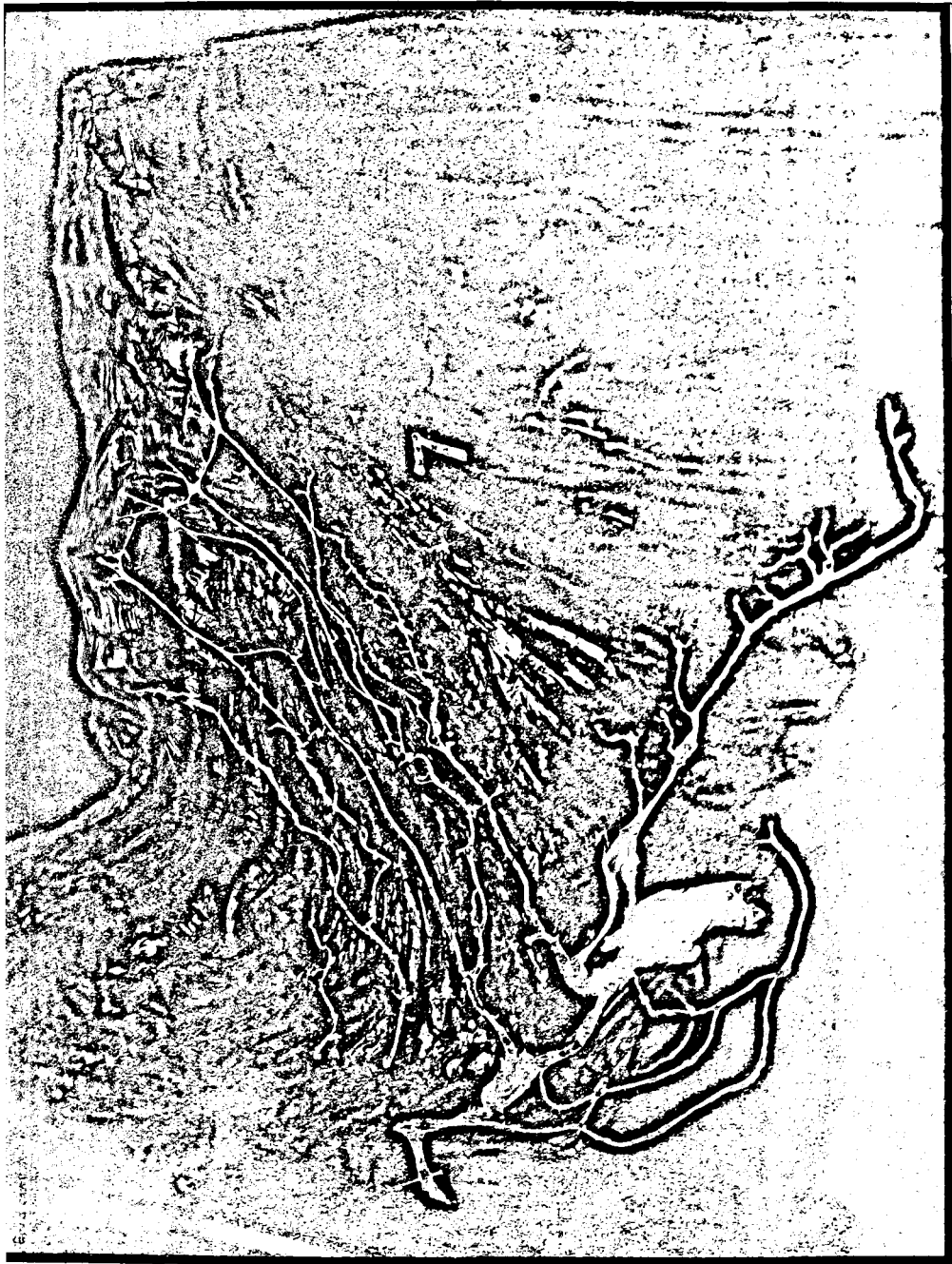
SUBJECT No. 7.—RIGHT.



SUBJECT No. 7.—Right.



SUBJECT No. 7.—LEFT.



SUBJECT NO. 7.*Right* : (Plate XVI, fig. 1 and Pl. XVII.)

Only phrenic nerve of this side was dissected and examined and it was found formed by the roots from the 4th, 5th, 6th and 7th. The root from the 4th was short and it ran down under the extreme upper part of the scalenus on its deep face and joined the root from the 5th. The united nerve thus formed ran downwards and backwards placing itself on the deep face of the scalenus and entered the thorax. The roots from the 6th and 7th ran on the outer surface of the scalenus and united. This cord entered the thorax and then joined the cord (4th and 5th) there behind the first rib.

SUMMARY.

Phrenic nerve of this side was formed by the 4th, 5th, 6th and 7th.

Left : (Plate XVI, fig. 2 and Pl. XVIII.)

Branch A from the 4th showed the usual behaviour and supplied L. A. S. and C. Rhomb.

Branch B from the 5th divided into C and D and both supplied L. A. S. Branch C leaving L. A. S., running on the splenius terminated in C. Rhomb. Branch D after supplying L. A. S. received a communicating branch E from G of the 6th, then ran upwards and backwards on the splenius and gaining the deep face of C. Rhomb. continued backwards describing a curve and detaching branches from its dorsal face to C. Rhomb. It then joined G of the 6th and formed a four-sided flat fasciculus L and a nerve M continued this L backwards. Number of branches issued from L to C. Rhomb.

Branch F from the 6th divided into G and H of which G after supplying and giving a communicating branch E to D of the 5th, reached the deep face of C. Rhomb. and joined D to form L as already said. The branch H after supplying L. A. S. divided into J and K of which J continued supplying L. A. S. for the rest of its course in that muscle and then gained the deep face of D. Rhomb., joined M and formed a much larger flat fasciculus N from which there issued a nerve O continuing N backwards. The branch K united Q of the 7th to form S.

Branch Z from the 7th divided immediately after its origin into P and V of which P went up in the L. A. S. and divided into Q and R. Branch Q joined K of the 6th and formed a nerve S which supplied L. A. S., then gained the deep face of D. Rhomb. and joined O forming another flat fasciculus T. Both O and T detached branches from their dorsal face to D. Rhomb. The branch R distributed itself to L. A. S. The nerve U continuing T backwards further branched and terminated in

D. Rhomb. The branch V joined the branch W from the 8th and formed a broad nerve X which after supplying L. A. S. gained S. Mag.

Phrenic nerve of this side was formed by the 5th, 6th and 7th.

SUMMARY.

Rhomboideus was supplied by 4th, 5th, 6th and 7th.

L. A. S. was supplied by 4th, 5th, 6th, 7th and 8th.

Phrenic nerve was formed by 5th, 6th and 7th.

SUBJECT NO. 8.

Left: (Plate XIX, fig. 1 and Pl. XX.)

The behaviour of the branch A of the 4th was similar to that in the previous subjects.

Branch B from the 5th running deep and supplying L. A. S. divided into C and D, of which C gained the deep face of C. Rhomb. and divided into E and F. F again divided into G and H. G joined E and the united nerve ramified in C. Rhomb.; but H continued F backwards and joined D forming a flat fasciculus. The nerve J resulting from the union of H and D continued backwards. Branch D after supplying L. A. S. detached a communicating branch (*f*) which crossed over N of the 6th and joined R of the 6th. It then continued upwards and joined H of the 5th. The nerve J divided into (*c*) and K.

Branch M of the 6th divided into N and O. Branch N supplied L. A. S., reached the deep face of C. Rhomb. and was joined by (*c*) of J forming a fasciculus L. Branch O divided into P and Q, of which Q terminated in L. A. S., while P after supplying L. A. S. divided into R and S. Branch R received a communicating branch (*f*) from D of the 5th and V from T and then reached the deep face of C. Rhomb. and joined the fasciculus L. Branch K of J also joined this fasciculus separately and gave off a branch to D. Rhomb. The fasciculus L thus formed by the meeting of (*c*), K, N and R was found to be very broad and many-sided. The nerve X continued L backwards. Branch S divided into T and U. Branch T after giving off a communicating branch to R joined U again and formed a nerve W which gaining the deep face of D. Rhomb. joined X. This X detached a number of branches from its dorsal face to D. Rhomb. The nerve Y continued the union of X and W backwards, ramified and terminated in D. Rhomb.

Branch Z from the 7th ran backwards with a curve and detached a long branch from its dorsal face to L. A. S. and then joined the branch (*a*) from the 8th and formed a thick broad nerve (*b*). This (*b*) gave off a number of branches to L. A. S. and then reached S. Mag.

SUMMARY.

Rhomboideus was supplied by 4th, 5th and 6th.

L. A. S. was supplied by 4th, 5th, 6th, 7th and 8th.

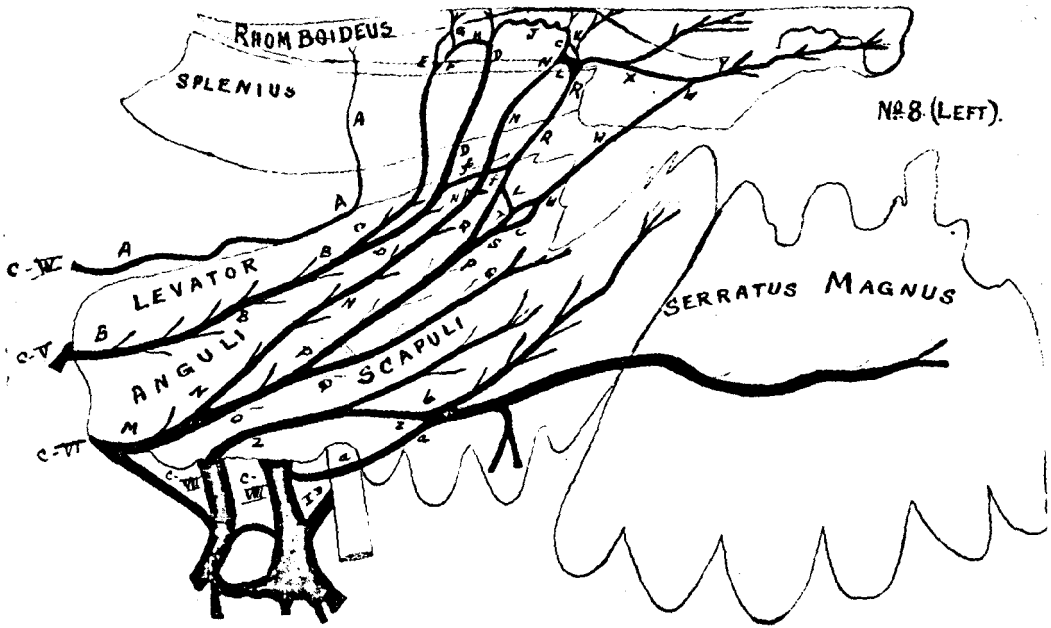


FIG. 1.

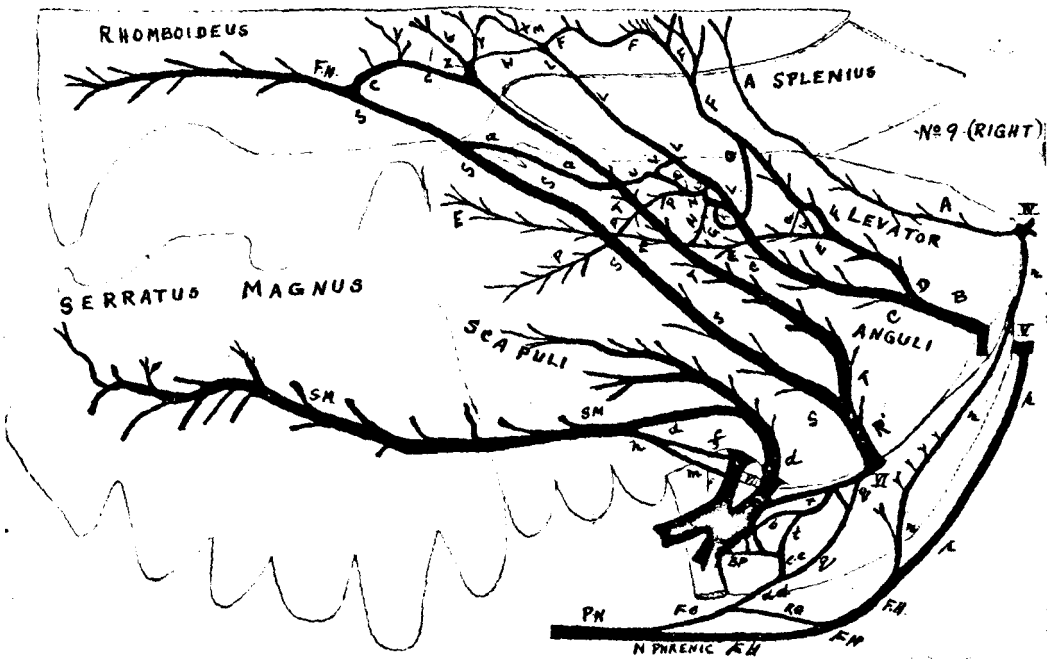
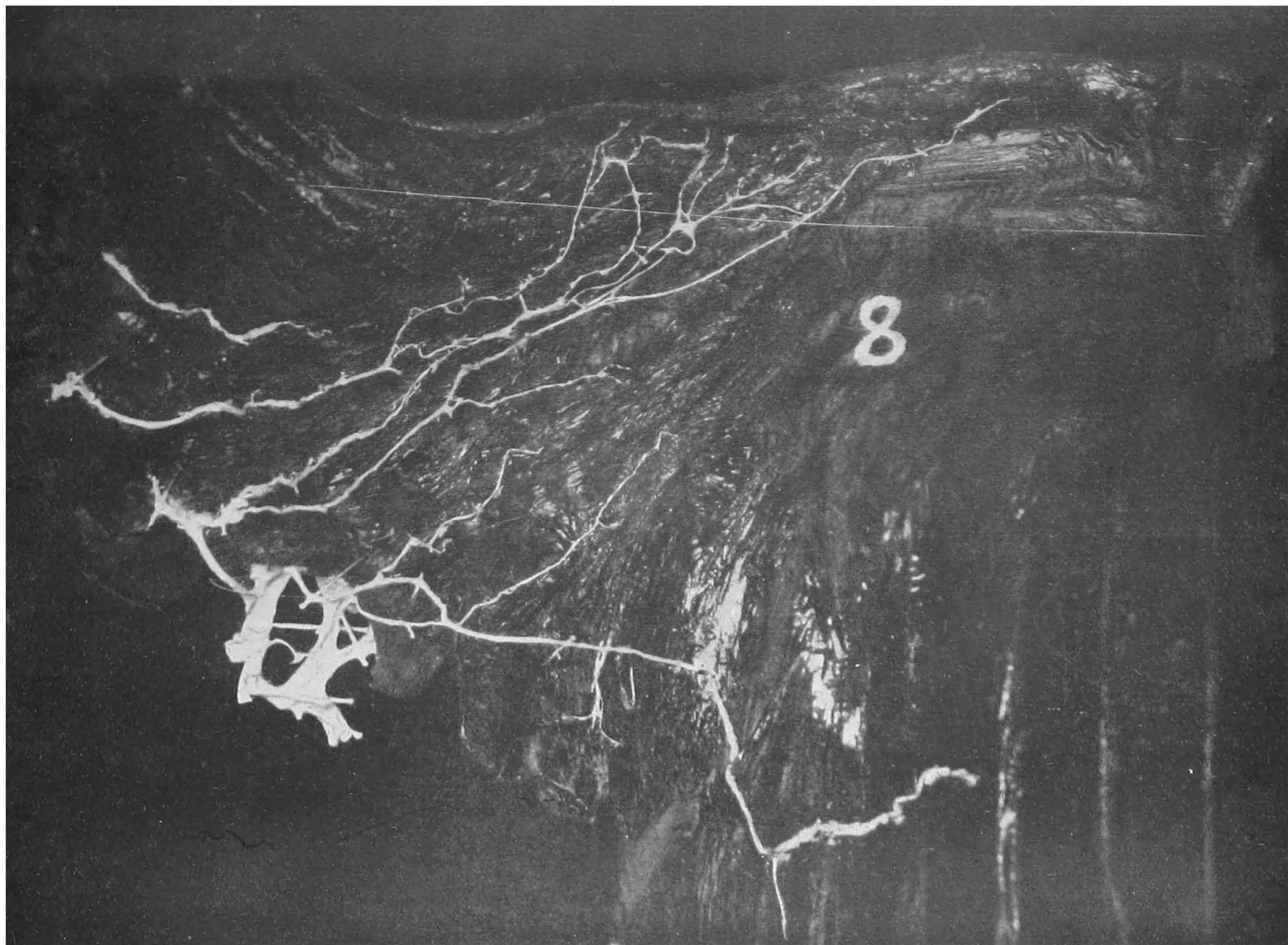
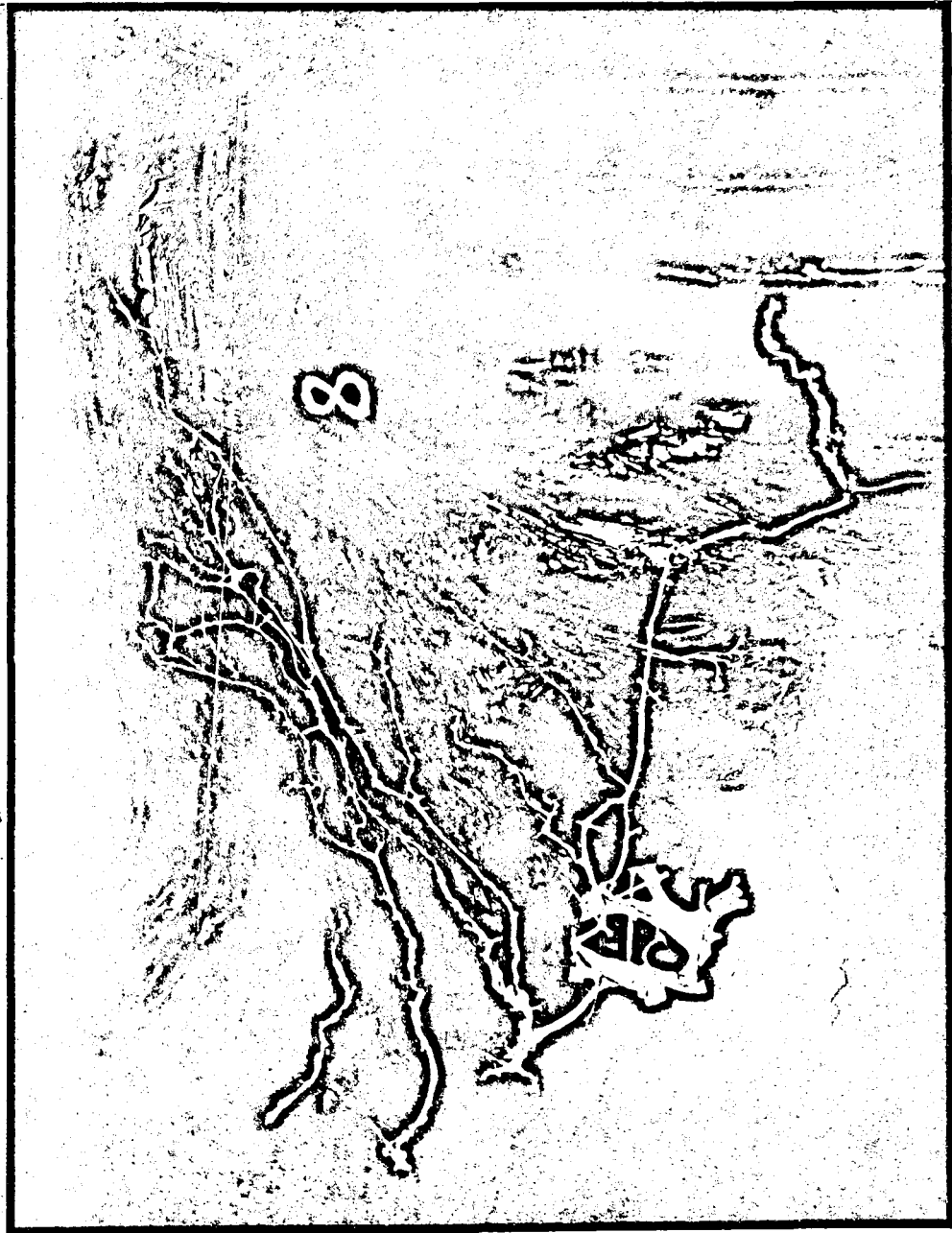


FIG. 2.



SUBJECT No. 8.—LEFT.



SUBJECT No. 8.—Left.



SUBJECT NO. 9.

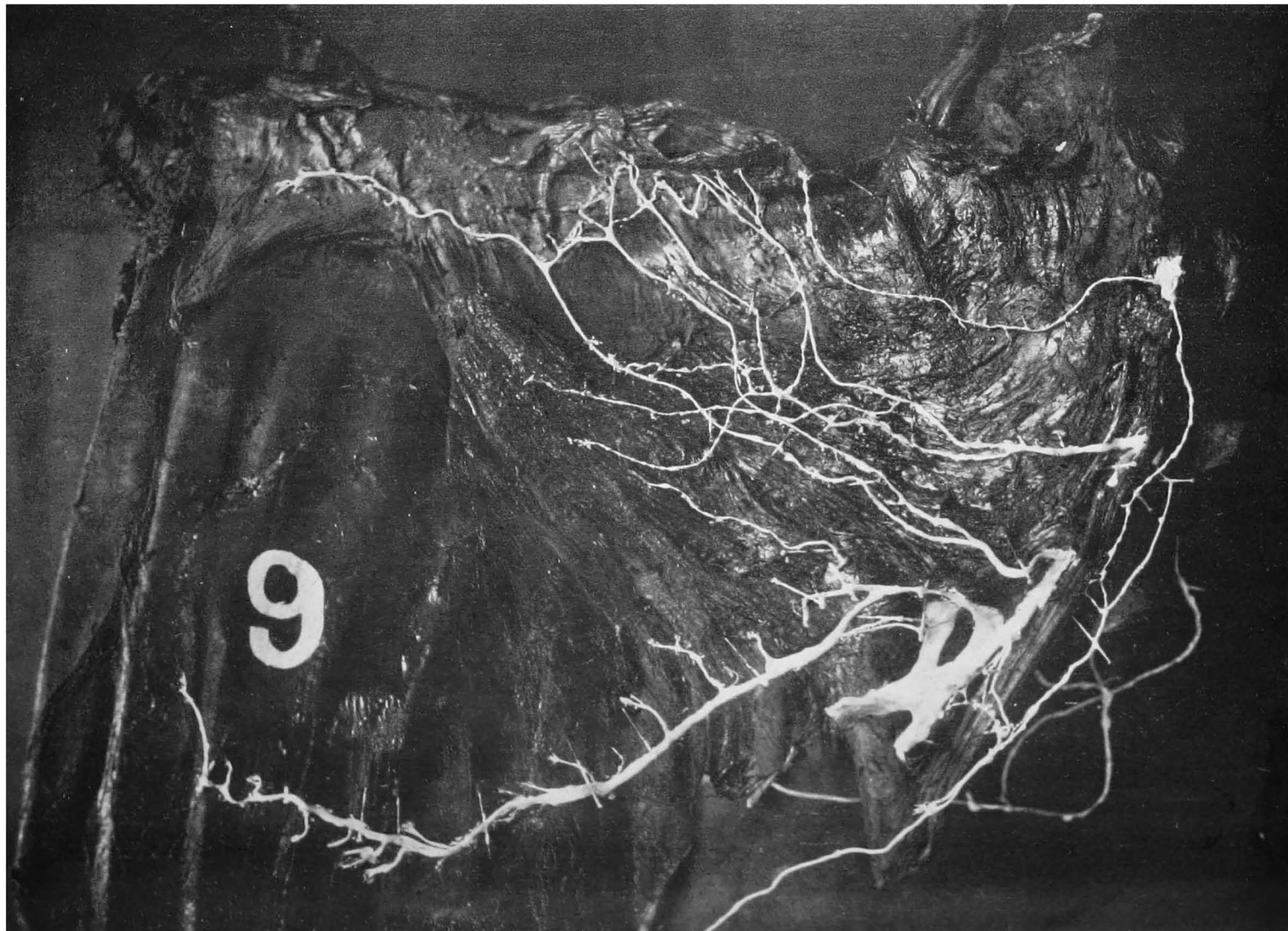
Right: (Plate XIX, fig. 2 and Pl. XXI.)

Branch A of the 4th showed the usual behaviour.

Branch B of the 5th divided into C and D. Branch D supplied L. A. S. and divided into E and F and both these were connected by anastomotic branches (a) and (b). After this, E crossed over C, received a communicating branch H from K and crossed over T and under P and then over S supplying L. A. S. all along and terminated in the supero-posterior corner of this muscle. The branch F after communication with E by (a) and (b) supplied L. A. S. and on emerging from under this muscle issued a long branch G which joined K. F then gained the deep face of C. Rhomb., proceeded backwards and joined L and formed a many-sided flat fasciculus M. Both F and M detached from their dorsal face branches to C. Rhomb. The branch C supplied L. A. S., crossed under E and divided into K and L. K received a branch G and detached a communicating branch H to E and then divided into two—N and O. The branch O immediately joined L and the branch N divided into P and Q. P then crossed over T, E and S and reached the area of L. A. S. below that supplied by E and terminated in it. The branch Q divided into U and V of which U joined T and V joined L. The branch L after receiving communicating branches O and V, gained the deep face of C. Rhomb. and joined F to form the fasciculus M as already said. From M started two nerves W and X of which W continued M backwards and X divided into two branches.

Branch R from the 6th divided into S and T of which T mounted up in the L. A. S. supplying it, proceeded further upwards under E and P and at the extreme upper part of the L. A. S. received a communicating branch U from Q and detached a communicating branch (a) to S, then gained the deep face of D. Rhomb., joined W and formed a large flat fasciculus Z with it. There issued a number of branches—Y, (b) and (c) from the dorsal face of this Z. One of it—Y branched into two and one of these branches anastomosed with one of the branches of X and formed a nervous arch and the other branch—each of X and Y terminated in C. and D. Rhomb. respectively; branch (b) terminated in D. Rhomb. while the branch (c) continued from the union Z backwards. The branch S supplied L. A. S. in its upward course and just before it emerged under L. A. S. it received a communicating branch (a) from T, reached then the deep face of D. Rhomb. and joined (c). Nerve FN continued backwards from this union and distributed itself to the rest of D. Rhomb. A number of branches were issued from (c) to D. Rhomb.

Branch (d) from the 7th curved backwards and detached a large branch which in its turn divided and terminated in L. A. S. Two branches (f) and (m) started from the 8th nerve, joined together and formed a common cord (n), and this (n) joined (d) and formed a broad nerve SM, which after supplying L. A. S. reached S. Mag.



SUBJECT No. 9.—RIGHT.

Phrenic nerve of this side :—

A branch from the 4th (*n'*) passed down along the dorso-medial aspect of the scalenus, inclined to its deep face and joined the root (*p*) from the 5th and formed a thick cord FH.

Root (*g*) from the 6th gained the outer face of the scalenus. A branch from the 6th joining the brachial plexus detached a branch (*r*) and a short branch from this (*r*) joined (*g*). Branch (*r*) then divided into (*s*) and (*t*). The branch (*s*) reached the 7th (brachial plexus) and got connected with it by very short filaments and then divided into two short branches. A branch BP started from the 7th and united with the two short branches of (*s*) and this united cord thus formed joined (*t*) and gave rise to a thicker cord (*cc*). This (*cc*) joined (*g*) and formed a thicker cord (*dd*). This (*dd*) was joined by a branch RQ from FH. FH then finally united with FC (formed by the union of (*dd*) and RQ) behind the first rib and formed the phrenic nerve P. N.

SUMMARY.

Rhomboideus was supplied by 4th, 5th and 6th.

L. A. S. was supplied by 4th, 5th, 6th, 7th and 8th (Two Branches).

Phrenic nerve was formed by 4th, 5th, 6th and 7th.

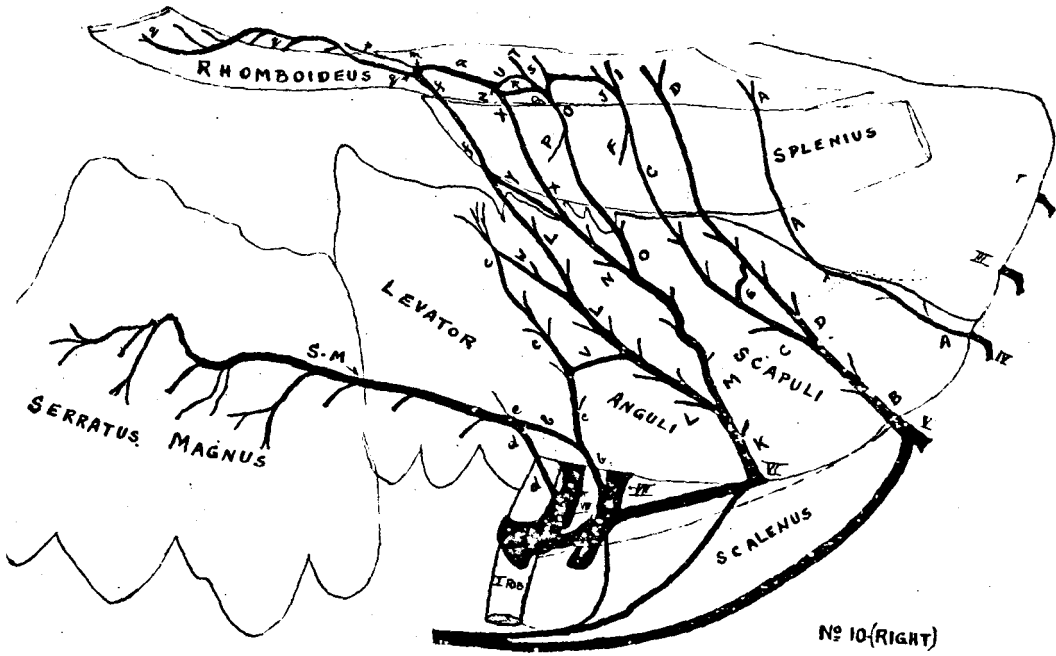
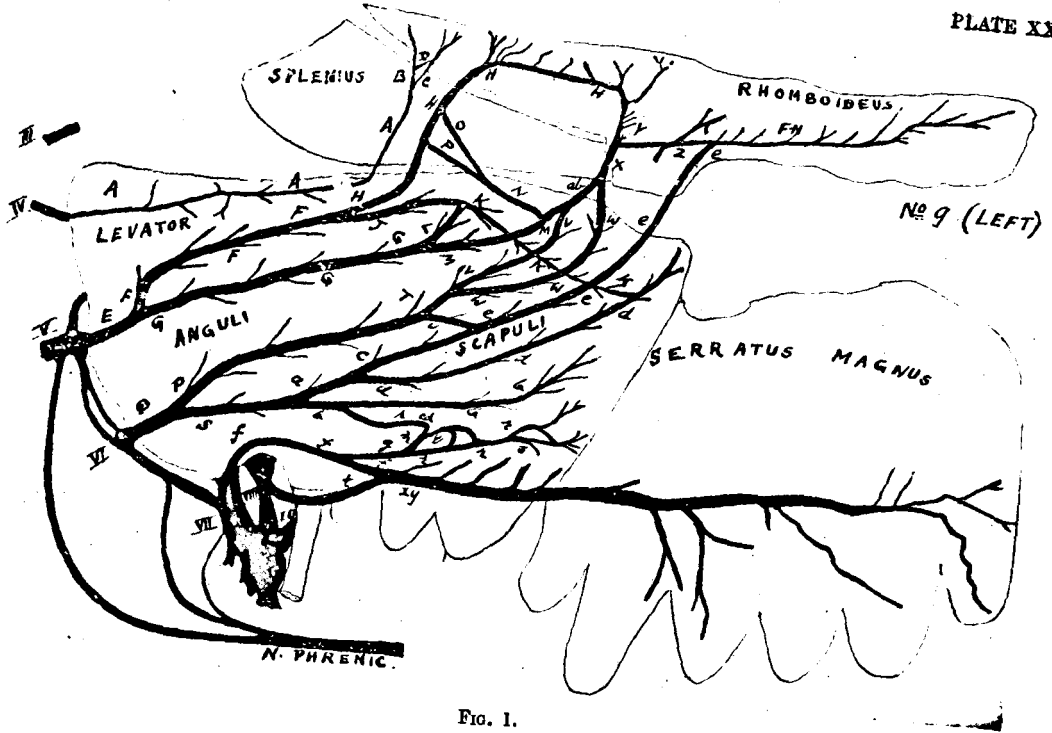
Left : (Plate XXII, fig. 1 and Pl. XXIII.)

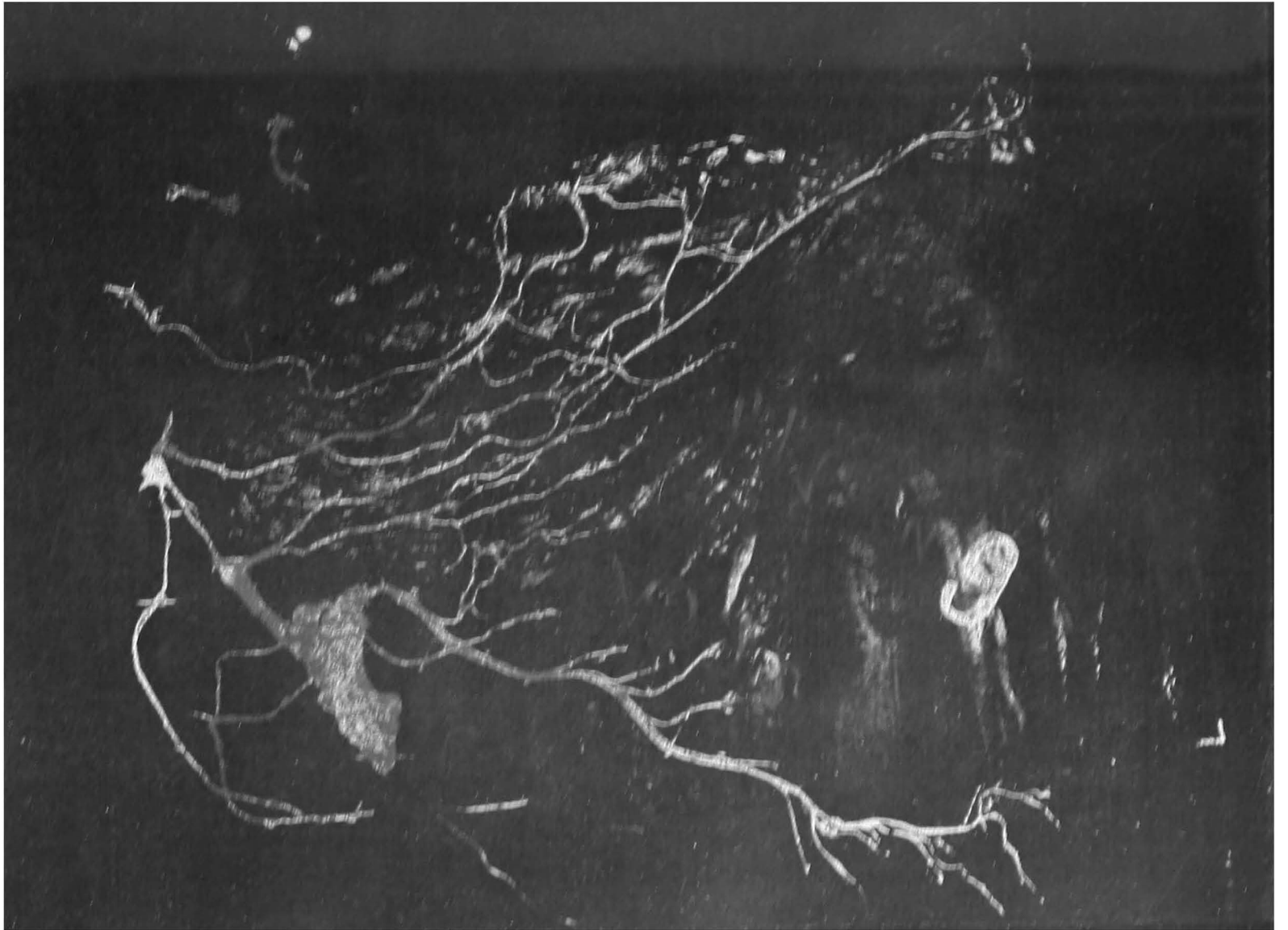
The behaviour of the branch A of the 4th was usual, but on reaching the C. Rhomb. it divided into B and C and these were connected by an anastomotic branch D and then terminated in C. Rhomb.

Branch E of the 5th divided into F and G. F supplied L. A. S. and divided into H and J. Branch H gave off communicating branches O and P. These O and P united together to form N which joined M of the 5th. H then reached the deep face of C. Rhomb. and passed backwards in an arched manner. From the dorsal face of this arch a number of branches issued to C. Rhomb. and H then joined X of the 5th and the 6th to form a flat fasciculus Y. Nerve Z continued this union backwards. The branch J supplied L. A. S., joined L of the 5th and formed a nerve K which crossing over M of the 5th and V, W and (*e*) of the 6th finally united with (*d*) of the 6th. The branch G after supplying L. A. S. divided into L and M, of which L joined J of the 5th, while M ran under K, received a communicating branch N from H, then united with V of the 6th and formed a short thick nerve (*ab*).

Branch Q of the 6th divided into R and S of which R supplied L. A. S. and divided into T and U. U joined (*e*) while T divided into V and W. V ran up under K, joined M of the 5th and formed nerve (*ab*).

Branch W also supplied L. A. S., ran up under K, joined (*ab*) and formed nerve X. This X joined H and formed the fasciculus Y as already said. The branch S divided into (*a*) and (*b*) of which (*a*) again divided into (*c*) and (*d*). (*c*) received a communicating branch U and the nerve (*e*) after this union ran up in the L. A. S.





SUBJECT NO. 9. LEFT.

supplying it, proceeded further up under K, gained the deep face of D. Rhomb. and joined Z. The nerve FN continued from this union backwards, ramified and terminated in D. Rhomb. The branch (*d*) supplied L. A. S. and after it was united by a branch K terminated in L. A. S. The branch (*b*) after giving off an anastomotic branch (*p*) to the 7th distributed itself to L. A. S.

Branch (*f*) from the 7th detached a branch (*g*) from its dorsal face and then was united by a branch (*t*) from the 8th to form a broad nerve (*xy*). The branch (*g*) divided into (*m*) and (*n*) of which (*m*) again divided into (*cd*) and (*q*). (*cd*) joined the anastomotic branch (*p*) of the 6th, while (*q*) divided into two and both these branches united (*n*) at different levels. The branch (*n*) after uniting with the two branches of (*q*) ran backwards and divided into (*r*) and (*s*). These two branches gave off twigs, formed an anastomosis again and terminated in L. A. S. The broad nerve (*xy*) after supplying L. A. S. reached S. Mag.

Phrenic nerve of this side was formed by the 5th, 6th and 7th.

SUMMARY.

Rhomboideus was supplied by the 4th, 5th and 6th.

L. A. S. was supplied by the 4th, 5th, 6th, 7th and 8th.

Phrenic nerve was formed by the 5th, 6th and 7th.

SUBJECT NO. 10.

Right: (Plate XXII, fig. 2 and Pl. XXIV.)

Branch A from the 4th after supplying L. A. S. ran up on the surface of the splenius and terminated on the deep face of the anterior part of C. Rhomb.

Branch B from the 5th after supplying some branches to the L. A. S. divided into C and D. These C and D ran up detaching branches to L. A. S. and were connected by a communicating branch E and then the branch D gained the deep face of C. Rhomb. and terminated in it. The branch C on gaining the surface of the splenius, detached a slender branch F to this muscle, then reached the deep face of C. Rhomb. and divided into two branches—J and I. The branch I terminated in C. Rhomb.; while the branch J coursed backwards in a flexuous manner on the deep face of this muscle, became broader at its termination and joined the branch O and formed a small flat fasciculus Q. The branch J also detached two branches from its dorsal face to C. Rhomb.

Branch K from the 6th, after detaching some branches to L. A. S., divided into L and M. The branch M continued its course upwards supplying L. A. S. and divided into N and O. The branch O supplied L. A. S., ran on the surface of the splenius detaching here a slender branch P to this muscle, gained the deep face of C. Rhomb. and was joined by J of the 5th to form the fasciculus Q. This fasciculus Q was continued backwards by a short nerve which divided into R and S. The branch

INVESTIGATIONS ON COURSE AND DISTRIBUTION OF NERVES SUPPLYING

again divided into T and U of which T terminated in C. Rhomb. and U joined the fasciculus Z. The branch R joined the branch X and together with the branch U gave rise to a fasciculus Z. The branch N of M divided into X and Y of which X joined R and U as already said, while the branch Y joined the branch L of K to form nerve (f). The branch L supplied L. A. S., gave off communicating branches V and W at different levels of its upward course to (c) of the 7th and then was joined by Y of N to form the nerve (f).

The nerve (a) from the fasciculus Z continued backwards, joined (f) and formed another fasciculus (m). From this fasciculus (m) started two nerves—one short (b) which terminated in the superficial part of D. Rhomb. and a second long one (g) which supplied the rest of D. Rhomb.

The branch (b) from the 7th, detached a branch (c), which running upwards in the L. A. S. was joined by branches V and W of L at different levels of its course and then terminated in the supero-posterior part of the L. A. S. The branch (b) then ran backwards, joined the branch (d) from the 8th and formed a broad thick nerve (e). This nerve (e) after supplying L. A. S. was continued backwards as SM to supply S. Mag.

Phrenic nerve of this side was formed by branches from the 5th, 6th and 7th nerves.

SUMMARY.

Rhomboideus was supplied by 4th, 5th and 6th.

L. A. S. was supplied by 4th, 5th, 6th, 7th and 8th.

Phrenic nerve was formed by 5th, 6th and 7th.

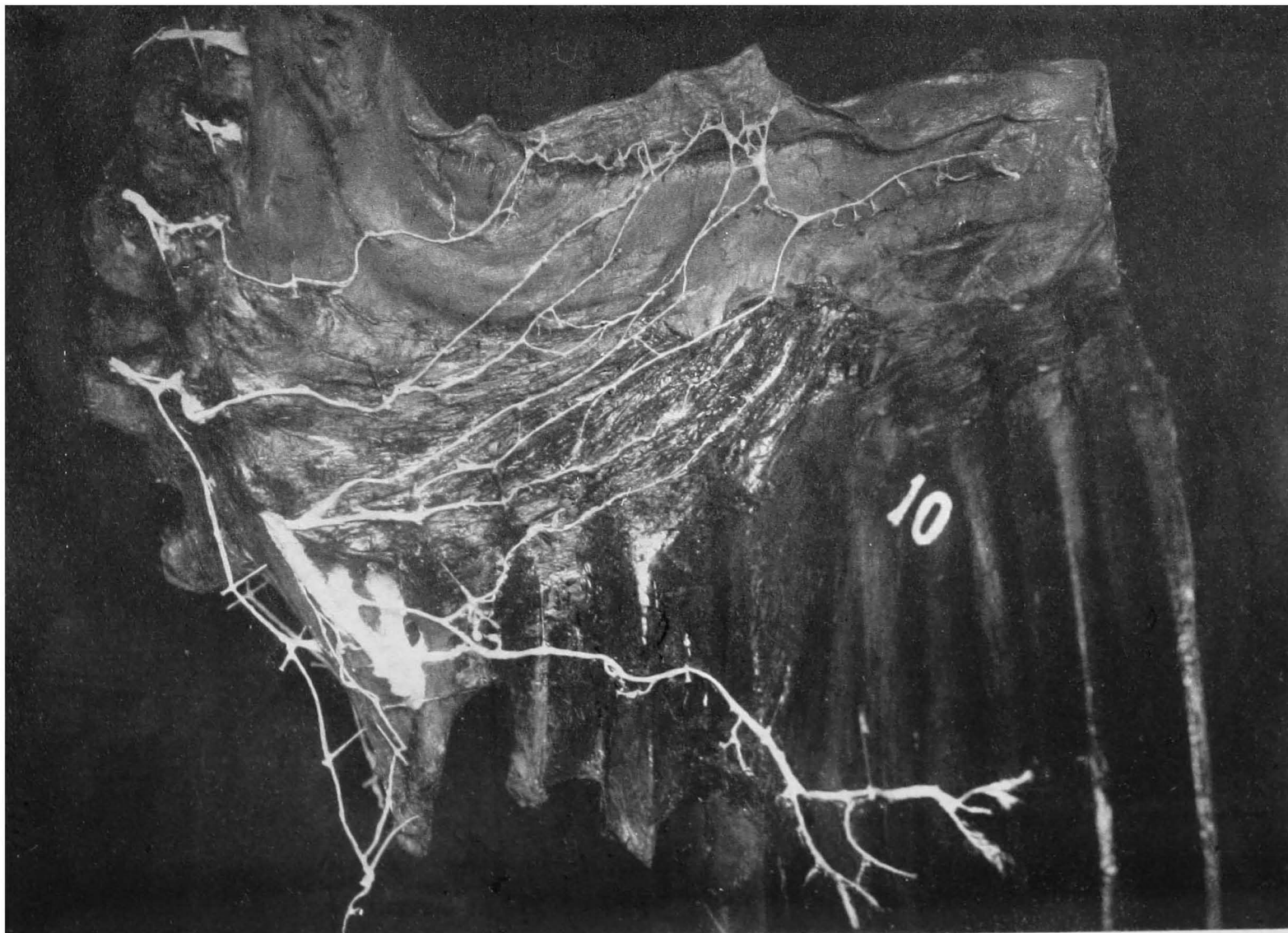
NOTE.—Supply of fine twigs to splenius from the 5th and the 6th is noteworthy.

Left: (Plate XXV, fig. 1 and Pl. XXVI.)

Branch A from the 4th supplied L. A. S. and ran up on the surface of the splenius detaching a branch B to it. Branch A then divided into C and D. The branch C gave off a branch E to the splenius and then terminated in C. Rhomb.; while the branch D after detaching some branches to the anterior part of C. Rhomb., ran back on the deep face of this muscle and joined G from the 5th to form a fasciculus J.

The branch F from the 5th after supplying L. A. S. divided into G and H, of which G, after leaving L. A. S., gained the deep face of C. Rhomb., was joined by D of the 4th and formed the fasciculus J. Nerve (ab) continued this J backwards. The branch H supplied L. A. S., gave off two branches K and L at different levels of its upward course and finally joined (ab) to form a nerve M. This nerve M detached a number of branches from its dorsal face to C. Rhomb. The branch K of H after supplying a few branches to L. A. S. anastomosed with L of H and formed a nerve N and this Q joined R—a branch from the 6th.

The branch N from the 6th divided into O and P of which O after supplying L. A. S. divided into R and S. Branch R joined Q and formed nerve T. The nerve



SUBJECT No. 10.—LEFT.

M broadened itself at its terminal portion and from this broad part of M there issued three branches. M', V and W. The branch V broke off into a number of branches some of which terminated in C. Rhomb., while the others with the branches of W formed a nerve network Y. M' joined T (from the 5th and 6th) and formed X. This branch X united with the backward continuation of W and V and the branch S from O of the 6th and formed a large thick fasciculus Z. The branch S of O, supplied L. A. S., gave off a communicating branch U to (b) of P from the 6th and joined the fasciculus Z. Nerve (a) continued this fasciculus Z backwards and detached from its ventral face a branch to D. Rhomb.

The branch P of N supplied L. A. S. and divided into (b) and (c). Branch (b) received at different levels communicating branches—(d) from (c) and U from S and finally joined the backward continuation of (a) forming a flat fasciculus (f) with it. The branch (c) divided into (d) and (e) of which (d) joined (b) as already said, while (e) terminated in L. A. S. Nerve (n') continued the fasciculus (f) backwards and supplied the D. Rhomb.

The branch (n) from the 7th after detaching a branch (p) which spent itself in the L. A. S., joined the branch (q) from the 8th and formed a broad nerve (t). This nerve (t) after supplying L. A. S. was continued backwards as S. M. to supply S. Mag.

Phrenic nerve of this side was formed by 5th, 6th and 7th.

SUMMARY.

Rhomboides was supplied by 4th, 5th and 6th.

L. A. S. was supplied by 4th, 5th, 6th, 7th and 8th.

Phrenic nerve was formed by 5th, 6th and 7th.

NOTE.—The supply of branches from the 4th to the splenius on this side of this subject is also a noteworthy feature.

SUBJECT NO. 11.

Formation of the phrenic nerve.—Phrenic nerve dissected and examined in this subject showed the following:—

Left: (Plate XXV, fig. 2.)

The branch B arising from the ventral branch of the 5th nerve A, passed downwards and backwards on the *deep face of the scalenus*, giving off a number of short branches in its course to this muscle and entered the thorax. The branch C arising from the 6th and the branch D from the 7th ran down on the *external face of the scalenus* and united together a little in front of the first rib. The common cord thus formed by the union of C and D entered the thorax and joined the branch B from the 5th, a little behind the first rib or opposite to the internal face of the first intercostal space and thus gave rise to the formation of the phrenic nerve.

Right.

The formation of the right phrenic nerve in this subject was quite similar to than on the left side.

SUMMARY.

Phrenic nerve in this subject was formed by the branches from the 5th, 6th and 7th cervical nerves.

SUBJECT NO. 12 (ADULT COW).

Right: (Plate XXVII, fig. 1 and Plate XXVIII.)

Branch A from the 4th, after distributing branches to the anterior part of the L. A. S. became superficial by emerging from under it, ran on the surface of the splenius and divided into B and C. B terminated in the anterior part of C. Rhomb., while C continued backwards in an arched manner on the deep face of C. Rhomb.

Branch D from the 5th ran up in the L. A. S. and divided into E and F. Branch E after supplying some branches to L. A. S. divided into G and H. G spent itself entirely in the L. A. S. The branch H after supplying some branches to L. A. S. divided into K and J. Branch J ran up supplying L. A. S. and divided into L and M. Branch L after a further course and supply (upwards) in L. A. S. was joined by K and formed a nerve N. Branch M ran up superficially over L, F and E', gained the deep face of the posterior part of C. Rhomb. and terminated in it. The nerve N was joined by C of the 4th and the nerve O continued this union backwards. Branch F ran up supplying L. A. S. and one of its branches P joined Y of the 6th and this P before it joined Y detached a fine branch Q and this Q joined F, again. Branch F emerged from under L. A. S., gained the deep face of C. Rhomb. and divided into E' and D'. Branch D' after it was joined by O divided into branches to supply C. Rhomb. Branch E' continued backwards under the terminal part of M of the 5th.

Branch R from the 6th after distributing some branches to L. A. S. divided into S and T. Branch S gave off a number of branches to L. A. S. Of these, the slender branches W and V joined a stout branch U and the fibres issuing from this network supplied by L. A. S. The branch S then divided into X and Y, of which Y was joined by P of F from the 5th, ran up and terminated in L. A. S.; while the branch X after supplying L. A. S. divided into A' and Z. The branch Z was first placed deep, supplied L. A. S., became superficial crossing over A', ran further up in the L. A. S. and divided into B' and C'. Branch C' first crossed superficially over B' and then after a short course upwards got deep under B', ran backwards and terminated in L. A. S., Branch B' after supplying L. A. S. reached the deep face of Rhomb. and divided into F' and G'. Branch F' ran up superficial to K' and terminated in D. Rhomb. Branch G' was joined by the backward continuation of E'.

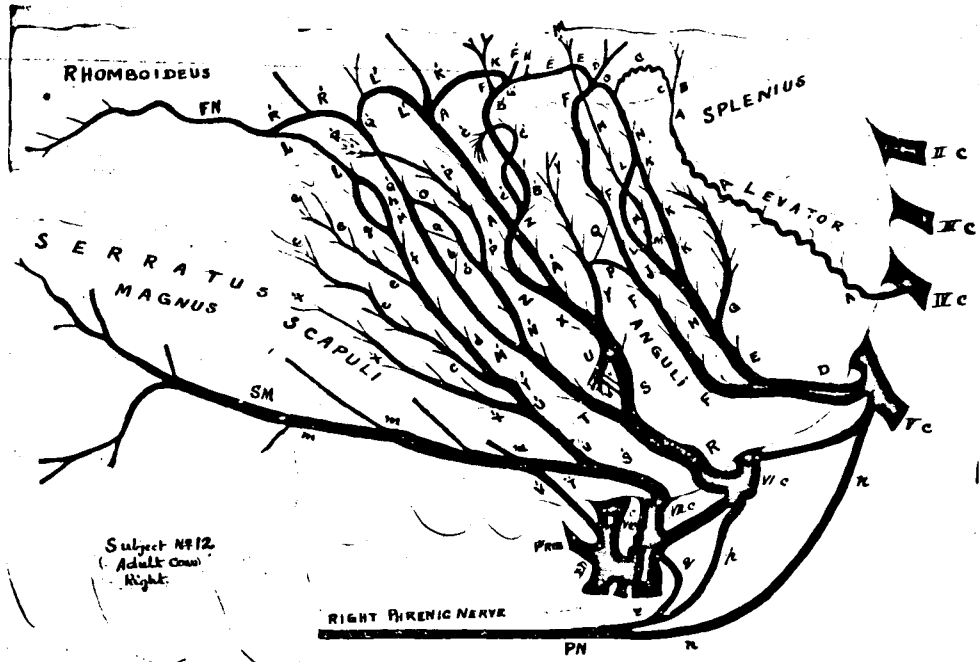


FIG. 1.

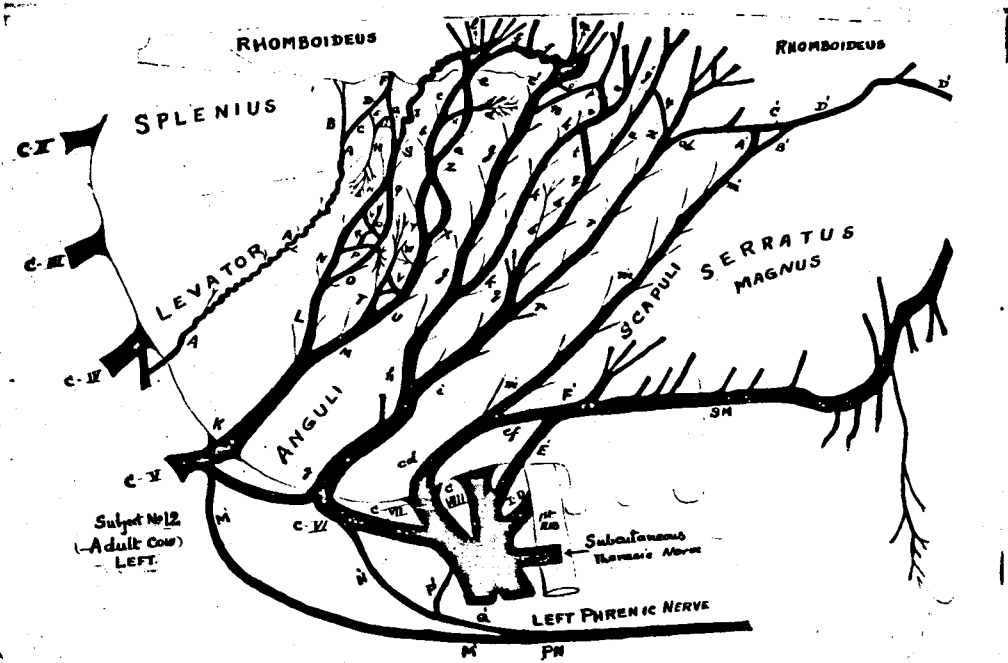
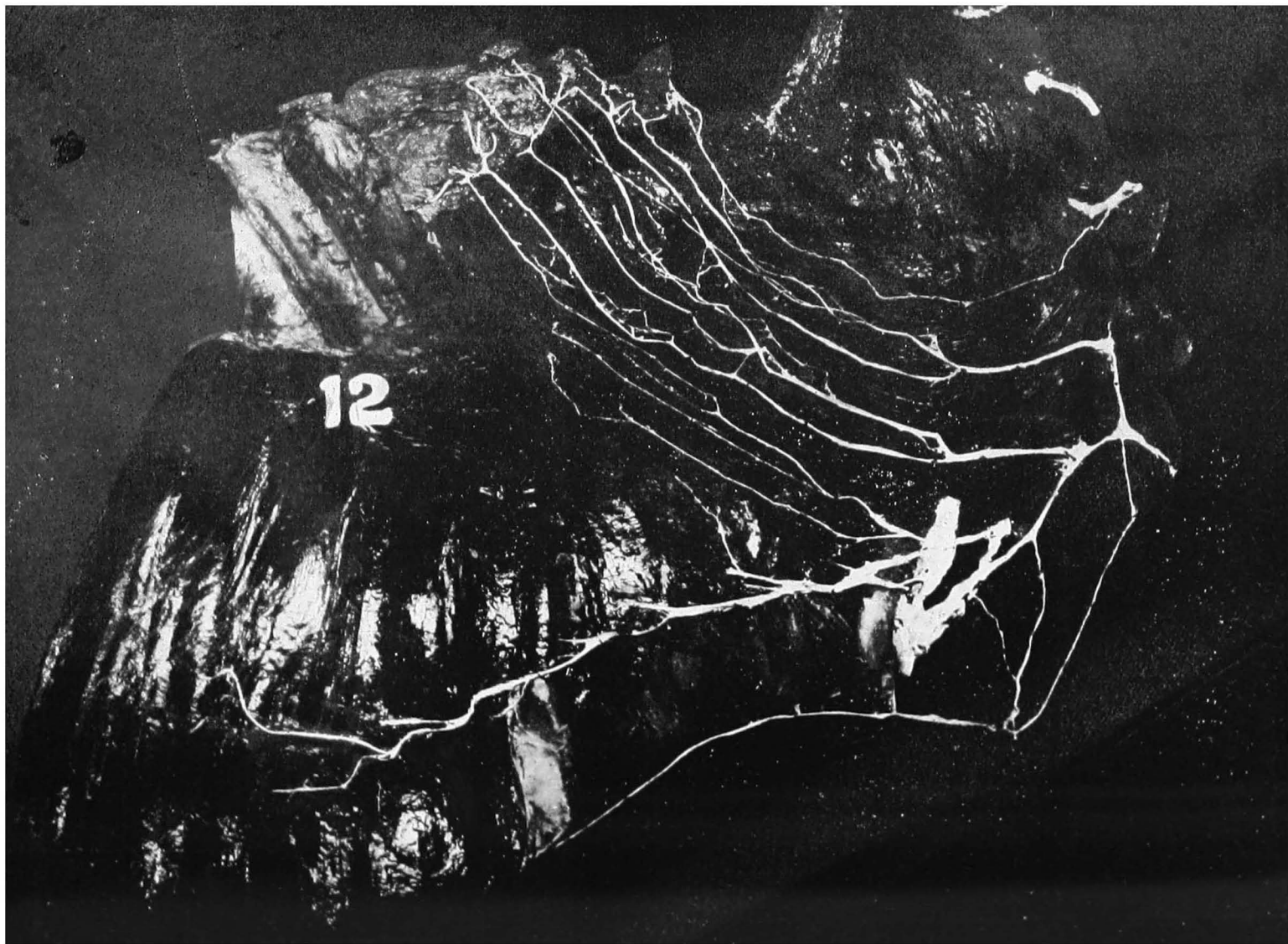
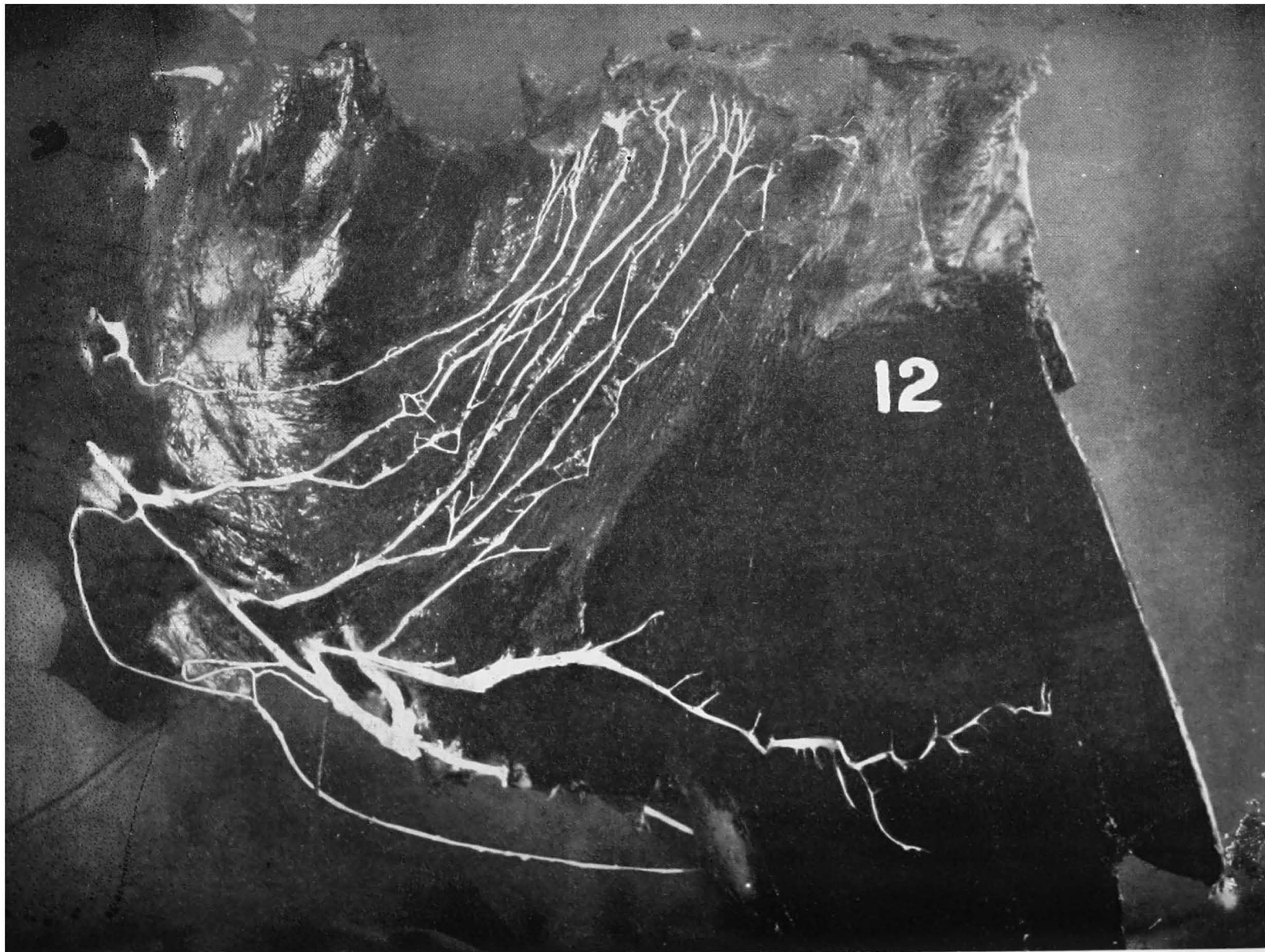


FIG. 2.



SUBJECT NO. 12.—RIGHT.



SUBJECT NO. 12.—LEFT.

From the dorsal face of E' and the dorsal face of union of E' and G' there started three branches H', F' and K'; of these, H' and F' supplied D. Rhomb. and terminated in it. K' continued from this union backwards, ran under F', detached a large branch from its dorsal face to D. Rhomb. and then joined A'. Branch A' ran up supplying L. A. S. under Z and on emerging from under L. A. S. was joined by K'. A nerve L' resulting from this union of K' and A' arched backwards.

The branch T crossed upwards deep in the L. A. S. and divided into M' and N'. N' again divided into O' and P'. P' ran up detaching branches to L. A. S., crossed backwards under Q' and terminated in L. A. S. Branch O' received a communicating branch (b) from M', gave off in its turn a communicating branch (a) to M' and finally joined M' to form a nerve Q'. Branch M' after giving off (b) to O' and getting (a) from O' united with O' as already said and formed the nerve Q'. This Q' supplied L. A. S., ran up superficial to P' and was joined by L'. Branches issued from the dorsal face of this union and spent themselves in D. Rhomb. A nerve R' continued from the union of L' and Q', detached a branch to D. Rhomb. and then joined (l) from the 7th.

The branch S' from the 7th divided into T' and U'. Branch U' divided into X' and Y'. The branch Y' divided into (c) and (d) of which (c) terminated in L. A. S., while (d) divided into (e) and (f). Branch (e) terminated in L. A. S. The branch (f) divided into (g) and (h), both of which again united to form a nerve (l). This (l) was joined by R'. Nerve FN continued from this union backwards and supplied the rest of D. Rhomb. The branch X' terminated in L. A. S. The branch T' was joined by V' from the 8th and the broad nerve (m) formed by this union ran backwards supplying L. A. S. and then was continued as SM to supply S. Mag.

The phrenic nerve of this side was formed by the roots from the 5th, 6th and 7th (*n*, *p*, *q* respectively). The cord (*r*) resulting from the union of the roots from the 6th and 7th (*p* and *q*) joined the root from the 5th (*n*) and formed the final phrenic nerve PN. This PN after running a course backwards for about two inches in the neck, entered the thoracic cavity, reached the right side of the tendinous part of the diaphragm and was distributed to it.

SUMMARY.

- L. A. S. was supplied by 4th, 5th, 6th, 7th and 8th cervicals.
- Rhomboides was supplied by 4th, 5th, 6th and 7th.
- Phrenic was formed by the roots from 5th, 6th and 7th.

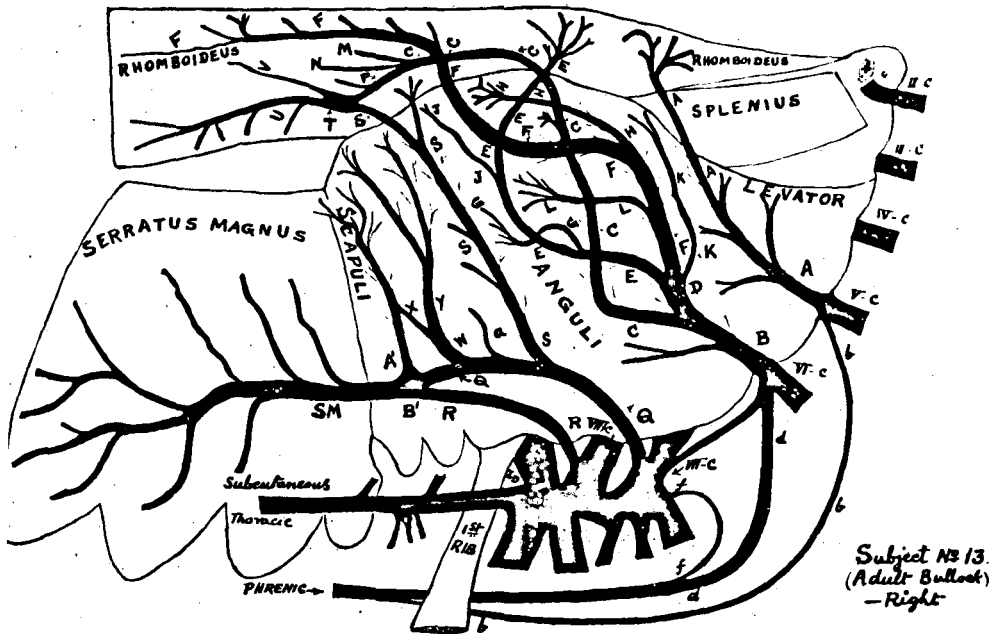
Left: (Plate XXVII, fig. 2 and Plate XXIX.)

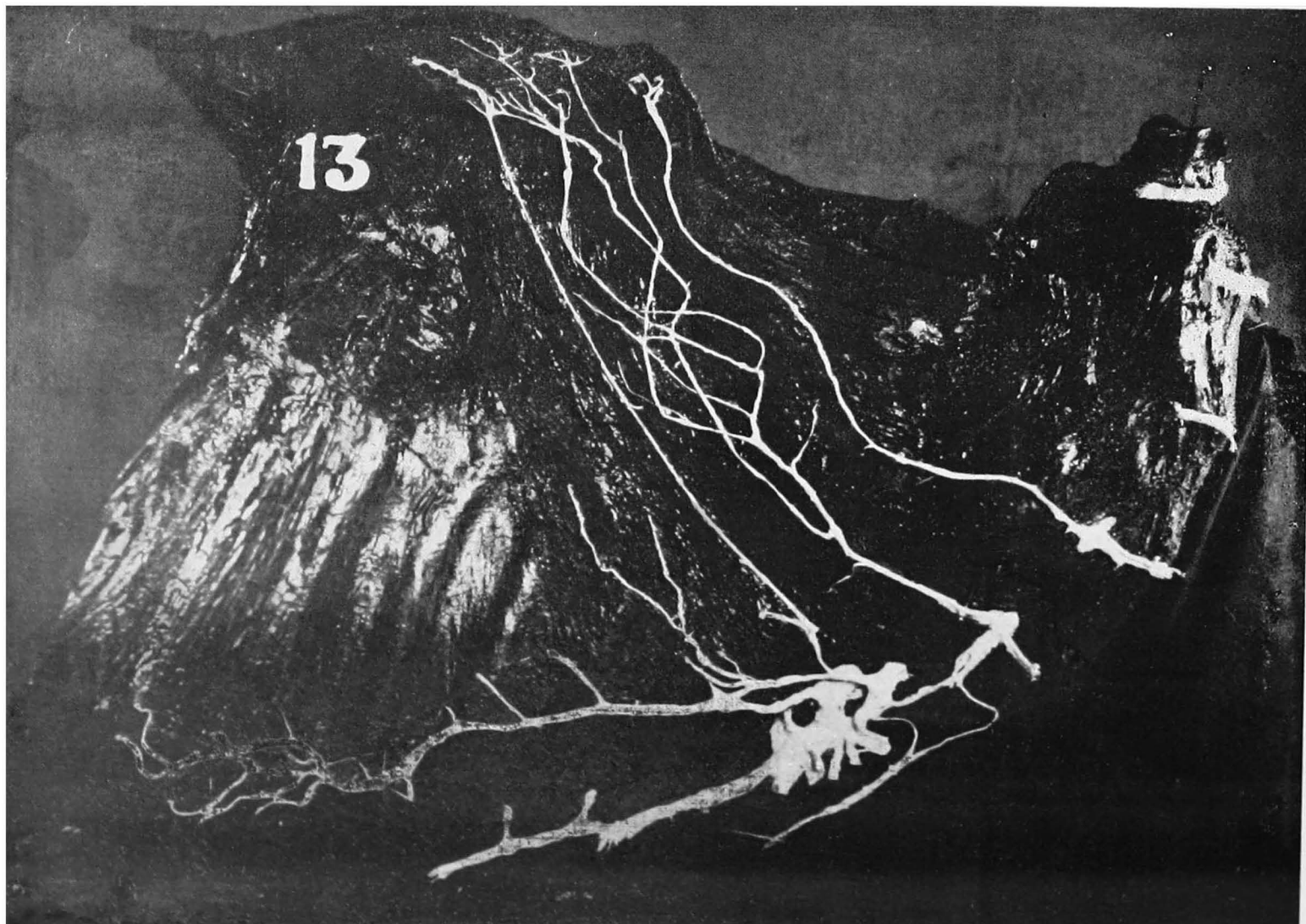
Branch A from the 4th ran up deep in the anterior part of L. A. S. supplying fine filaments to it, became superficial by emerging from under it, ran up on the splenius and divided into B and C. The branch B terminated in the most anterior part of

. Rhomb., while C divided into D and E. The branch E joined (*a'*) of G and formed H, and this branch H ran down and branched to supply L. A. S. The branch D joined G and formed F which spent itself in C. Rhomb.

Branch K from the 5th divided after a short distance up in the L. A. S. into L and M. The branch L distributed some branches to L. A. S. and then divided into N and O. The branch N ran up in the L. A. S. supplying it and one of its branches P after it was joined by branch R from Q, got deeply under O and terminated in L. A. S. The branch N then joined the branch O of L. The branch O supplied L. A. S. and one of its branches Q divided into three branches—the branch R joined P of N, the branch (*b'*) joined the branch N and the third branch spent itself in the L. A. S. The branch O then joined N and together formed a nerve S and this S after emerging from under the L. A. S. divided into G and J. The branch G after detaching a branch (*a'*) which joined E of C to form H, joined D of C to form F as already said. The branch J continued backwards on the deep face of C. Rhomb. in an arched manner. The branch M after supplying L. A. S. for a short distance divided into T and U. The short branch T was joined by branches V and W of U and terminated in L. A. S. The branch U after detaching the communicating branches V and W to L. A. S., ran up in the L. A. S. and divided into X and Y. These two branches X and Y again united after a short course up in the L. A. S. and formed a nerve Z. This branch Z again divided into a narrow branch (*a*) and a thick branch (*b*). The branch (*b*) divided into (*c*) and (*d*). The branch (*d*) ran superficially crossing over the branch (*a*) and terminated in L. A. S. The branch (*c*) joined (*a*) which ran up deep under (*d*) and formed a nerve (*e*). This branch (*e*) was joined by the backward continuation of J and formed a flat fasciculus (*l*). About five branches started from the dorsal face of this fasciculus (*l*) to supply C. Rhomb. and a branch (*f*) continued backwards from this fasciculus and detached a branch in its turn from its dorsal face to C. Rhomb.

The branch (*g*) from 6th after detaching some branches to L. A. S. ran up deep in the muscle and divided into (*h*) and (*i*). The branch (*h*) ran up supplying L. A. S. and divided into (*j*) and (*k*). The branch (*j*) after supplying and emerging from under L. A. S. divided into (*c'*) and (*n*). The branch (*c'*) was joined by the backward continuation (*f*) and formed another flat fasciculus (*m*). This fasciculus (*m*) detached a number of branches from its dorsal face to Rhomb. The branch (*n*) continued backwards and was joined by a fine branch (*o'*) from the fasciculus (*m*) and the nerve (*p*) resulting from this union coursed backwards detaching a branch from its dorsal face to D. Rhomb. The branch (*k*) ran up supplying L. A. S., was joined by (*t*) of (*q*) and then divided into (*v*) and (*w*). The branch (*v*) was joined by the backward continuation of (*p*), while branch (*w*) divided into branches and terminated in D. Rhomb. The branch (*i*) supplied L. A. S. for a short distance and then divided into (*q*) and (*r*). The branch (*q*) detached a number of branches to L. A. S., but one of its branches (*s*) rejoined (*q*). The branch (*q*) then divided into (*t*) and (*u*). The branch (*t*) joined (*k*) as already said, while the branch (*u*) divided into (*y'*) and





SUBJECT No. 13.—RIGHT.

(*y*). The branch (*y'*) terminated in D. Rhomb., while (*y*) continued its course backwards. The branch (*r*) supplied L. A. S. and on gaining the deep face of D. Rhomb. divided into (*x*) and (*ab*). The backward continuation (*y*) joined (*x*) from whose dorsal face a number of branches sprang up to supply D. Rhomb. The branch (*ab*) continued backwards.

The branch (*cd*) from the 7th ran up in the L. A. S. and divided into (*m'*) and (*ef*). The branch (*m'*) supplied L. A. S. and divided into A' and B'. The branch A' joined the backward continuation (*ab*) and formed a short cord C'. This cord C' was then joined by B' and formed D' which ran up in D. Rhomb. and distributed branches to it. The branch (*ef*) joined the branch E' from the 8th and formed a broad nerve F' which ran on the posterior part of L. A. S. supplying branches to it from its dorsal face and was continued as SM to supply S. Mag.

The phrenic nerve of this side was formed by the roots—M' from the 5th, N' from the 6th and P' from the 7th. The roots N' and P' formed a cord Q' which was then joined by M' from the 5th and formed PN—the phrenic nerve. This PN ran down the neck for a distance of about two inches, as on the right side of this subject and then entered the thoracic cavity.

SUMMARY.

L. A. S. was supplied by 4th, 5th, 6th, 7th and 8th cervicals.

Rhomboideus was supplied by 4th, 5th, 6th and 7th.

Phrenic nerve was formed by 5th, 6th and 7th.

GENERAL NOTES.

1. The final formation of the phrenic nerve by the union of the common cord from the 6th and 7th with the 5th, as has been noticed till now, is usually in the thoracic cavity behind the level of the first rib or opposite the internal face of the first intercostal space. The interesting and noteworthy feature in this subject is that this union was noticed on both sides in the neck but not inside the thoracic cavity.

2. The formation of two flat fasciculi was observed on the left side of this subject and none such were found on the right side. But in the previous subjects examined, formation of a larger number of these fasciculi was observed on both sides.

3. The eleven subjects in which the investigation was previously made to study this nerve distribution were all buffaloes. This subject—No. 12—was an adult cow.

SUBJECT NO. 13 (ADULT BULLOCK).

Right: (Plates XXX & XXXI.)

The branch A from the 5th, after distributing branches to L. A. S. in its upward course, ran up superficially on the splenius, reached the deep face of C. Rhomb. and terminated in two branches. Both these in their turn branched and distributed themselves to C. Rhomb.

The branch B from the 6th, after a short course upwards in the L. A. S. detached ranches to L. A. S. and divided into C and D. The branch D gave off some fine ranches and one large branch K to L. A. S. and then divided into E and F. The ranch E crossed backwards over C, ran superficially upwards and detached two ranches—G and J to L. A. S. Of these, the branch G got deep under E and terminated in L. A. S. after crossing under E. The branch E then crossed over the ranches F, H and C in succession from below upwards, reached the deep face of D. Rhomb. and divided into five branches—all of which terminated in C. Rhomb. The branch F hereafter proceeded upwards and backwards and gave off a first branch which crossing under the branch C terminated in L. A. S. It then detached a second branch H which coursed backwards over the branch C and under the branch J, got gradually deeper and terminated in L. A. S. The branch F then crossed backwards over the branch C and under the branch E, reached the deep face of D. Rhomb. crossed then the branch C and terminated here by giving off a number of branches from its dorsal face to D. Rhomb. The branch C took a deep course upwards in L. A. S., ran up under the branch E (at its beginning), over the branch L and under the branches F, H and E (at its upper part). On gaining the deep face of D. Rhomb., it crossed under the terminal part of the branch F again, ran backwards and divided into three branches—M, N and P. Of these, the branches M and N terminated in D. Rhomb., but the branch P ran further backwards and joined the branch S from the 7th.

The branch Q from the 7th took a backward course. It detached a branch S which, placing itself deep in the L. A. S., took a straight course upwards detaching ranches to L. A. S. and as it reached the deep face of D. Rhomb. it was joined by branch P from the 6th. This union gave rise to the formation of a broad fasciculus R. Two nerves—one short (*v*) and one long (*u*)—started from the dorsal face of this fasciculus and both these terminated in D. Rhomb.

The branch Q then took a further backward course after detaching the branch S and gave off one small branch (*a*) and a large branch W from its dorsal face. The small branch entered L. A. S. and terminated in it. The large branch W divided, after going up for a short distance, into branches X and Y.

The branch Y proceeded further upwards, divided into branches and terminated in the posterior part of L. A. S. The branch X joined a branch A'.

The branch Q, after detaching branches S and W, joined a branch R from the 8th and formed a broad nerve B'. Just at the point of union of the branches S and R and that from its dorsal face, a branch A' was detached and this branch was joined by the branch X of W as already said. The united nerve then supplied the posterior part of L. A. S. The broad nerve B' after supplying branches to L. A. S. continued backwards (SM) on the serratus magnus and supplied this muscle.

Phrenic nerve in this subject was formed by the roots from the 5th, 6th and 7th cervicals. The noteworthy point here is that the branch from the 5th was not the largest but that it was next in size to that from the 6th. The branch from the 6th

was the largest. The final formation of the phrenic nerve was in the thoracic cavity—behind the first rib.

NOTE.—A number of interesting points observed in the previous subjects, such as the repeated branching of the nerves supplying L. A. S. and Rhomb., series of anastomosis, formation of a common cord by the union of various nerves on the deep face of Rhomb, and the formation of a number of fasciculi at such points of union, were not noticed in this subject. The whole of the branch from the 5th and most of the branches from the 6th terminated independently in C. Rhomb. Only one of the branches of the 6th united with a branch from the 7th and a flat fasciculus was formed at the point of this union. The disposition of the nerves supplying L. A. S. and Rhomb. was rather very simple in this subject.

SUMMARY.

L. A. S. was supplied by the 5th, 6th, 7th and 8th cervicals.

Rhomb. was supplied by the 5th, 6th and 7th cervicals.

Phrenic was formed by the roots from the 5th, 6th and 7th (the branch from the 6th being the largest).

DISCUSSION.

BRADLEY [1896] names the L. A. S. in the horse as *Depressor anguli scapuli* and states that it is supplied by the 6th and 7th cervical nerves. The nerve supply to the cervical and dorsal part of the rhomboideus in the horse is said to be from the 6th cervical and to the S. Mag. from the Superior thoracic branch (Nerve to S. Mag.) of the brachial plexus. In describing the branches of the brachial plexus he mentions that the angularis and rhomboideal branches terminate in the L. A. S. and rhomboideus. As to the phrenic nerve in the horse, he says that it is formed by the branches from the 5th, 6th and 7th cervical nerves and that the branch from the 5th is inconstant. He further adds [1922] that the root from the 5th when present is smaller than the other two. The comparative differences in the nerve supply to these muscles in the ox are not noted. It is merely pointed out that [1896] the comparative differences are of minor importance.

CHAUVEAU [1891] in describing the branches of the brachial plexus (horse) says that the 6th cervical supplies the L. A. S. and rhomboideus and that the 6th and 7th supply S. Mag. But in describing the differential characters of the brachial plexus in the ruminants, he clearly asserts that there are no differences in the branches of angularis and rhomboideus. So far as the author is aware, he is the only anatomist who has made a definite and clear statement like this. The author's investigation shows that his finding is not correct.

As he has not recorded any differential points in the formation of the phrenic nerve in the ox, it would appear that he has not met with any differences worthy of note. He particularly mentions under the ruminants, the phrenic nerve of the sheep and says that it is formed from the 5th (running under the scalenus) and the 6th (running on the outer surface of the scalenus)—the union being on the inner surface of the first rib.

M'FAYDEAN [1902], in describing the branches of the brachial plexus and that with reference to the nerve supply to L. A. S. (horse), says that they are not, strictly speaking, branches of the brachial plexus but come from the inferior primary

branches of the 6th nerve and pierce the muscle either together or separately. They are distributed to the L. A. S. and the posterior of the two is continued in that muscle to reach the rhomboideus. He further states that the nerve to S. Mag. is formed by the union of the branches from the 7th and 8th nerves and that the 7th before fusion with the 8th gives off a nerve which is distributed to both the L. A. S. and S. Mag.

It is thus learnt that the L. A. S. is supplied from the 6th and 7th, rhomboideus from the 6th and S. Mag. from the 7th and 8th cervicals.

As to the phrenic nerve, he states that it is formed by the union of two and sometimes three branches. He further notes that the inconstant branch is from the 5th cervical and the other two come from the 6th and 7th. He observes that *the root of the 6th first unites with the root from the 5th when that is present* and the resulting single cord then passes backwards and downwards and at the lower edge of the scalenus joins the root from the 7th.

As M'Faydean's anatomy is purely a book on the horse and does not deal with the comparative anatomy of other animals, differences in these nerves, if any in the ox-type, are not contained in this book.

SISSON [1914] names the L. A. S. and S. Mag. as one muscle—*SERRATUS VENTRALIS* (horse) and divides it into cervical and thoracic parts—*Serratus cervicis* and *Serratus thoracis*. He does not mention in detail the nerve supply to these two parts separately but notes that the nerve supply to *serratus ventralis* is from the 5th to 8th cervicals.

In his description of the cervical nerves he states against the 5th that it often contributes a small twig to the phrenic nerve. In describing the ventral branch of the 6th nerve, he says that it supplies twigs to the cervical part of the *serratus* and *rhomboideus* and furnishes a root of the phrenic nerve. In describing the branches of the 7th and 8th, he notes that the dorsal branches ascend between the *longissimus dorsi* and *multifidus*, supplying these muscles and giving off twigs to *rhomboideus*, skin, *semi-spinalis*, etc. ; while the ventral branch of the 7th contributes the posterior root of the phrenic nerve. *Rhomboideus* in the horse, as observed by Sisson, therefore, gets the nerve supply from the 6th and 7th cervical nerves. He describes the phrenic nerve as follows :—It is formed by the union of two or three roots which run obliquely downwards and backwards over the superficial face of the *scalenus* muscle and the chief roots are from the ventral branches of the 6th and 7th cervical nerves. The nerve crosses the ventral border of the *scalenus* a fingerbreadth in front of the first rib and then enters the thorax.

In his comparative myology of the ox, he does not mention the differences in the nerve distribution to the muscles in question but states against his description of spinal nerves, the brachial plexus and its branches as follows : The spinal nerves resemble those of the horse in origin and general arrangement. The differences in the nerves above the elbow are not of sufficient moment to receive notice in this brief account.

STRANGEWAYS [1904] does not mention the nerve supply to any of the muscles of the horse-type, but in describing the disposition of the cervical spinal nerves he observes that the inferior branches of the 3rd, 4th, 5th and 6th cervical nerves pass through the intertransverse muscle and divide into deep and superficial branches, the one being distributed to the deep muscles of the neck and the anterior part of the shoulder and the other to the skin of the neck and the panniculus. He further states that the deep branches of the 6th and 7th and a filament from the 5th help to form the phrenic or the diaphragmatic nerve. No note of nerve distribution to these muscles is made either in his comparative neurology or myology of ruminantia. It is therefore not possible to make out anything definite of the nerve supply to the muscles in question either in the horse or in the ox from the information available in this book.

In the dissections on the horse all these years, L. A. S. and rhomboideus have always been found getting the nerve supply from the 6th cervical nerve. The branch from the 7th before joining the branch from the 8th to form the "nerve to S. Mag." was always found to detach a branch which worked upwards and behaved as a common "nerve to L. A. S. and S. Mag." and distributed branches to both these muscles. If the L. A. S. and S. Mag. put together be considered as serratus ventralis (Sisson), then the total number of nerves found supplying this muscle was from the 6th to the 8th. Of the reference books available, it is only Sisson's that says that the nerve supply to this muscle is from the 5th to 8th, while the author's findings are in accordance with those of the other anatomists.

As to the phrenic nerve in the horse, its root from the 5th was absent in some subjects but when present, it was the longest and the narrowest of the three roots. A slight deviation in the order of union of these roots was met with in two subjects. The root from the 5th instead of uniting with that from the 6th, passed down on the surface of the scalenus and united with the common cord formed by the union of the roots from the 6th and 7th. (Figures A and B.)

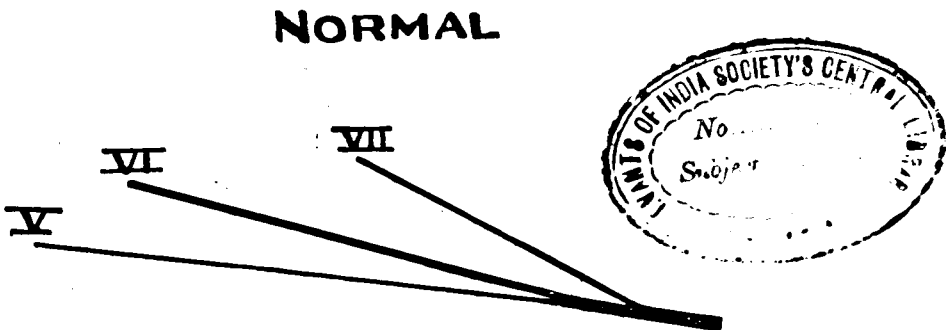


Fig. A, Horse-Phrenic nerve formation—normal,

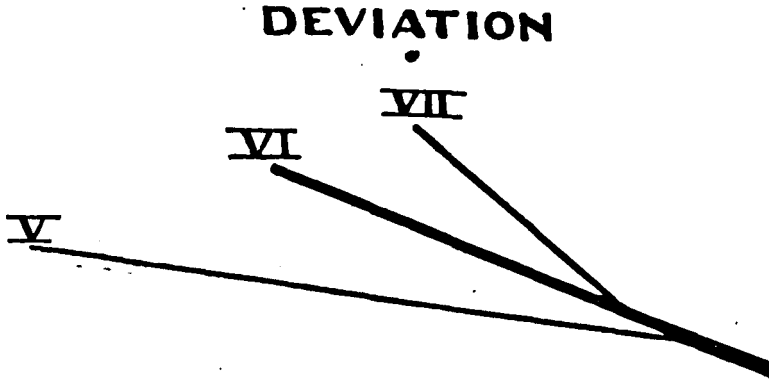


FIG. B. Horse-Phrenic nerve formation—deviation.

L. A. S. and rhomboideus examined in twelve subjects showed the following nerve supply :—

1. L. A. S. in nine subjects was found supplied from the 4th to 8th cervicals.
L. A. S. in three subjects was found supplied from the 5th to 8th cervicals.
2. Rhombodeus in five subjects was found supplied from the 4th, 5th and 6th cervicals.
Rhomboideus in one subject was found supplied from the 5th and 6th cervicals.
Rhomboideus in two subjects was found supplied from the 6th and 7th cervicals.
Rhomboideus in four subjects was found supplied from the 4th, 5th, 6th and 7th cervicals.
3. Phrenic nerve examined in eleven subjects was found as follows :—
In eight subjects was found formed by the 5th, 6th and 7th.
In two subjects was found formed by the 5th, 6th and 7th (left)—4th, 5th, 6th and 7th (right).
In one subject was found formed by the 5th and 6th (left)—4th, 5th and 6th (right).

The branch from the 5th was, in all cases the largest and the longest. It ran down *the deep face of the scalenus*, while the branches from the 6th and 7th were found placing themselves on the *superficial face* of the scalenus. Branches from the 6th and 7th first united and this cord then united with the branch from the 5th behind the level of the first rib or at the internal face of the first intercostal space and formed the phrenic nerve. (The phrenic nerve in the horse gets completely formed even a little in front of the first rib—at any rate before its entrance into the thorax).

In three out of the eleven subjects examined, a branch from the 4th cervical also contributed towards the formation of this nerve. The behaviour, position and the length of this branch from the 4th was not similar in all the subjects it was found

in. In one subject, this branch ran down the dorsal border of the scalenus for a distance of about four inches giving off a number of twigs to this muscle, inclined then on to the deep face of that muscle and finally united with the branch from the 5th. In a second subject, the branch from the 4th passed downwards and backwards for about only one inch on the deep face of the extreme upper part of the scalenus and then joined the branch of the 5th immediately after the origin of the latter. The branch from the 4th in a third subject, proceeded down to the ventral border of the scalenus for a distance of about 7 inches giving off twigs to this muscle (almost to a little above the insertion of this muscle to the first rib), then inclined to its deep face and united with the branch from the 5th.

SUMMARY.

1. The usual nerve supply to the levator anguli scapuli is from the 5th to 8th cervicals. Very frequently, it is also supplied by a branch from the 4th.

2. The nerve supply to rhomboideus, generally, is from 5th and 6th cervicals. It often gets a supply from the 4th also. Occasionally, branches from the 7th contribute towards the nerve supply of this muscle.

3. The nerve supplying the levator anguli scapuli and rhomboideus, besides being more flexuous than in the horse, show very frequent anastomosis which condition is not met with in the horse.

4. The formation of flattened and various shaped fasciculi at the junction of the various nerves supplying the rhomboideus on the deep face of the muscle, the coursing backward of the united nerve in an arch-like manner giving off twigs (entering the deep face of the rhomboideus) mostly from its dorsal face and the ease with which the common cord could be traced to the most posterior part of the dorsal rhomboideus all along its deep face are points not experienced in the dissection of the "nerve to rhomboideus" in the horse.

5. (a) The branches from the 5th, 6th and 7th usually form the roots of the phrenic nerve in the ox.
- (b) The branch from the 5th which is inconstant in the horse, is always present in the ox.
- (c) The branch from the 5th is the largest and the longest and is *always placed on the deep face of the scalenus.*
- (d) The branches from the 6th and 7th are *always on the superficial face of the scalenus.*
- (e) Sometimes, a branch from the 4th cervical nerve also forms one of the roots of the phrenic nerve.
- (f) The branch from the 7th is the shortest and the narrowest.
- (g) The branches from the 6th and 7th first unite and this cord then enters the thorax where it is joined by a branch from the 5th behind the level of the first rib.

30 INVESTIGATIONS ON COURSE & DISTRIBUTION OF NERVES SUPPLYING LEVATOR, ETC.

- (h) When the 4th nerve enters into the formation of the phrenic, the branch from the 4th first unites with that from the 5th and the common cord resulting from this meets the common cord formed by the union of the branches from the 6th and 7th, in the thorax.

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SECTION II
Observations on Certain Anatomical Deviations.

II. OBSERVATIONS ON CERTAIN ANATOMICAL DEVIATIONS.*

1. UNDUE DEVELOPMENT OF THE NODULE ON THE CORACOID PROCESS OF THE SCAPULA.

In most of the animals (horse) the area of the coracoid process of the scapula from which the coraco-humeralis originates is only in the form of a small nodule and Sisson has observed that this nodule in exceptional cases shows an undue development and then is in the form of a large process measuring an inch or more ($2\frac{1}{2}$ -3 cm.).

During his observations, the author has come across two cases (horse) in which both sides scapulae showed undue development of these nodules and measurements of these were found to be even greater than the ones recorded by Sisson ($1\frac{1}{2}$ -2 inches). (Plate XXXII, fig. 1.)

2. AN INDEPENDENT NERVE TO CORACO-HUMERALIS.

Usually, the nerve supply to the biceps and coraco-humeralis is from a common source "the nerve to biceps and coraco-humeralis" (a branch given off from the median either from its anterior root or from the united nerve) which after supplying the coraco-humeralis terminates in the biceps.

In seventeen cases (dissection subjects-horse), the nerves to biceps and coraco-humeralis were independent of each other, both arising from the median one below the other—(Plate XXXII, fig. 2.)

NOTE.—In cases where the "nerve to biceps and coraco-humeralis" was detached from the united nerve, the new branch that has been referred to also came off from the united nerve about an inch below the "nerve to biceps and coraco-humeralis." In cases where this branch common to the biceps and coraco-humeralis came off from the anterior root of the median, the new branch referred to also came off from the anterior root about an inch below the common "nerve to biceps and coraco-humeralis."

3. NERVE TO LEVATOR ANGULI SCAPULI AND RHOMBOIDEUS.

Though this nerve has been mentioned in the text-books as one among the branches of the brachial plexus, the fibres of this nerve have nothing to do with this plexus, in as much as they are derived from the inferior primary branches of the sixth cervical nerve. These fibres are then disposed off in two branches, Anterior and Posterior, and these two branches pierce the upper border of the scalenus. The anterior then places itself entirely in the levator anguli scapuli, while the posterior not only supplies this muscle but runs up in this muscle to terminate in the rhomboideus.

*Pages 32-52 (articles 1 to 37) are reprinted from the *Indian Veterinary Journal*.

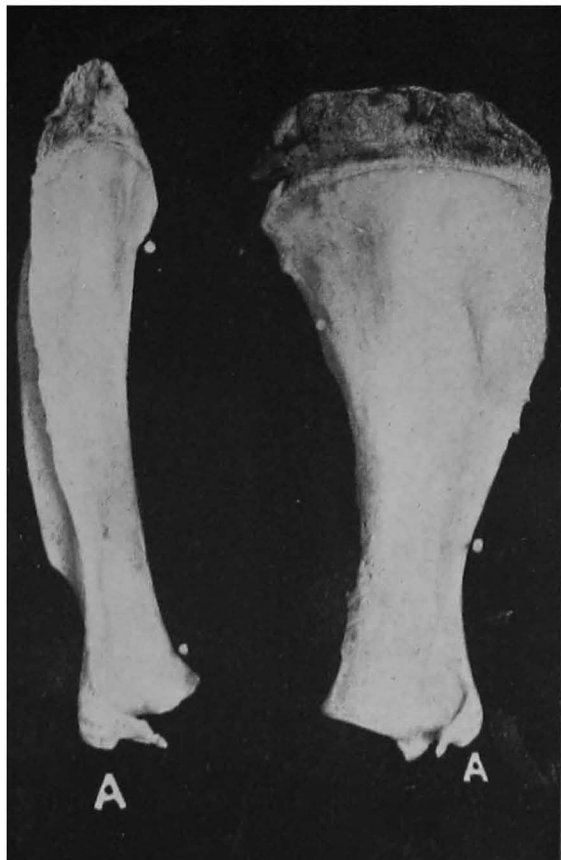


FIG. 1. A : Coracoid Process.

(By the courtesy of the Editor, Indian Veterinary Journal.)

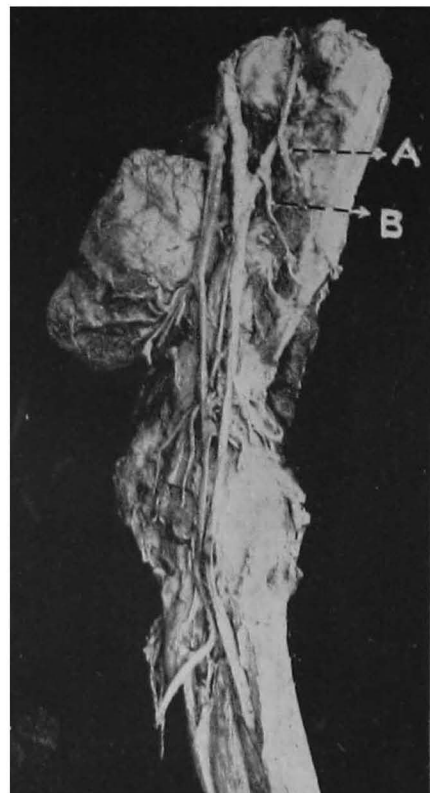


FIG. 2. A : Nerve to Coraco-humeralis and biceps.

B : Independent to coraco-humeralis.



FIG. 1. A: Coracoid Process.

(By the courtesy of the Editor, Indian Veterinary Journal.)

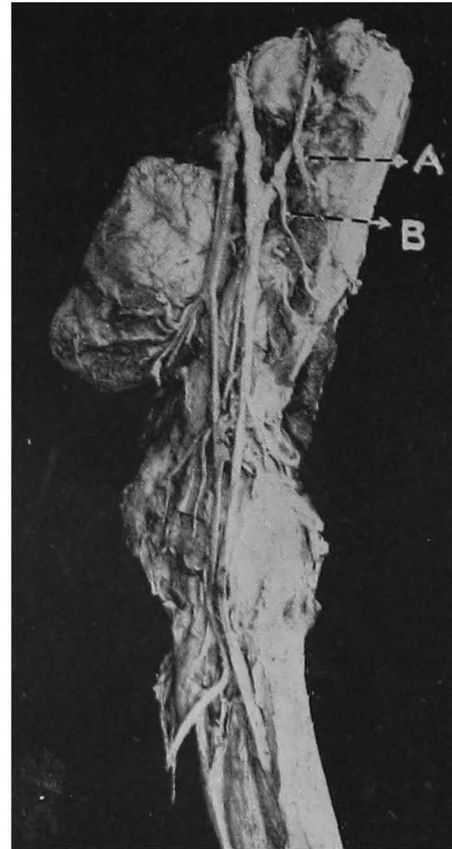
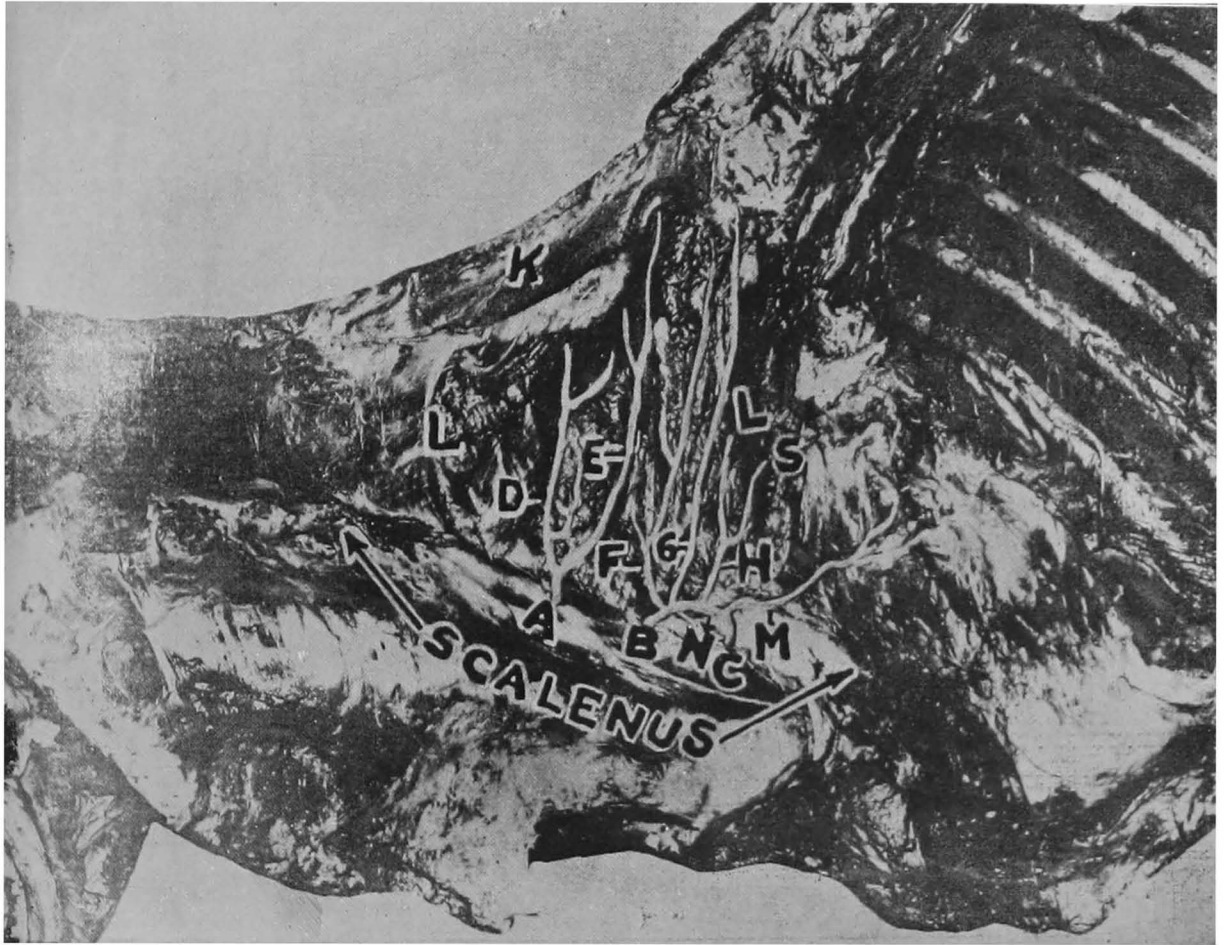


FIG. 2. A: Nerve to Coraco-humeralis and biceps.

B: Independent to coraco-humeralis.



KEY TO PLATE.

- | | |
|--|--|
| <p>A : branch of the sixth cervical nerve.
 B : branch of the seventh nerve.
 C : branch of the eighth nerve.
 D : anterior branch of A.
 E : posterior branch of A.
 F, G & H : anterior, middle and posterior branches of B.</p> | <p>N : backward continuation of H joining C to form the nerve to serratus magnus—M.
 K : rhomboideus.
 L to L' : levator anguli scapuli.
 S : anteriormost part of serratus magnus.
 M : nerve to serratus magnus.</p> |
|--|--|

(By the courtesy of the Editor, Indian Veterinary Journal.)



FIG. 1.

B: Brachial artery.
P: Prehumeral artery.
M: Largest muscular branch to biceps.
U: Branch of M going up to P. (A) Anastomosis of U & P.

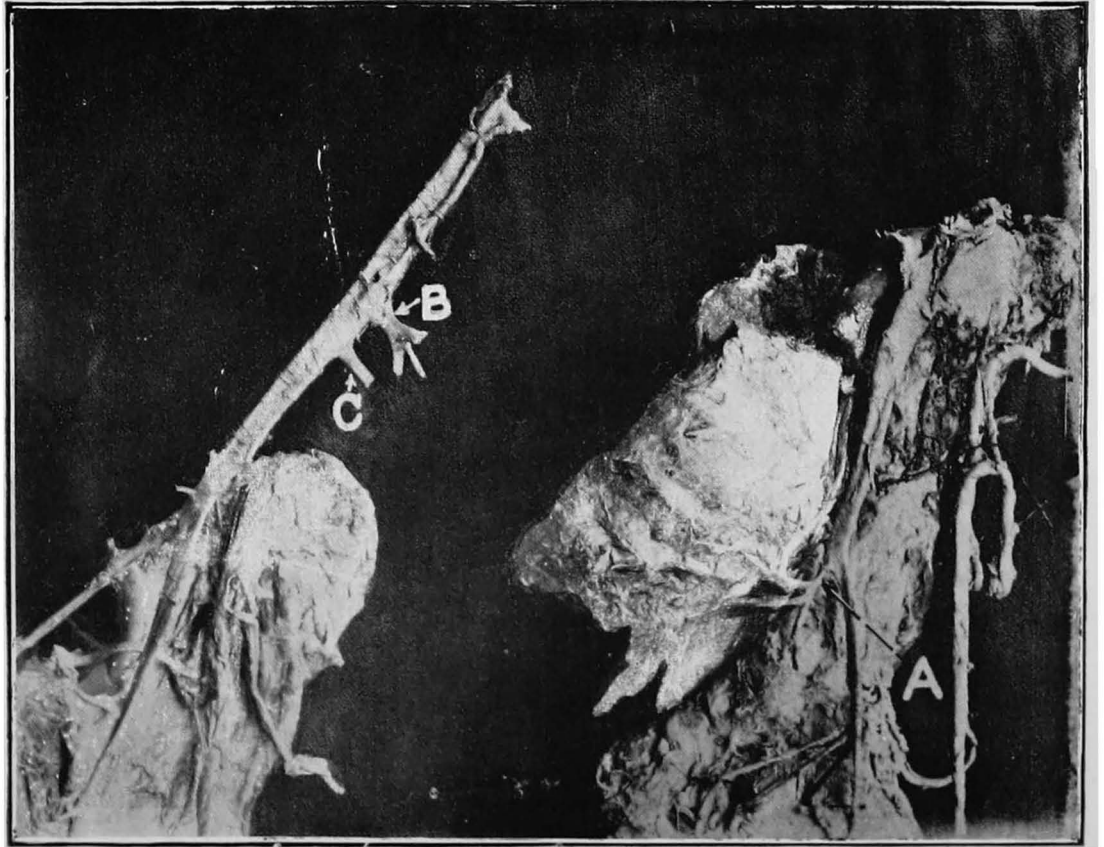


FIG. 2.

A: Normal deep humeral artery.
B: Deep humeral dividing into three branches.
C: The compensatory branch.

(By the courtesy of the Editor, Indian Veterinary Journal.)

(a) In one of the subjects (horse) dissected by the author on 11th February 1927, the anterior branch like the posterior one was also found terminating in the rhomboideus. Besides the branches of the sixth nerve, a branch from the fifth cervical nerve was also found supplying and terminating in the levator anguli scapuli in this subject.

(b) In another subject (horse) dissected on 30th January 1930, the author found the anterior and posterior branches derived from the sixth cervical nerve showing the usual behaviour. But the peculiarity met with in this subject was, that besides the branches derived from the sixth nerve, the seventh cervical nerve gave a branch which, emerging after piercing the upper border of the scalenus, divided itself into three branches—Anterior, Middle and Posterior. (Plate XXXIII.)

The anterior and the middle branches, when traced, were found going upwards placing themselves deeply in the levator anguli scapuli, detaching branches to it in their upward course and both finally terminating in the rhomboideus. The third—the posterior branch placed itself in the levator anguli scapuli and gave off in its turn a *First* branch which spent itself purely in the levator anguli scapuli and a *Second* branch which became a common “nerve to levator anguli scapuli and serratus magnus”. This posterior division after furnishing these two branches ran backwards and joined a branch coming from the eighth nerve thus giving rise to the formation of the “nerve to serratus magnus”.

4. ANASTOMOSIS OF THE PRE-HUMERAL ARTERY WITH A BRANCH OF ONE OF THE LARGEST MUSCULAR BRANCHES OF THE BRACHIAL ARTERY.

In all the subjects (horse) that were dissected all these years, the pre-humeral artery did not show any deviation in its course and distribution except in one subject. In the left fore of this subject that was dissected on 7th October 1925, this pre-humeral artery was found to be extremely slender and one of the largest muscular branches which was intended for the biceps and which was detached from the brachial artery at the inferior third of the humerus, divided into two branches; one of these spent itself in the biceps at its inferior part, while the other branch went up and anastomosed with the extremely slender pre-humeral. (Plate XXXIV, fig. 1.)

NOTE.—The pre-humeral artery of the right fore limb of this subject was normal.

5. VARIATION IN THE NUMBER OF BRANCHES OF THE DEEP HUMERAL ARTERY.

This branch—the deep humeral artery, is given off from the brachial artery either a little below or almost at the same level as the pre-humeral artery and after a short course backwards usually divides into four branches and supplies the three heads of the triceps extensor cubiti and scapulo-ulnaris. (Plate XXXIV, fig. 2-a.)

This deep humeral artery in the left fore of three subjects (horse) dissected on 7th October 1925, 9th September 1926 and 15th October 1930 and in the right fore of the subject dissected on 25th October 1929, instead of dividing into four usual branches divided only into three. (Plate XXXIV, fig. 2-b.) Perhaps to compensate the want of the fourth branch, a branch nearly as large as the deep humeral was found coming off from the brachial artery about an inch below the deep humeral. (Plate XXXIV, fig. 2-c.) This additional branch was found spending itself purely in the caput magnum (long head) and caput parvum (medial head).

6. PECULIAR ORIGIN OF THE ULNAR ARTERY.

The ulnar artery usually comes off as a branch of the brachial artery arising from its posterior face and that just above the elbow joint at the lower border of the caput parvum (medial head of the triceps). This condition has been uniformly found in all the subjects but in the left fore of the subject that the author dissected on 7th January 1925, this ulnar artery was found to be a branch of the anterior radial artery instead of being a branch of the brachial artery and that marking its lower limit. (Plate XXXV.)

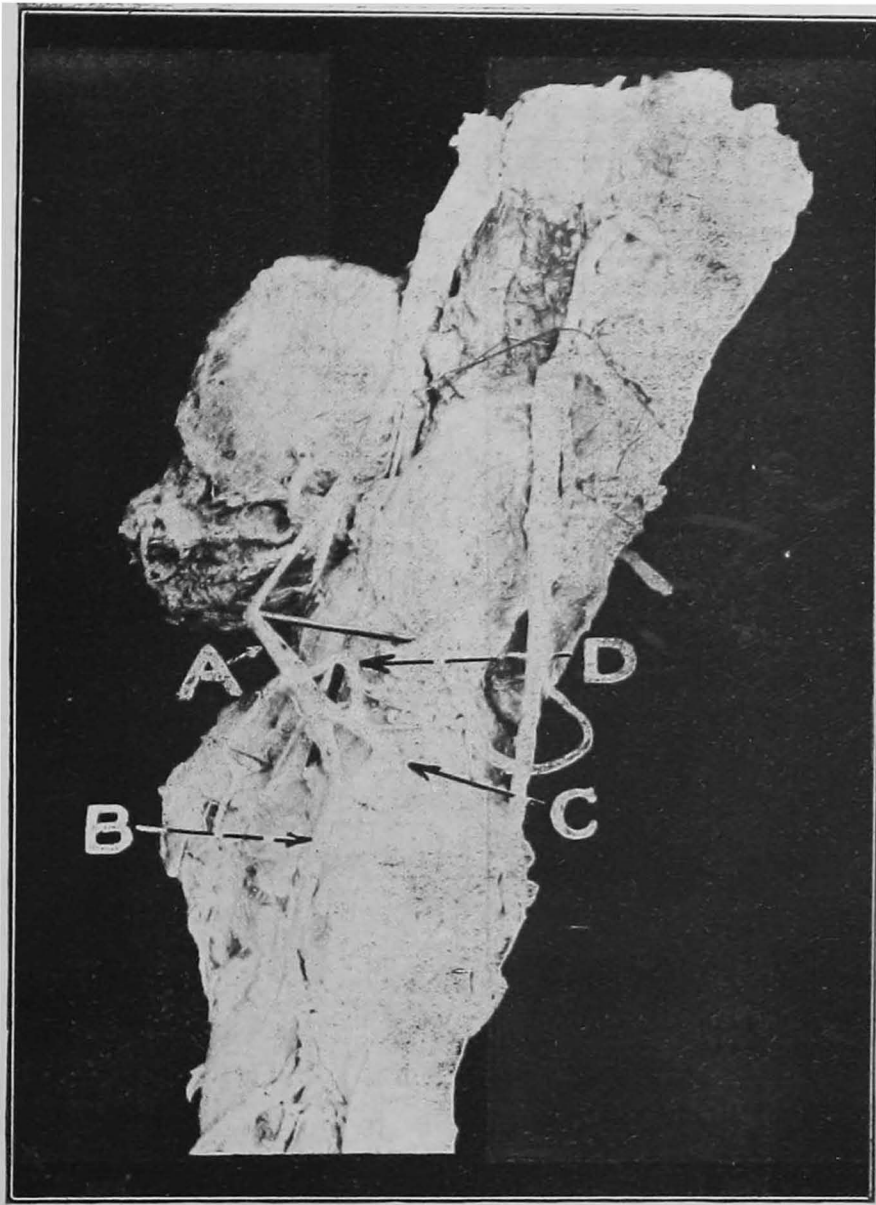
The ulnar artery of the right fore limb of this subject did not show this deviation in its origin.

7. VARIATION IN THE NUMBER OF BRANCHES OF THE LARGE METACARPAL ARTERY.

(a) *Want of a lower branch of the large metacarpal artery.*—Large metacarpal artery usually gives off two unnamed branches and the first branch which is given off at the origin of the large metacarpal artery, joins the ulnar artery to form the supra-carpal arch, while the second branch given off a little before the bifurcation of the large metacarpal artery into two digital arteries. These branches of the second branch ascend to anastomose with the two anterior and two posterior interosseous metacarpal arteries.

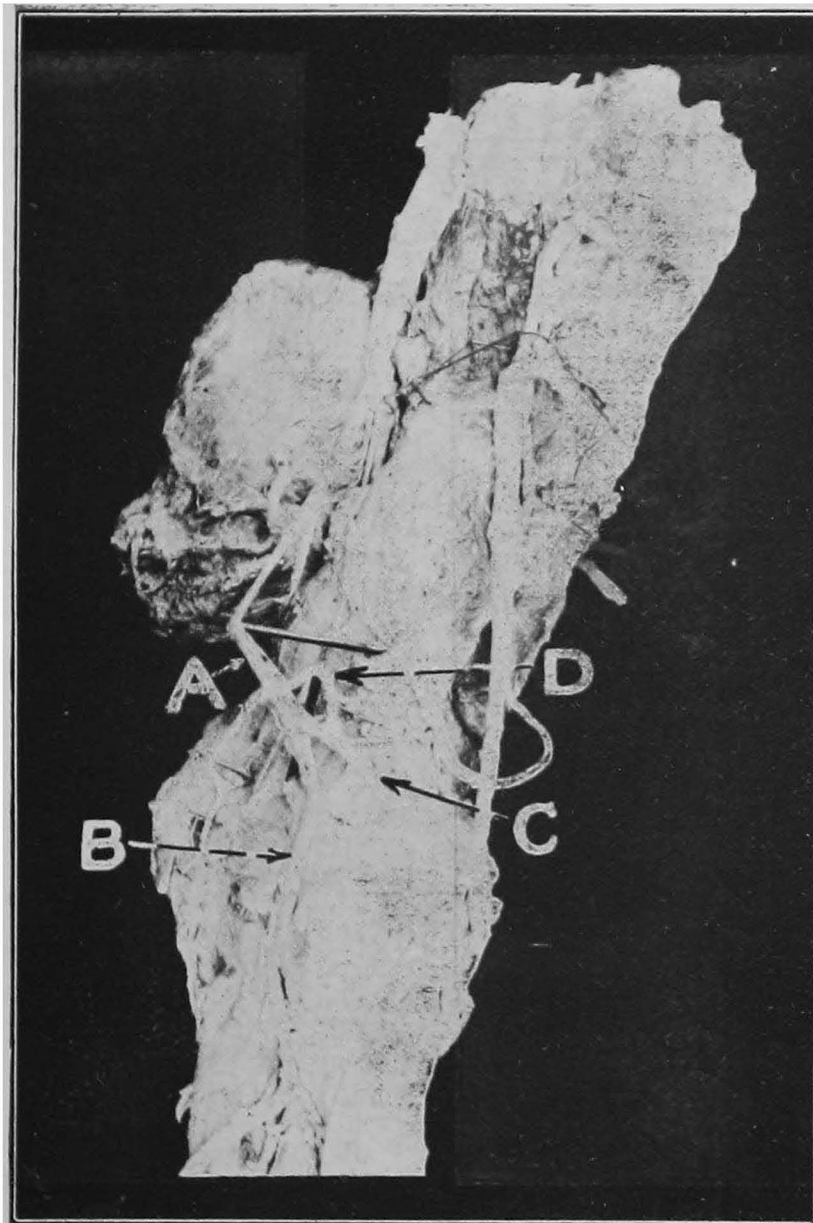
The second branch of the large metacarpal artery of both fore limbs in the subjects dissected on 14th October 1926, 21st October 1926, 23rd September 1926 and 25th September 1929, was wanting. A branch from the external digital artery went up (Plate XXXVI, fig. 1) and branched in its turn. These branches ascended to anastomose with the two anterior and two posterior interosseous metacarpal arteries. It is therefore seen that in these four subjects that the want of the second unnamed branch was compensated for by this additional branch (of the external digital arteries) which behaved in a manner similar to the second unnamed branch of the large metacarpal artery.

(b) *An additional branch of the large metacarpal artery.*—Though only two unnamed branches of the large metacarpal artery were noticed usually in almost all the other subjects (with the exception of the four cases described in 7 (a), yet in the left



- A : Brachial artery.
- B : Posterior radial artery.
- C : Anterior radial artery.
- D : Ulnar artery arising from C.

(By the courtesy of the Editor, Indian Veterinary Journal.)



- A : Brachial artery.
- B : Posterior radial artery.
- C : Anterior radial artery.
- D : Ulnar artery arising from C.

(By the courtesy of the Editor, Indian Veterinary Journal.)



FIG. 1.

- a. A branch of the external digital.
- b. External digital artery.
- c. Internal digital artery.
- d. Large metacarpal artery.

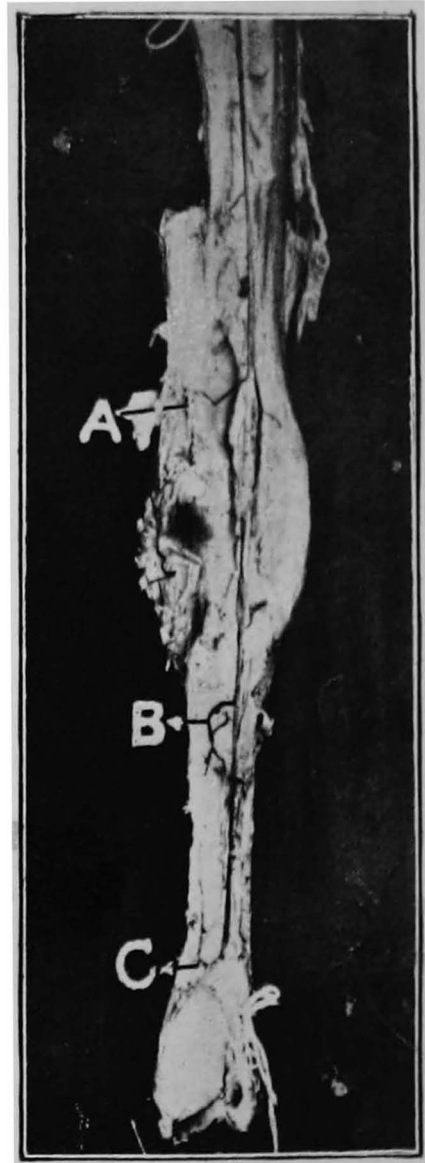
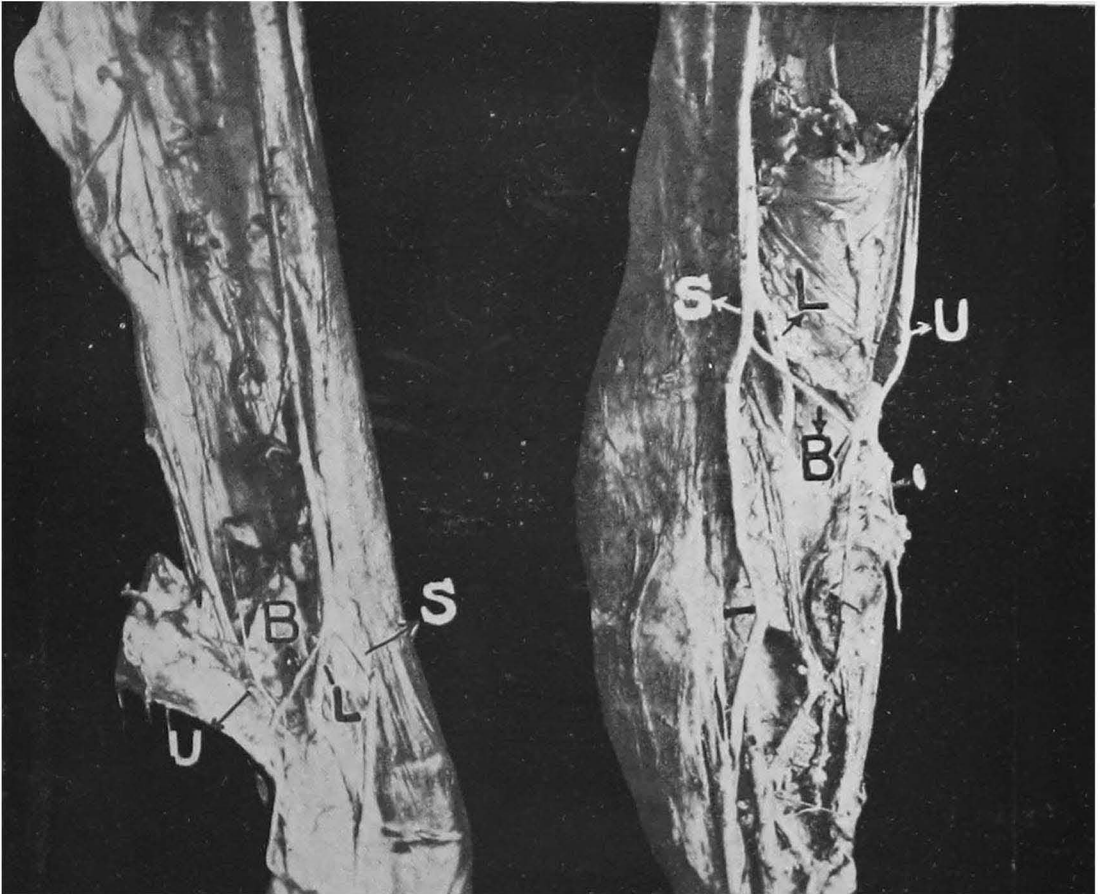


FIG. 2.

- A & C: The usual upper and lower branches, respectively, of the large metacarpal artery.
- B: The third stout branch.

(By the courtesy of the Editor, Indian Veterinary Journal.)

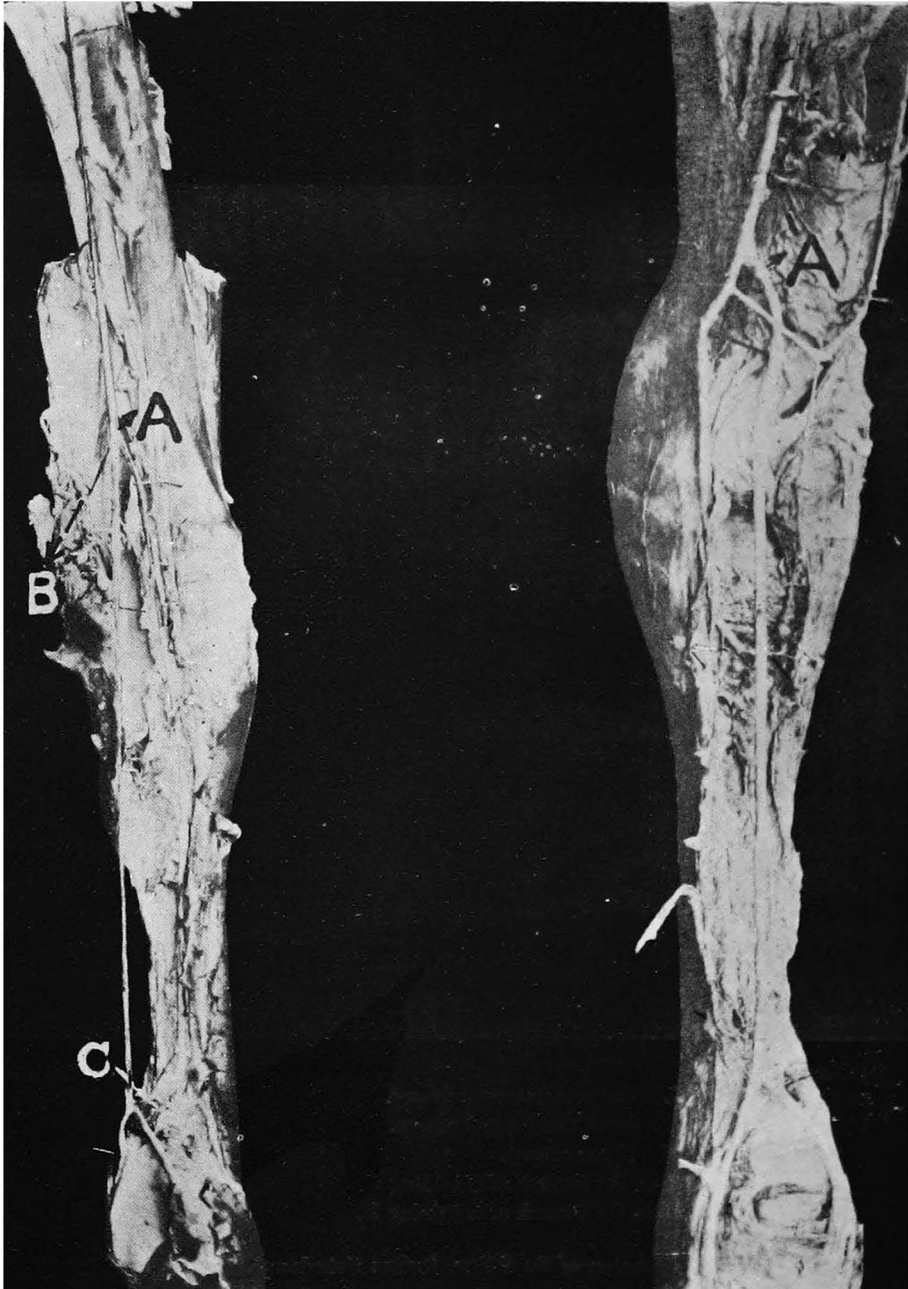


C : Normal.

A : Variation.

L : Large metacarpal artery.
S : Small metacarpal artery.
U : Ulnar artery.
B in A : Branch of S joining U.
A in C : Branch of L joining U.

(By the courtesy of the Editor, Indian Veterinary Journal.)



A. A : Large metacarpal artery.
B and C : Branches of large metacarpal artery.
B and C are found wanting in A.
(By the courtesy of the Editor, Indian Veterinary Journal.)

fore of one subject dissected on 7th October 1925, a third branch was noticed coming off from the large metacarpal artery in its course above the level of the lower part of the upper third of the large metacarpal bone. (Plate XXXVI, fig. 2.)

8. BRANCH FROM THE SMALL METACARPAL ARTERY HELPING THE FORMATION OF THE SUPRA-CARPAL OR THE SUPERFICIAL PALMAR ARCH.

This arch is usually found formed by the anastomosis of the ulnar artery with a branch from the large metacarpal artery immediately after its origin from the posterior radial artery or from the posterior radial artery itself. But in the subject dissected on 25th October 1929, this arch in the right fore limb (horse) was found formed by the anastomosis of the ulnar artery with a branch from the small metacarpal artery (Plates XXXVII & XXXVIII). The formation of this arch in the left fore of this subject was found normal.

9. WANT OF THE USUAL COLLATERAL BRANCHES OF THE LARGE METACARPAL ARTERY.

The large metacarpal artery has usually two un-named branches. The first comes off at its (large metacarpal) origin from the parent vessel (posterior radial) and joins the termination of the ulnar artery to form the supra-carpal arch. The second un-named branch is given off from the large metacarpal at or near the point of its bifurcation into two digital arteries and it then divides into branches which ascend to anastomose with the interosseous metacarpal arteries. In the right fore of the subject dissected on 25th October 1929, the two un-named branches referred to above were wanting. A branch from the small metacarpal artery anastomosed with the termination of the ulnar artery and formed the supra-carpal arch (Plate XXXVIII).

A branch from the external digital artery took the place of the second un-named branch of the large metacarpal artery. It is thus seen that in this particular subject and that only in one of the fore limbs the large metacarpal artery was not found detaching its usual branches.

The large metacarpal artery of the left fore limb of this subject showed the two usual un-named branches.

10. AN ADDITIONAL BRANCH ON THE DIGITAL ARTERY.

The digital arteries usually begin to give off collateral branches at the back of the digit but not above it. But in the subject dissected on 14th October 1926, 26th October 1926, 22nd September 1927 and 25th October 1929, external digital arteries of both fore limbs of each subject showed an additional branch immediately after its origin from the large metacarpal artery (Plate XXXVI, fig. 1-a). This

branch ascended, branched and anastomosed with the interosseous metacarpal arteries. In all the subjects in which this additional branch of the external digital artery was met with, the lower un-named branch of the large metacarpal artery was wanting.

The digital arteries and their collateral branches in the hind limbs of these subjects were found normal.

11. VARIATION IN THE ORIGIN OF THE CIRCUMFLEX ILIAC ARTERY.

The circumflex iliac artery is usually detached from the outer side of the external iliac artery close to its origin from the posterior aorta. Sisson has observed that this circumflex iliac artery may arise either from the external iliac artery close to its origin or from the aorta directly. The author has, in the course of his dissections in the horse, invariably found this branch coming off from the external iliac artery. But in the subjects dissected on 9th November 1929 and 22nd October 1930, circumflex iliac of the left side instead of being a branch of the external iliac of that side was found to be coming off from the aorta itself about an inch in front of the quadrification. But the circumflex iliac of the right side originated from the external face of the external iliac of that side (Plate XXXIX as seen in the subject on its back).

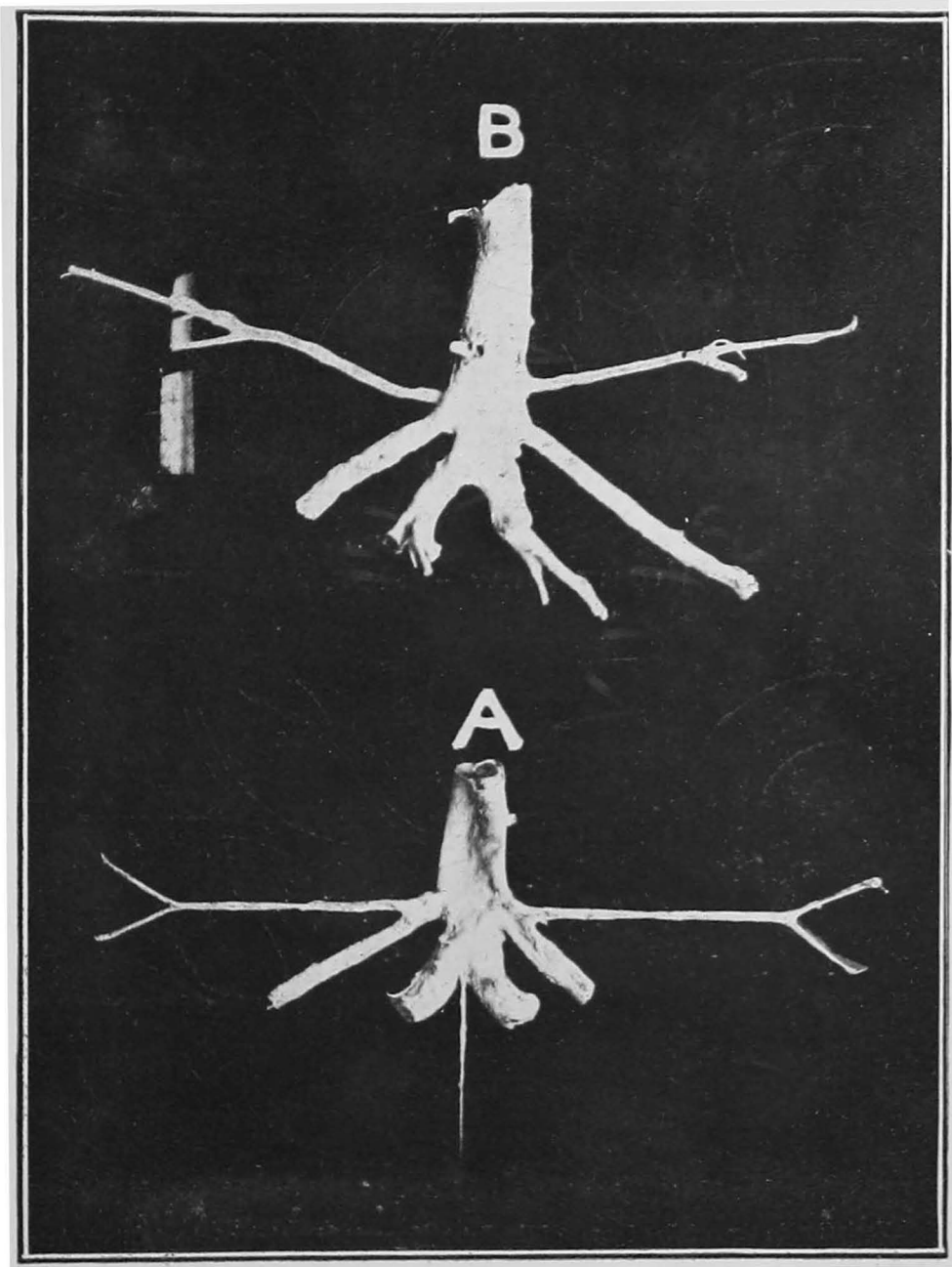
In the cat and dog, the circumflex iliacs are usually seen arising from the terminal part of the aorta.

Though Sisson observes that these circumflex iliac arteries in the horse, in some cases, may arise from the aorta directly, he does not add that one of them may arise from the aorta and the other from the external iliac artery in the same subject and hence this note.

12. VARIATION IN THE ORIGIN OF SOME OF THE INTRA-THORACIC BRANCHES OF THE AXILLARY ARTERY.

What is usually described in books and what is generally met with in the course of dissection of the right axillary artery is that it gives off a branch—the *internal thoracic artery* from its posterior face at its inferior part and that just at its point of winding round the anterior border of the first rib, it detaches: (1) the *inferior cervical artery* (from its anterior face) and (2) the external thoracic artery (at the same level but from its posterior face). (Plate XL-A.) In a pony-mare dissected on 10th October 1929, the author found the following:—

(a) One of the intra-thoracic branches—the *vertebral artery*—was found coming off from the superior face of the *arteria innominata* (brachio-cephalic) a little in front of the dorso-cervical artery and about half an inch behind the bifurcation of the *arteria innominata*. It is thus seen that the vertebral artery was a branch of the *arteria innominata* instead of being as usual a branch of the right axillary artery. The dorso-cervical artery itself which is usually either at or a little behind the *arteria*



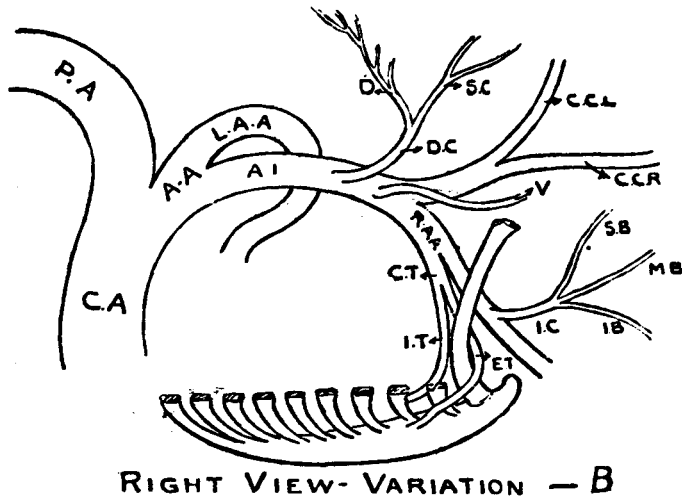
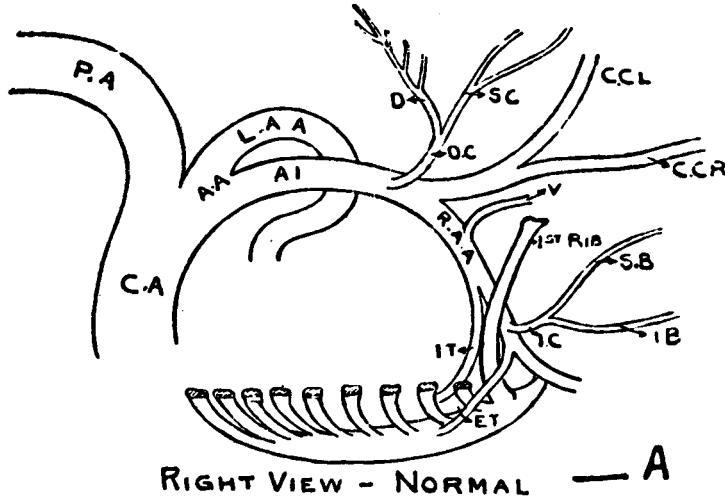
Variation in the origin of the circumflex iliac artery.

A : Normal.

B : Variation in the origin of the circumflex iliac artery of one side.

(By the courtesy of the Editor, *Indian Veterinary Journal*.)

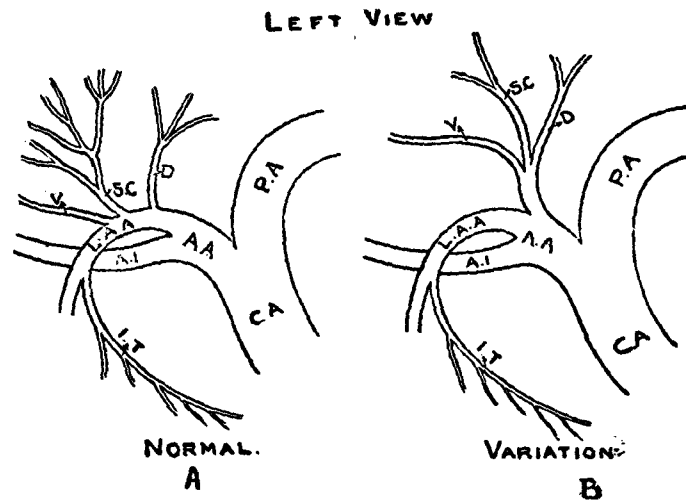
PLATE XL.



Variation in the origin of some of the Intra-thoracic branches of the Axillary Artery.

C. A. : common aorta ; P. A. : posterior aorta ; A. A. : anterior aorta ; L. A. A. : left axillary artery ; A. I. : arteria innominata ; D. C. : dorsocervical artery ; D. : dorsal artery ; S. C. : superior cervical artery ; C. C. L. : common carotid-left ; C. C. R. : common carotid-right ; R. A. A. : right axillary artery ; V. : Vertebral artery ; I. C. : inferior cervical artery ; S. B. : superior branch ; I. B. : inferior branch ; M. B. : middle branch ; I. T. : internal thoracic ; E. T. : external thoracic artery.

(By the courtesy of the Editor, Indian Veterinary Journal.)



Intra-thoracic branches. Left Axillary Artery.
 C. A. : common aorta ; P. A. : posterior aorta ; A. A. : anterior aorta ; L. A. A. : left axillary artery ;
 A. I. : arteria innominata ; I. T. : internal thoracic artery ; V : Vertebral ; S. C. : superior cervical ;
 D : Dorsal.

(By the courtesy of the Editor, Indian Veterinary Journal.)

innominata was found detached from the arteria innominata further back or, in other words, its origin was found about an inch behind the bifurcation (Plate XL-B).

(b) The intra-thoracic branch of the right axillary—the (*right*) *internal thoracic artery*—instead of being a direct branch of the right axillary, was found as a large branch coming off a trunk which originated from the posterior face of the right axillary artery just as the parent (right axillary) vessel was winding the anterior border of the first rib. (The other branch of this trunk was found to be the external thoracic artery) (Plate XL-B).

(c) *The external thoracic artery*, instead of appearing as a clear extra thoracic branch, was found to be coming off from the trunk from which originated the internal thoracic artery. In other words, the right internal and external thoracic arteries both originated from a common trunk which was detached from the right axillary artery (Plate XL-B).

(d) *The inferior cervical artery* usually takes its origin from the anterior face of the right axillary just as this winds round the anterior border of the first rib and after a short course divides into superior and inferior branches. The superior runs up in a groove formed between mastoido-humeralis and subscapulo-hyoideus (brachio-cephalicus and omo-hyoideus) supplying these muscles and the prescapular lymphatic gland; while the inferior runs down in a groove formed between the mastoido-humeralis and the anterior superficial pectoral supplying these muscles (Plate XL-A).

But in this particular subject dissected on 10th October 1929, the author found a third branch (Middle branch) (Plate XL-B) of about the same size as the other two and this third branch, when traced, was found entering the anterior deep pectoral about the level of the shoulder-joint and terminating in it.

13. THREE OF THE INTRA-THORACIC BRANCHES OF THE LEFT AXILLARY ARTERY WANTING.

In a pony-mare dissected on 23rd January 1930, three of the intra-thoracic branches of the left axillary, viz., vertebral, superior or deep cervical and dorsal branches, were wanting. There was found a short branch springing from the upper face of the anterior aorta about half an inch behind its bifurcation. This branch divided in its turn into three distinct branches which took the place of the vertebral, superior or deep cervical and dorsal arteries (Plate XLI-B—Vessels as seen in the natural position.) The internal thoracic artery of this axillary artery in this subject was normal.

14. URACHUS.

In describing the bladder, Sisson says that the abdominal end of the bladder in the foetus and the new-born, lies at the umbilicus through which it is continued by the urachus to the extra-embryonic part of the allantois.

Prof. Bradley, in his "Topographical Anatomy" of the Horse, in describing the bladder says that the middle part of the vertex of the bladder is marked by a puckered scar "the centum verticis" which indicates the remains of the connection in the embryo between the bladder and the foetal envelope known as allantois.

Mivart, in describing the development of the Cat, states that the part of the allantois which is within the abdominal cavity becomes differentiated into what are ultimately (1) the proximal part of the Urethra, (2) the bladder and (3) the Urachus: the urachus being that part of the allantois intervening between the bladder and the umbilicus or the naval. He further notes that the cavity of the urachus becomes narrower and narrower till it closes and that in this way this part becomes transformed into a ligament with traces perhaps of its primitive cavity.

Again, in describing the attachment of the bladder, Mivart says that the bladder is connected with the anterior wall of the abdomen at the umbilicus by a fibrous cord called the urachus which is the remnant of a foetal structure and that it, at least sometimes, includes a small irregular internal cavity lined with epithelium.

Gray, in his Anatomy on Man, in describing the bladder says that apex of the empty bladder is directed forwards towards the upper part of the Symphysis Pubis and that from the bladder a fibrous cord is continued upwards on the back of the anterior abdominal wall to the umbilicus. He calls this cord as the Urachus and says that it represents the fibrous remains of the intra-abdominal part of the foetal allantois.

Buchanan, in his Manual of Anatomy, observes that the intra-embryonic part of the allantois is at first directly continuous with the upper part of the bladder and that in the course of the *Second month*, its lumen usually disappears and this portion is then transformed into a fibrous cord which is called the urachus. He further adds that it is, however, to be noted that the lumen of the intra-embryonic part of the allantois may remain persistent for some time, thus giving rise to the condition which is known after birth as an "Umbilical Urinary Fistula".

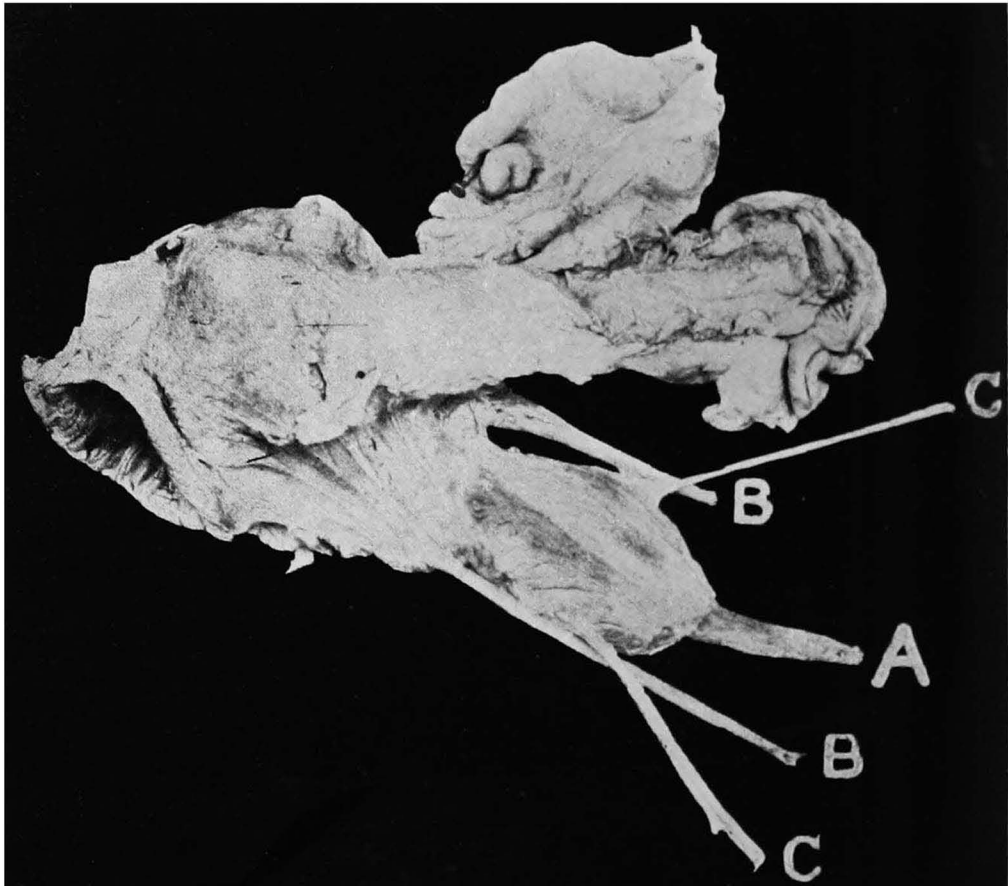
Cheuveau, in his comparative Anatomy, defines the urachus as a musculo-membranous canal that extends from the umbilicus to the summit of the bladder with the umbilical arteries on each side. He further notes that during foetal life, the bladder is extended by the urachus to the umbilical ring and that after birth the urachus is obliterated and the bladder is withdrawn into the pelvic cavity.

OBSERVATION.

When a post-mortem on a heifer (in-patient No. 433) was being conducted, the author happened to be present in the post-mortem room of the Madras Veterinary College. This heifer was six months old.

After the stomach and the intestines were removed, the author found the bladder lying prominently in the abdominal and partly (to a very small extent) in the pelvic cavity. Usually, the bladder is found retracted into the pelvic cavity

PLATE XLII.



- A : Urachus.
- B : Umbilical Arteries.
- C : Ureters.

(By the courtesy of the Editor, Indian Veterinary Journal.)

(when empty or nearly so) during post-mortem examination in animals as the horse and the ox; and usually in all subjects—horse, ox and even dog-types that were brought in for post-mortem or dissection, the anterior part of the bladder was never found stretched forwards and fixed. In this particular subject, the central portion of the anterior blind round end was kept attached to the umbilicus. After taking out the bladder and an examination of the structure that was attaching the anterior end of the bladder to the umbilicus, the author found that it was Urachus.

The urachus in this heifer of six months old measures six inches long and is nearly conical (Plate XLII)—being widest at its vesical extremity and narrowest at its umbilical extremity. This urachus has still the lumen which is $\frac{3}{4}$ inch in diameter at its widest part. The calibre of the tube is found gradually diminishing from the vesical extremity until at last at the umbilical extremity it is only as wide as to allow a narrow probe. The two umbilical arteries—one on either side of the urachus were also found extending up to the umbilicus at the free margin of the lateral ligaments which were also equally extensive—as extensive as it is either in the newborn or in the later stages of foetal life.

On referring to the various books on Anatomy, the author finds that it is only Mivart, in his Anatomy of the Cat, clearly states that this urachus after the birth of the young one is transformed into a fibrous cord which constitutes an Anterior ligament holding the bladder to the umbilicus. No other Veterinary Anatomist has made any reference to this.

NOTE.—Subsequent to noting this, the author investigated into this in seven cats during post-mortem examinations. Of the seven cats examined, it is only in one that he found the urachus agreeing with Mivart's description, but in the remaining six, this condition was absent and the centre of the vertex resembled those of other animals in having only a cicatrix.

Books on human anatomy also clearly state that the urachus is converted into a fibrous cord after birth and this cord acts as a ligament holding the bladder to the umbilicus.

Buchanan's observations in his Manual of Anatomy makes it clear that in the course of the second month the lumen of the urachus generally disappears and that if the lumen should persist for some time, it may give rise to a condition which is known after birth as "Umbilical Urinary Fistula".

Veterinary anatomists in general, speaking of the horse, ox and dog-type, all uniformly say that the central portion of the vertex of the bladder has a cicatrix which indicates the remains of the connection between the foetal bladder and the allantois.

It may be interesting to know:—

1. If any has observed in the subjects the actual period after birth when the urachus gets disconnected from the bladder.
2. What happens to the length of the urachus which gets separated from the bladder.

(Naturally, after the connection ceases, the urachus must be pulled towards the umbilicus just as the bladder must retract towards the pelvis.)

3. Does this section of the urachus drawn towards the umbilicus undergo atrophy? and if so,
4. What period does it generally take to efface the remains altogether?

The author in course of his work examined the peritoneal face of the umbilicus of the adult subjects of all the three types and he failed to see any trace whatever of the remains—not even to the smallest extent.

15. POSTERIOR RADIAL ARTERY AND ITS TERMINAL BRANCHES.

Usually, the posterior radial artery divides about the lower third of the fore arm into two branches of unequal size—Small and Large Metacarpal arteries. In some cases the posterior radial artery detaches a branch which joins the termination of the Ulnar artery to form the Supra-carpal arch.

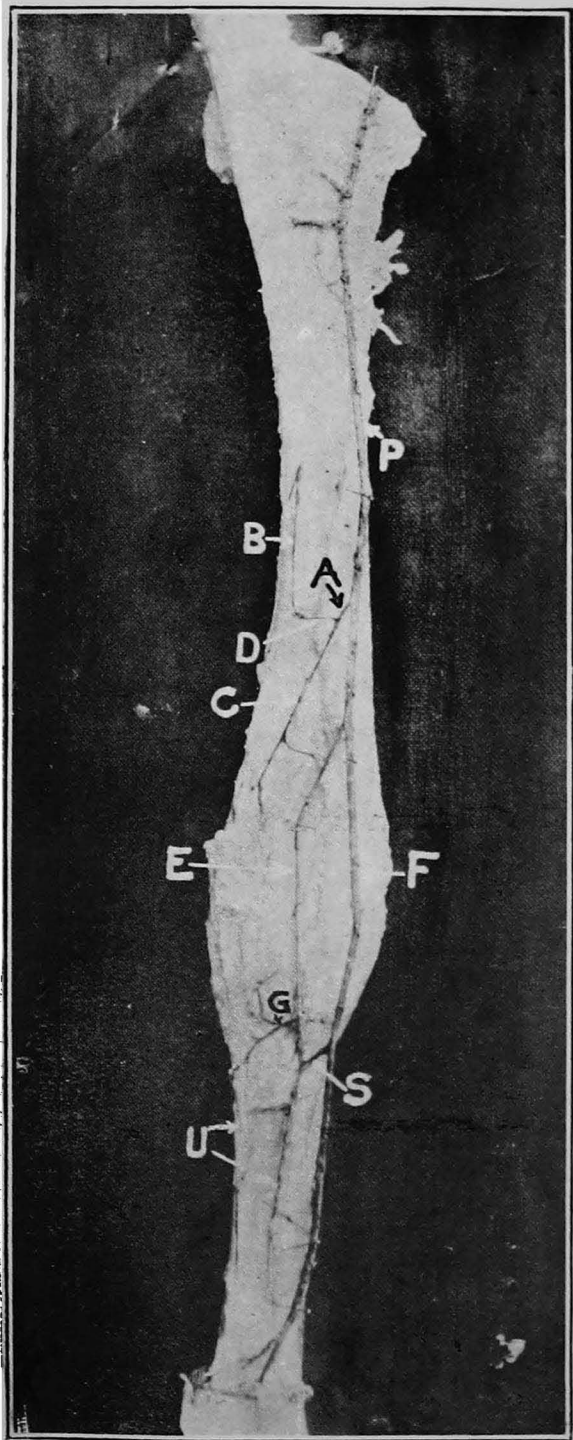
Usually, the large metacarpal artery—the larger of the two terminal branches of the posterior radial artery—descends in company with the flexor tendons by passing behind the carpus beneath the carpal arch. Emerging from beneath the carpal arch, it continues to descend on the inner side of the flexor tendons, until a little above the fetlock where it sinks slightly inwards to bifurcate into two Digital arteries. Only two of its collateral branches are of sufficient size to merit description and both are somewhat irregular in their origin. The first of these comes off near the origin of the parent vessel or may come off from the posterior radial itself. This anastomoses with the termination of the ulnar artery to form the supra-carpal arch. The second is also an unnamed vessel springing from the large metacarpal at or near its point of bifurcation and divides into branches that ascend to anastomose with the Interosseous Metacarpal arteries.

The supra-carpal arch is formed behind the lower extremity of the radius, usually by the junction of the first branch of the large metacarpal artery with the termination of the ulnar artery (or sometimes with a branch from the posterior radial artery itself). From the convexity of this arch there arise several branches. The largest and most regular of these descends within the carpal sheath and joins the small metacarpal artery to form the sub-carpal arch.

The small metacarpal artery—smaller of the terminal branches of the posterior radial artery—usually behaves in the following manner:—It descends behind the carpus towards its inner side and is superficially placed. At the level of the head of the inner small metacarpal bone it crosses to the outer side by passing between the suspensory ligament and the sub-carpal ligament. It here anastomoses with a branch already described above as descending from the supra-carpal arch. The sub-carpal arch is formed in this way.

This sub-carpal arch gives off two pairs of branches, Anterior Interosseous Metacarpal and Posterior Interosseous Metacarpal arteries, These two pairs in their

PLATE XLIII.



A : Branch of posterior radial joining B.

B : Ulnar artery.

C : Largest branch from D.

G : Sub-carpal arch.

P : Posterior radial artery.

D : Supra-carpal arch.

E : Small metacarpal artery.

F : Large metacarpal artery.

U : Posterior interosseous metacarpal arteries.

S : Branch from F joining E.

(By the courtesy of the Editor, Indian Veterinary Journal.)

turn descend and branch which anastomose with the branches of the second un-named branch of the large metacarpal artery.

In the left fore limb of the subject dissected in February 1930, the posterior radial artery and its terminal branches showed the following :—(Plate XLIII).

1. The supra-carpal arch was found formed by a branch from the posterior radial artery joining the termination of the ulnar artery.
2. The largest and the most regular of the branches arising from the convexity of this supra-carpal arch was there and behaved as usual.
3. The small metacarpal artery instead of turning to the outside about the level of the head of the inner small metacarpal bone, to join the branch from the supra-carpal arch, merely detached a *branch* which joined the branch coming from the supra-carpal arch and formed the sub-carpal arch.
4. The small metacarpal artery, after detaching the branch towards the formation of the sub-carpal arch, continued downwards and took the place of the inner posterior interosseous metacarpal artery.
5. The outer anterior and posterior interosseous metacarpal arteries sprang from the sub-carpal arch as usual.
6. Inner anterior interosseous metacarpal artery was found to be a branch detached from the small metacarpal artery—detached at the same level as no. 3.
7. The small metacarpal artery as it descended below the level of the sub-carpal arch after detaching Nos. 3 and 6, showed about the level of the upper third of the metacarpal region, a communicating branch from the large metacarpal artery joining it.
8. The small metacarpal artery, instead of as usual terminating in the upper third of the metacarpus by forming the sub-carpal arch, is continued down to the lower third of the metacarpal region, taking the place of the inner posterior interosseous metacarpal artery.

NOTE.—The formation of the supra- and sub-carpal arches, disposition and the course of the large and small metacarpal arteries in the right fore limb of this subject were normal and did not show the foregone deviation noted in the left fore.

16. (a) INTERNAL AND EXTERNAL THORACIC ARTERIES.

The internal thoracic artery is usually said to come off as an intra-thoracic branch of the axillary artery before the latter emerges out of the thoracic cavity and *the external thoracic artery* is usually said to come off as an extra-thoracic branch of the axillary artery just as the latter winds round the anterior border of the first rib at the same level as the *inferior cervical artery* but from the posterior face of the vessel (axillary artery).

But in the subject (horse) the author had for dissection on 15th October 1930, the external thoracic of the left axillary artery was altogether absent. Instead, two

large branches from the internal thoracic artery at different levels of its course took the place of the usual external thoracic artery. Of these two branches—one the *Anterior* sprang from the internal thoracic about an inch after its origin from the axillary artery, left the thoracic cavity winding round the anterior border of the first rib, placing itself behind the axillary artery, gained the posterior deep pectoral muscle and after detaching branches to this muscle, broke up into smaller branches which supplied other pectoral muscles. (Plate XLIV.)

Sisson, in the course of his description of this vessel, observes "The external thoracic artery varies in its origin and size. Not rarely, it arises from the internal thoracic or from the Brachial (Axillary) outside the thorax. In other cases, it arises by a common trunk with the inferior cervical artery. It may be very small or even absent in which case the perforating branches of the internal thoracic compensate."

During 1929, the author had a subject—a horse—in which the internal and external thoracics of the axillary artery did not arise as intra- and extra-thoracic branches, respectively from the axillary artery. Instead, a large vessel was found arising from the axillary within the thoracic cavity, and this large branch was found dividing into two—one of which took the place of the internal thoracic and the other—the external thoracic arteries. (Plate XL-B—Right View—Variation).

16. (b) INFERIOR OR DESCENDING BRANCH OF THE INFERIOR CERVICAL ARTERY.

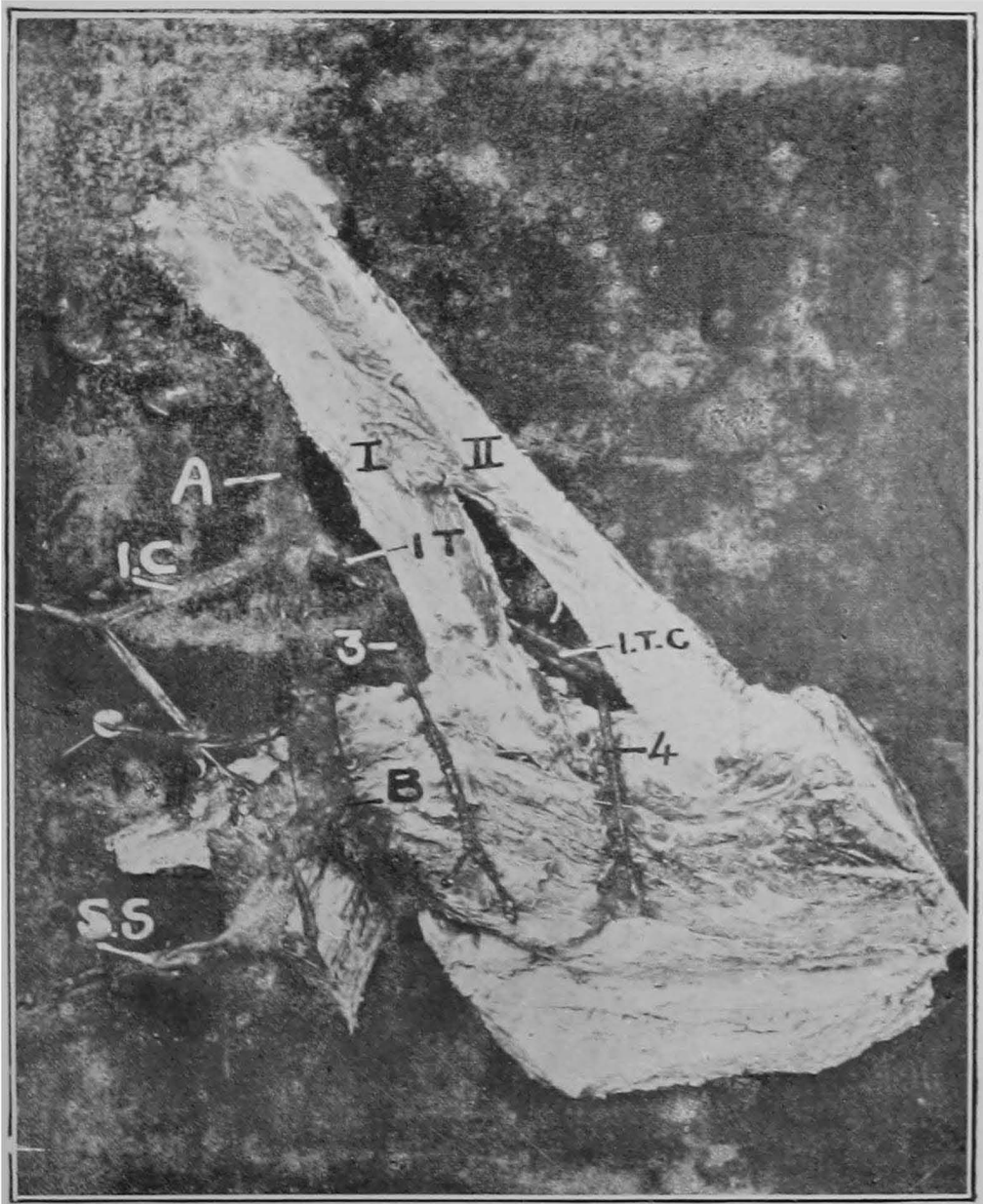
Of the left axillary artery of this subject (15th October 1930) was found supplying not only the anterior superficial pectoral and the mastoido-humeralis (brachiocephalicus) but was also found detaching branches to the anterior and posterior deep pectoral muscles. (Plate XLIV.) Its supply to the anterior and posterior deep pectorals is not generally noted.

In another subject—a pony-mare—which the author had for dissection on 10th October 1929 (Plate XL-B) the inferior cervical artery besides presenting the usual ascending or superior (S. B.) and descending or inferior branches (I. B.), was found detaching a third branch as large as the other two and this third (middle) branch (M.B.) when traced was found entering and spending itself in the anterior deep pectoral.

NOTE.—The internal and external thoracics and the inferior cervical artery of the right axillary of this subject of 15th October 1930, were found to be normal.

NOTE TO THE PLATE.—The axillary has been drawn out of the thoracic cavity to show clearly the origin of the internal thoracic artery from the axillary artery as well as the origins of 3 and 4 from the internal thoracic artery.

The author's thanks are due to Dr. O. Charnock Bradley, M.D., D.Sc., M.R.C.V.S., Principal, Royal Dick (Veterinary) College, Edinburgh, who has been kind enough to peruse the notes and the photographs and expressed that the findings are interesting.



Internal and External Thoracic Arteries.
(By the courtesy of the Editor, Indian Veterinary Journal.)

17. THE FORMATION OF THE SUPRA AND SUB-CARPAL ARCHES AND THE DISPOSITION OF THEIR BRANCHES.

Usually, the posterior radial artery divides about the lower third of the fore-arm into two branches of unequal size—Small and Large metacarpal arteries. In some cases, the posterior radial artery detaches a branch which joins the termination of the ulnar artery to form the supra-carpal arch.

Usually, the large metacarpal artery—the larger of the two terminal branches of the posterior radial artery—descends in company with the flexor tendons by passing behind the carpus beneath the carpal arch. Emerging from beneath the carpal arch, continues to descend on the inner side of the flexor tendons until a little above the fetlock where it sinks slightly inwards to bifurcate into two digital arteries. Only two of its branches are of sufficient size to merit description and both are somewhat irregular in their origin. The first of these comes off near the origin of the parent vessel or may come off from the posterior radial itself. This anastomoses with the termination of the ulnar artery to form the supra-carpal arch. The second is also an unnamed vessel springing from the large metacarpal artery at or near its point of bifurcation and divides into branches that ascend to anastomose with the interosseous metacarpal arteries.

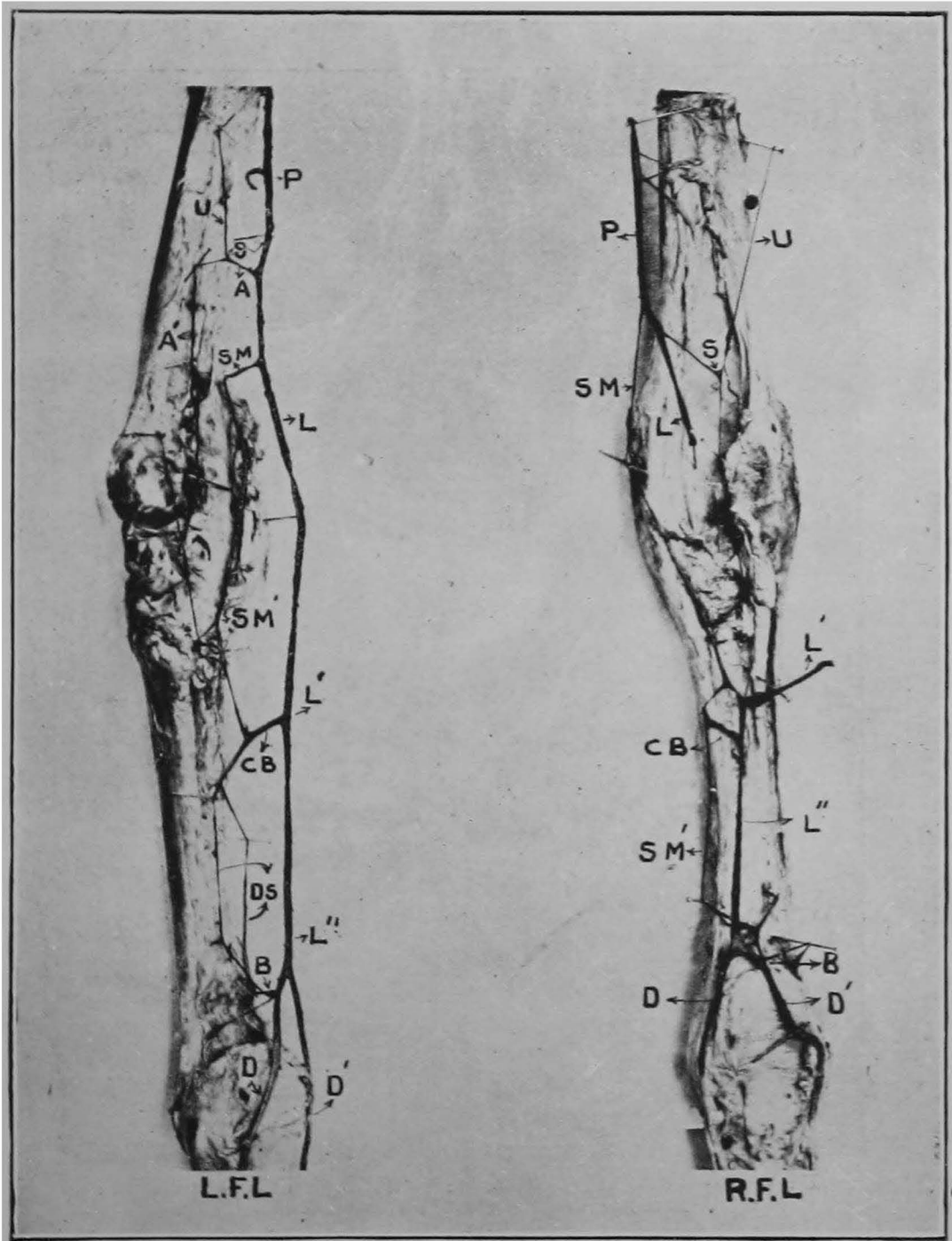
The supra-carpal arch is formed behind the lower extremity of the radius, usually by the junction of the first branch of the large metacarpal artery with the termination of the ulnar artery (or sometimes with a branch of the posterior radial itself). From the convexity of this arch there arise several branches. The largest and the most regular of these descends through the carpal sheath and joins small metacarpal artery to form the sub-carpal arch.

The small metacarpal artery—the smaller of the terminal branches of the posterior radial artery—usually behaves in the following manner:—It descends behind the carpus towards the inner side and is superficially placed. At the level of the head of the inner small metacarpal bone, it crosses to the outer side by passing between the suspensory and sub-carpal ligaments. It here anastomoses with a branch already described above as descending from the supra-carpal arch. The sub-carpal arch is formed in this way.

This sub-carpal arch gives off two pairs of branches—anterior interosseous metacarpal and posterior interosseous metacarpal arteries. These two pairs in their turn descend and branch. These branches anastomose with the branches of the second unnamed branch of the large metacarpal artery.

The following are the findings with reference to the formation of the supra- and sub-carpal arches and the disposition of their branches in the fore limbs of a pony (dissected on 25th November 1931):—

Right fore limb.—The formation of the supra-carpal arch was as usual. But the small metacarpal artery instead of terminating below the carpus by forming the sub-carpal arch, was found giving off a branch below the carpus and this branch



L. F. L. : left fore limb ; R. F. L. : right fore limb ; U : ulnar artery ; P : posterior radial artery ; S : supracarpal arch ; A to A' in L. F. L. : articular branch to the carpus ; L. L' and L'' : Large metacarpal artery ; SM to SM' : small metacarpal artery ; C. B. : communicating branch from L ; B : branch from external digital ; D and D' : Digital arteries ; D. S. in L. F. L. : divisions of small metacarpal artery.

(By the courtesy of the Editor, Indian Veterinary Journal.)

joined a branch descending from the supra-carpal arch and formed the sub-carpal arch. The small metacarpal after detaching the branch towards the formation of the sub-carpal arch continued down the metacarpus as the internal posterior interosseous metacarpal artery. The inner anterior interosseous metacarpal artery was found to be a branch from the small metacarpal artery and detached a little below its branch which contributed to the formation of the sub-carpal arch. A similar behaviour of the small metacarpal artery was observed by the author for the first time in the left fore of a subject dissected in February 1930. (*Vide* Article No. 15, Plate XLIII.) The outer anterior and posterior interosseous metacarpal arteries of this limb were found as usual to come off from the convexity of the sub-carpal arch.

The large metacarpal artery communicated with the internal posterior interosseous metacarpal artery by a large branch at the back of the upper third of the large metacarpal bone.

The usual lower unnamed branch of the large metacarpal artery was wanting but was compensated for by a branch from the external digital artery. (Plate XLV—R. F. L.)

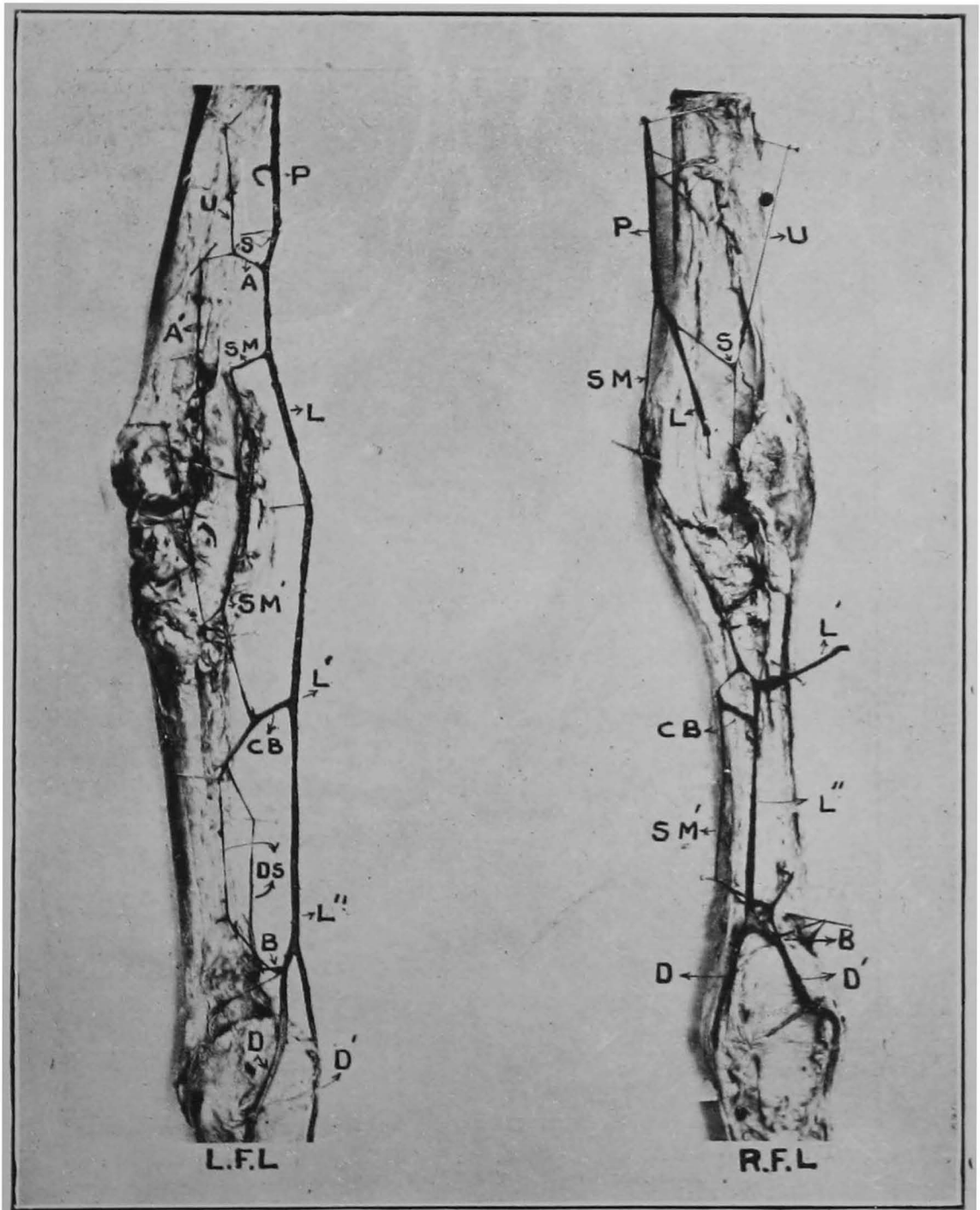
Left fore limb.—A large branch was found detached from the posterior radial artery a little above the lower third of the radius. This branch after its origin from the posterior radial gave off (*a*) a number of Muscular branches to the Deep Flexor; (*b*) a narrow branch which, with the termination of the ulnar artery, formed the supra-carpal arch. The large branch after detaching branches (*a*) and (*b*) placed itself on the back of the radius and continued down to the carpus as "articular branch to the carpus".

Division of the posterior radial artery into its terminal branches—large and small metacarpal arteries—was found to be about $1\frac{1}{2}$ inches below the level of the formation of the supra-carpal arch. This peculiar formation of the supra-carpal arch was noticed in this subject for the first time. Another peculiar formation of this supra-carpal arch formed by a branch from the small metacarpal artery with the ulnar artery was noticed in the right fore of a subject dissected on 25th October 1929, and has been described in Article No. 8 with Plate XXXVII.

The first—the upper unnamed branch of the large metacarpal—artery was wanting.

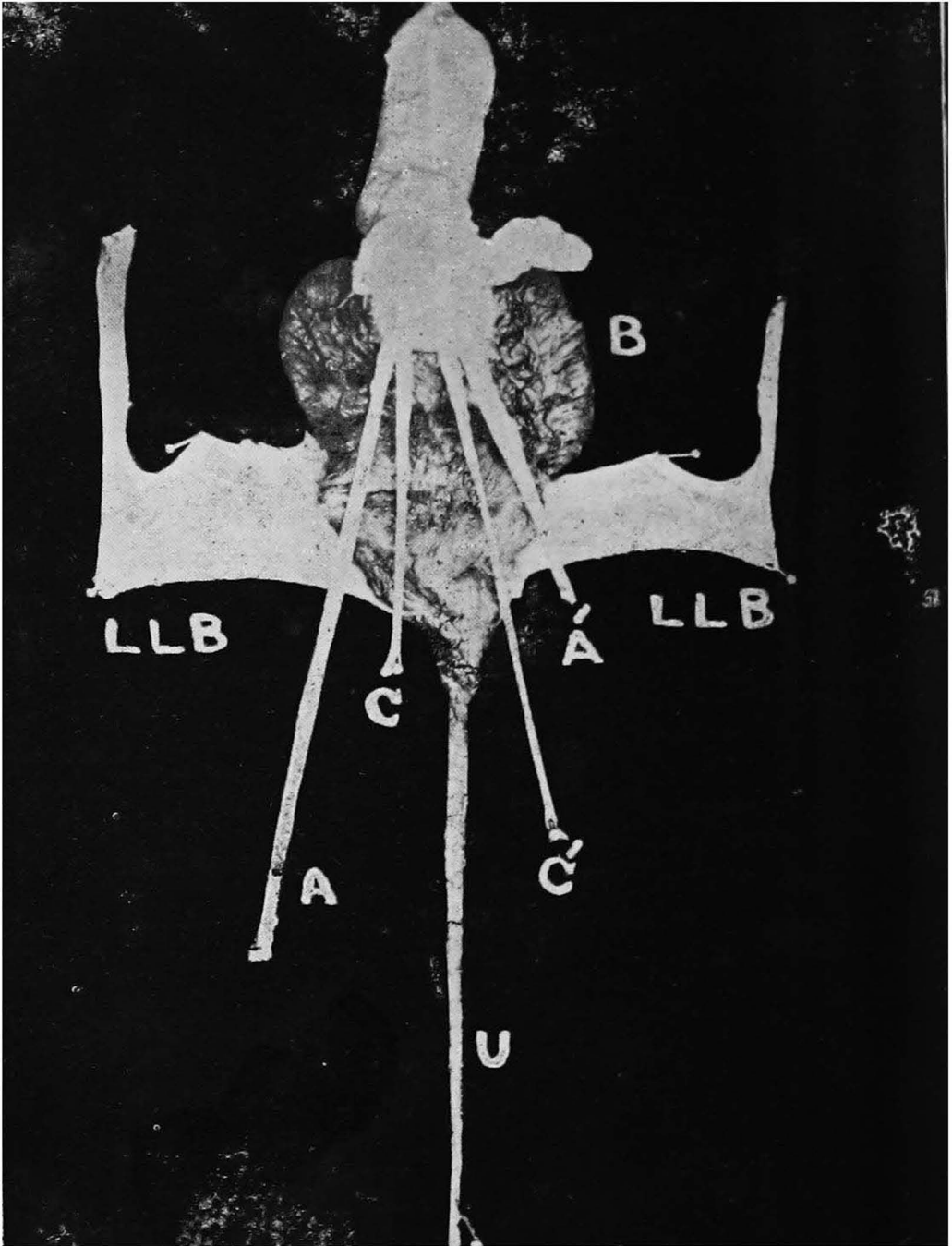
The small metacarpal artery, after it contributed towards the formation of the sub-carpal arch by giving off a small branch at the usual level, continued down the metacarpus and received a large communicating branch from the large metacarpal artery. The small metacarpal artery divided below this point of communication into two nearly equal branches which hereafter took the place of external and internal posterior interosseous metacarpal arteries.

The lower unnamed branch of the large metacarpal artery was wanting but it was compensated for by a branch from the external digital artery which behaved in a manner similar to the usual lower unnamed branch. (Plate XLV—L.F.L.)



L. F. L : left fore limb ; R. F. L : right fore limb ; U : ulnar artery ; P : posterior radial artery ; S : supracarpal arch ; A to A' in L. F. L : articular branch to the carpus ; L. L' and L'' : Large metacarpal artery ; SM to SM' : small metacarpal artery ; C. B : communicating branch from L ; B : branch from external digital ; D and D' : Digital arteries ; D. S. in L. F. L : divisions of small metacarpal artery.

(By the courtesy of the Editor, Indian Veterinary Journal.)



U: Urachus; B: Bladder; L. L. B: Lateral ligaments of the bladder;
A & A': Ureters; C & C': Vasa deferentia.

(By the courtesy of the Editor, Indian Veterinary Journal.)

18. PRESENCE OF URACHUS IN A TWO-YEAR OLD BULL-CALF.

This was met with in a two-year old bull-calf opened for demonstration on 12th November 1931. This was found extending from the vertex of the bladder to the umbilicus. Total length of this urachus was eleven inches. It was wide at its vesical extremity and was narrow at its umbilical extremity. The lumen of $7\frac{1}{2}$ inches of this tube from the umbilical extremity was obliterated and this length of the urachus was in the form of a flattened narrow fibrous band widening posteriorly. The remaining $3\frac{1}{2}$ inches of this structure still showed the lumen communicating with the cavity of the bladder. (Plate XLVI.)

This is the second case the author has come across in which the urachus still persisted though the animal was two years old and which, in fact, was acting as one of the ligaments of the bladder as it were, attaching the bladder to the position of the umbilicus.

The author has already described his findings in a six months old Heifer-calf in which the urachus was still persistent (*vide* Article No. 14 with Plate XLII). The urachus in this first subject was—rather very large though short and the lumen existed throughout the length of that conical tube.

19. BRONCHIAL AND ŒSOPHAGEAL VESSELS OF THE AORTA.

The following anatomical deviations in the way of blood and nerve distribution to certain organs and muscles in the ox-type were observed :—

Usually, the bronchial artery in the ox arises from the thoracic aorta and divides into right and left bronchial arteries. These reaching the dorsal face of the respective bronchus enter the roots of the corresponding lungs and are distributed to them.

The Œsophageal artery of the ox usually arises from the thoracic aorta a little behind the bronchial, divides into a number of branches which enter the dorsal wall of the Œsophagus at intervals and are distributed to it. One of these branches terminates in the posterior mediastinal lymphatic gland.

Bronchial and Œsophageal arteries in the ox are therefore generally found to arise separately from the thoracic aorta.

But in one subject, the bronchial artery sprang from the aorta as usual but instead of dividing into right and left bronchials, it gave an additional branch. This additional branch ran forwards as far as the origin of the thoracic aorta, placing itself on the left face between the thoracic aorta and the Œsophagus and terminated above the base of the heart in the wall of the Œsophagus on its under aspect. It is thus seen that the bronchial artery in this subject besides supplying the lungs detached also the Œsophageal branch which supplied the anterior portion of the Œsophagus in the thoracic cavity. The middle and the posterior parts of the thoracic portion of the Œsophagus showed the usual independent supply directly from the thoracic aorta.

Again, in another subject, the œsophageal artery besides dividing into branches to supply as usual the œsophagus and the posterior mediastinal lymphatic gland detached also a long branch. This long branch ran downwards and forwards, crossed the left face of the œsophagus and divided at the bifurcation of the trachea into right and left branches. Each of these ran backwards on the dorsal face of the respective bronchus and entered the root of the corresponding lung.

It is thus seen that the bronchial of one and the œsophageal of the other of the above two subjects may be taken as the "Broncho-œsophageal" artery bearing a resemblance to the 'broncho-œsophageal' artery of the horse.

20. VARIATION IN THE ORIGIN OF THE MIDDLE SACRAL ARTERY OF THE OX.

This vessel in the ox is usually present and is sometimes very large. This is said to continue the abdominal aorta behind the iliac quadrifurcation. It originates from the dorsal face of the aorta at the angle of divergence of the internal iliacs, runs back on the pelvic face of the sacrum and is continued as the middle coccygeal artery.

This condition was present in the bovines that came under observation all these years. But the following variations in its origin were observed in three subjects:— In two of these subjects, the middle sacral arteries did not originate from the aorta, but they were found arising in each of these two subjects from a common trunk—a collateral of the internal iliac artery. The other branches of this trunk were Ileo-lumbar and Anterior gluteals. In the third subject, a direct collateral branch of the internal iliac artery took the position of the middle sacral artery.

21. VARIATION IN THE DISTRIBUTION OF ONE OF THE BRANCHES OF THE INTERNAL ILIAC ARTERY IN THE OX.

The first of the collateral branches given off by the internal iliac artery is the last pair of lumbar arteries. The next collateral branch is a large trunk which in its turn divides in the female into *umbilical* and *middle uterine* artery. In the male it is usually found dividing into *umbilical* and *vesical* branches. The umbilical artery at its origin detaches *uretral* and *deferential* twigs. The Internal Pudic artery which may be taken as the direct continuation of the internal iliac artery in the ox, supplies usually Rectum, Bladder, Urethra and Genital organs. In the male, it supplies the accessory genital glands and also the penis, while in the female, it detaches a large posterior uterine artery supplying vagina and posterior part of the uterus and ends as "Artery of the Clitoris."

The following variations were noted in two male subjects:—(1) In one subject the large trunk referred to divided into (a) *umbilical* which at its origin detached one *uretral* branch and (b) a branch after detaching a number of uretral twigs branched

in its turn into *vesical* to the antero-lateral aspect of the bladder, *Deferential* to Pars Glandularis of the vas deferens, *vesicular seminal* to vesiculæ seminalis, *prostatic* to prostate and finally divided into a number of small branches which terminated on the fore part and on the under surface of the urethra. Internal Pudic artery in this subject was found as usual supplying the accessory genitals, the bladder and the urethra.

It is therefore seen that these organs besides getting their usual supply from the branches of the Internal Pudic artery also derived an additional supply from the ramifications of the branch (b) referred to above.

(2) In another male subject, the large trunk referred to divided into umbilical and vesical arteries. The branch (b) referred to in (1) was not found in this subject. But a collateral branch of the Internal Iliac artery divided in its turn and supplied *uretral*, *vesicular seminal*, *prostatic*, *deferential* and *uretral* branches. This collateral branch was found originating from the internal face of the internal iliac artery a little in advance of a branch supplying the rectum. The urethra in front of the ischial arch and the *Bulbo-urethral* gland were supplied by a branch from the Internal Pudic artery and this Internal Pudic artery detached again a *Rectal* branch which supplied the anus and the posterior portion of the rectum.

22. VARIATION IN THE ORIGIN OF THE PREPUBIC ARTERY OF THE OX.

This vessel usually arises by a common trunk with the *Deep Femoral* artery a little below the pelvic brim, then gains the internal inguinal ring and divides into (1) Posterior abdominal and (2) External Pudic arteries.

In one subject (female), this vessel did not arise by a common trunk with the deep femoral artery but was found detached as an independent branch from the anterior face of the external iliac artery, a little below the middle of its course. The deep femoral in this subject also originated as an independent branch from the external iliac artery about half an inch below the origin of the prepubic and that from the posterior face of the external iliac artery. It is therefore seen that the Prepubic artery in this subject did not arise by a common trunk and that its origin was not below the pelvic brim.

In another subject (male), the origin of the prepubic artery was as usual by a common trunk with the deep femoral but the level at which it originated was about two inches above the anterior border of the pubis.

23. FURTHER VARIATION IN THE ORIGIN OF THE ARTERY OF THE CORD (OX).

This vessel is otherwise termed the external Spermatic or Cremasteric artery and is a very small vessel. Its origin is very variable. It is learnt from the record

of observations made so far that it may spring either from the aorta, external iliac, circumflex iliac or even the internal iliac artery.

A further variation in its origin was noticed by the author in a single subject in which this vessel was found arising from the prepubic artery before the latter divided into posterior abdominal and external pudic arteries.

24. ADDITIONAL BLOOD VESSEL TO SEMITENDINOSUS IN THE OX.

Usually, the deep femoral artery, after detaching branches to Gracilis, Pectineus, Adductor, Obturator Internus, Biceps Femoris and Semi-membranosus, terminates by dividing into branches which enter into Biceps Femoris and Semitendinosus. It is therefore observed that the semitendinosus in all the subjects that came under observation had its blood supply from the terminal branches of the deep femoral artery.

In one subject, a stout branch, detached from the deep femoral higher up in its course, *i.e.*, below the level of the obturator externus, was found passing upwards and backwards and terminating in the extreme upper part of semitendinosus. It was also found having the usual supply from the terminal branches of the deep femoral artery which entered the muscle about its middle.

The branch of the deep femoral artery supplying the semitendinosus at its upper part is the additional vessel referred to and this was not noticed in any other subject.

25. ABSENCE OF ONE OF THE EXTRA THORACIC BRANCHES OF THE AXILLARY ARTERY—OX.

The Inferior Cervical Arteries in one subject were found wanting.

26. DEVIATION IN THE DISPOSITION OF THE INTERNAL AND EXTERNAL JUGULARS—OX.

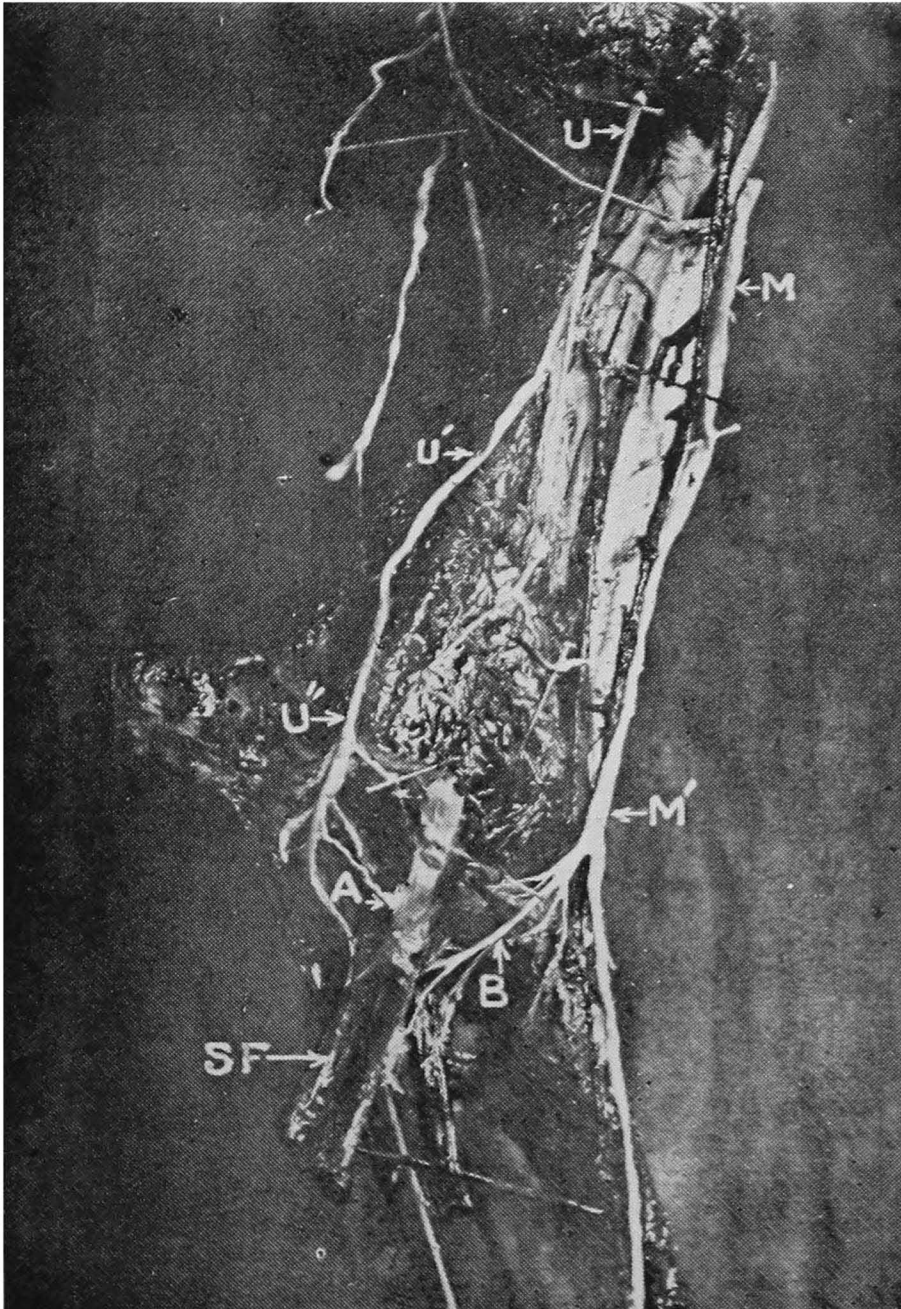
The internal jugular of each side usually joins the external jugular of the same side to form the "Common jugular" of that side. The two common jugulars of the two sides then unite to form the Jugular Confluent.

The following deviation was noted in one subject:—

The internal jugular of one side joined the internal jugular of the opposite side and each internal jugular also sent a *Communicating* branch to the corresponding external jugular.

The two external jugulars united a little below the level of the union of the two internal jugulars. A common internal jugular was therefore found formed in this subject.

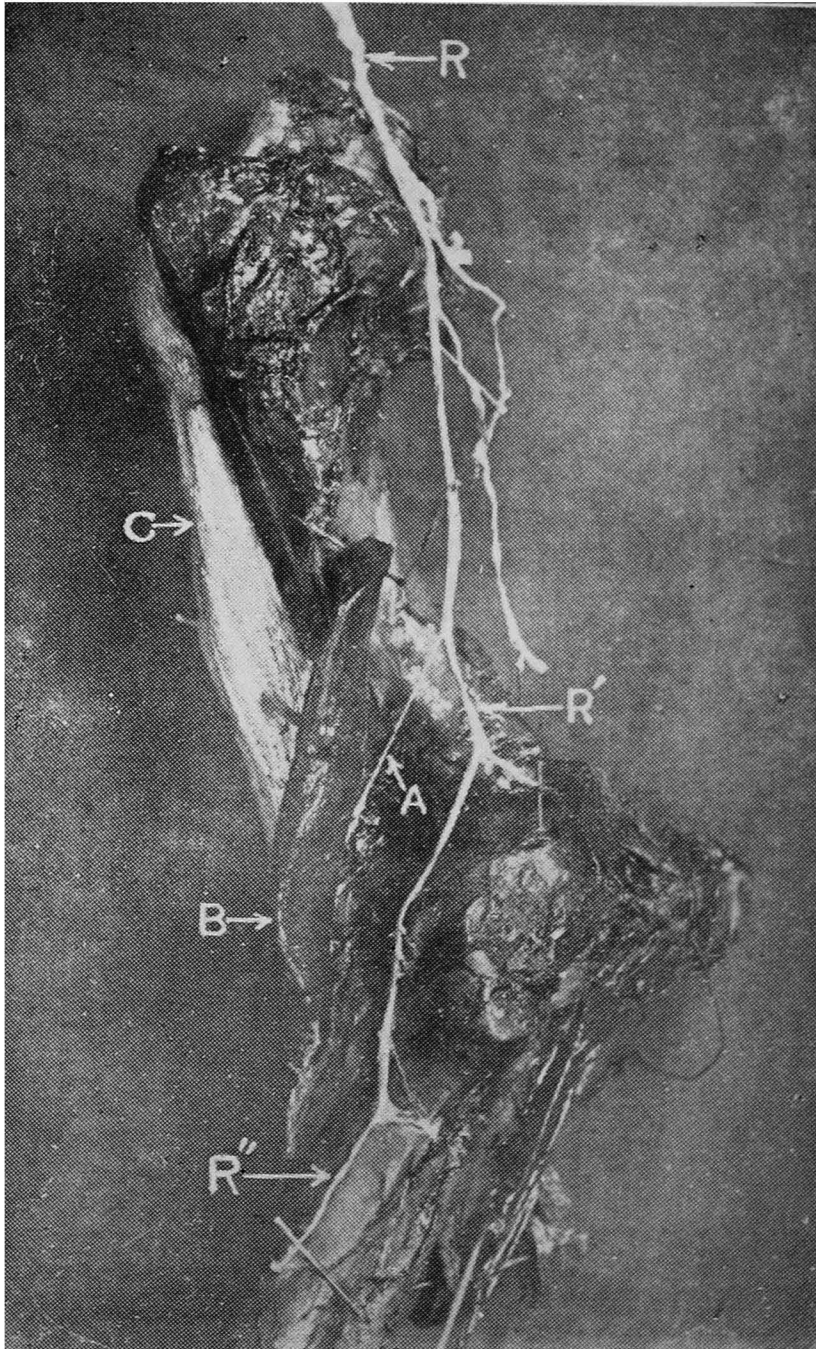
The common trunk formed by the union of the two internal jugulars, after running down a distance of about an inch, terminated at the place of meeting of the two external jugulars. (Plate L.)



**M. M' : Median nerve ; U. U' . U'' : Ulnar nerve ; S. F : Superficial flexor ;
A : Branch of U into S. F ; B : Branch of M into S. F.**

(By the courtesy of the Editor, Indian Veterinary Journal.)

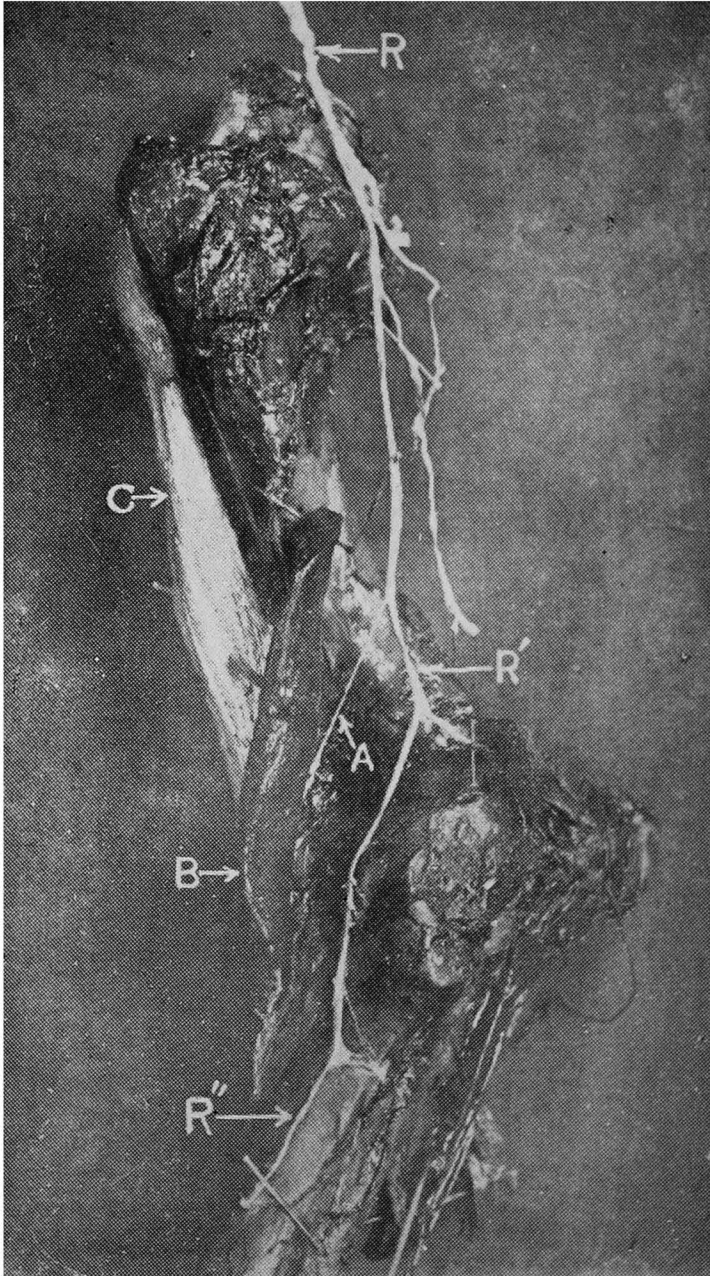
PLATE XLVIII.



R : Radial nerve ; B : Brachialis anticus ; C : Coraco-radialis ;
M : Musculo-spiral groove ; A : Branch of radial nerve to brachialis anticus.-

(By the courtesy of the Editor, Indian Veterinary Journal.)

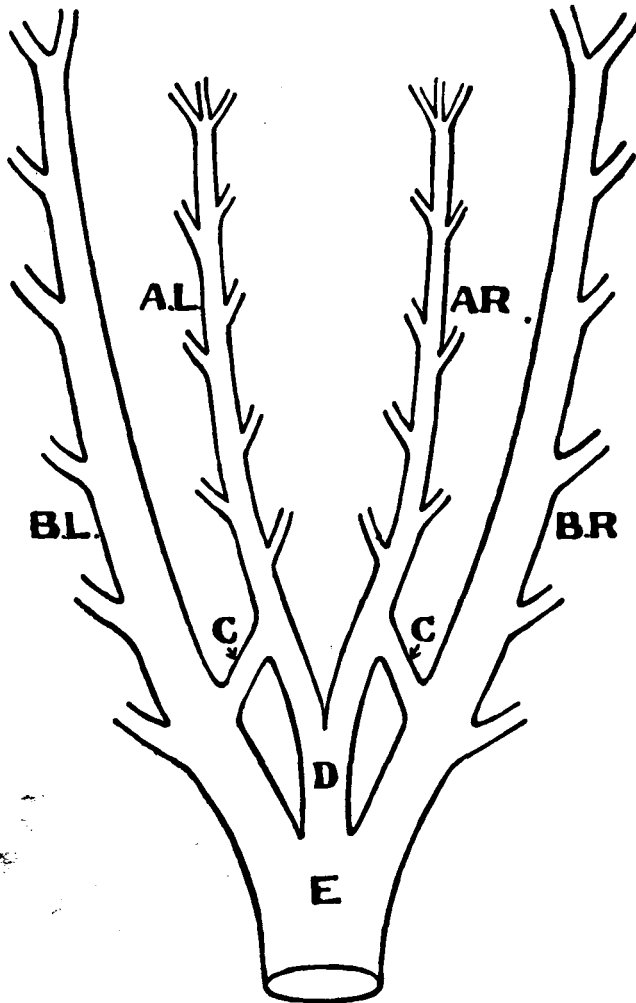
PLATE XLVIII.



R : Radial nerve ; B : Brachialis anticus ; C : Coraco-radialis ;
M : Musculo-spiral groove ; A : Branch of radial nerve to brachialis anticus.

(By the courtesy of the Editor, Indian Veterinary Journal.)

PLATE I.



A. L. : Left internal jugular ; A. R. : Right internal jugular ; B. L. : Left external jugular ; B. R. : Right external jugular ; C. : Communicating branch from each internal jugular to the corresponding external jugular ; D. : Common internal jugular formed by the union of the internal jugulars ; E. : Termination of D at the meeting of the two external jugulars.

(By the courtesy of the Editor, Indian Veterinary Journal.)

27. ADDITIONAL NERVE TO SUPERFICIAL FLEXOR OF THE FORE LIMB—OX.

Though this muscle is said to get a nerve supply both from the ulnar and median nerves in the horse, the author has so far found in almost all the subjects of the ox-type this muscle supplied by the branches from the ulnar nerve only.

In one subject that came under observation during 1934, this muscle was observed getting branches from the median nerve also, besides its usual supply from the ulnar nerve.

28. NERVE TO BRACHIALIS ANTICUS MUSCLE—OX.

The brachialis anticus or brachialis (Sisson) is usually supplied by the muscular division of the "Musculo-cutaneous" branch of the median. Although Sisson observes that it is supplied frequently by the radial nerve also, it was never observed either in the horse or the ox till now. But in a subject of the ox-type, for the first time in 1934 (19-1-34), this muscle was observed receiving branches both from the median and the radial nerves. (Plate XLVIII.)

29. NERVE TO CORACO-RADIALIS—OX.

A branch from the median nerve—"Nerve to coraco-brachialis and Coraco-radialis" usually supplies the muscle.

In one subject, this coraco-radialis, besides being supplied by this nerve, was also supplied by a branch coming from the "Musculo-cutaneous branch" of the median. The muscular branch of the musculo-cutaneous divided into two and one of these entered the brachialis anticus and the other the lower part of the coraco-radialis.

30. NERVE TO PECTINEUS—OX.

The pectineus muscle usually gets its nerve supply from the obturator nerve. In two subjects, this muscle was found to get an additional supply by a branch derived from the internal saphena nerve besides the usual supply from the obturator nerve. This additional branch was found detached from the internal saphena nerve about $2\frac{1}{2}$ inches above the pelvic brim, in front of the iliac shaft about its middle. It then ran backwards, entered the pectineus, divided into branches and supplied this muscle.

31. NERVE TO OBTURATOR INTERNUS MUSCLE—OX.

This muscle usually gets supplied by a slender branch detached from the sciatic nerve. This muscle, in one subject, was supplied by an additional branch derived from the obturator nerve, besides the usual branch from the sciatic nerve.

32. NERVE TO TENSOR VAGINÆ FEMORIS (TENSOR FASCIÆ LATÆ)**—OX.**

This muscle is usually supplied by the longest branch of the anterior gluteal nerve. But in two subjects, the lateral cutaneous nerve (the continuation of the ventral branch of the third lumbar) was found to detach as it was descending on the medial face of this muscle, one small branch to the Precrural lymphatic gland and a large branch to this muscle. The tensor vaginæ femoris, in these two subjects, besides getting the usual nerve supply from the long branch of the anterior gluteal was also supplied by the branch of the Lateral cutaneous nerve.

33. ARTICULAR BRANCH (NERVE) TO STIFLE—OX.

Internal saphena nerve in one subject, besides supplying branches to Sartorius muscle and Femoral artery, was found detaching a distinct articular branch to the stifle joint.

34. PERONEAL CUTANEOUS WANTING IN TWO SUBJECTS—OX.

Usually, the peroneal cutaneous nerve (lateral cutaneous nerve of the leg)—a branch from the external popliteal (Peroneal nerve) emerges from under the Biceps femoris at the level of the stifle joint and supplies the skin on the outer side of the stifle joint.

This nerve was found wanting in two subjects so far.

35. ADDITIONAL NERVE TO SUPERFICIAL FLEXOR OF THE FORE LIMB—**OX.**

The median nerve supplying the superficial flexor of the fore limb was observed for the first time in 1933 (*vide* article No. 27—Plate XLVII). A similar condition was again observed for the second time in 1934, in one of the demonstration subjects (Ox).

Though this muscle in the horse is said to be supplied by both the median and ulnar nerves, the main supply that the author has observed to this muscle in the ox is from the ulnar and he has never found branches of the median going into this muscle in any of the subjects of the ox-type that came under observation except in the two subjects referred to above.

This muscle in the ox is invariably supplied by the branches from the ulnar nerve only.

36. NERVES FORMING THE LUMBO-SACRAL PLEXUS IN THE HORSE AND**OX.**

Chauveau observes that both in solipeds and in ruminants, the lumbo-sacral plexus is formed by *last two lumbar and the first three sacral*. The third

sacral is described by him as giving a fine filament which reaches the second in passing downwards and forwards.

Sisson describes the lumbo-sacral plexus in the horse as being formed by the *last three lumbar and the first two sacral nerves* but does not say if the formation of this plexus is any different in the ruminants.

Bradley (Veterinary Anatomy—138—Part II-1896) describes the lumbo-sacral plexus as being formed by *the last three lumbar and the first three sacral nerves* in the horse but does not note differences, if any, in the ruminant.

M'Fadyean states that this plexus is formed in the horse by the inferior primary branches of the *last three lumbar and the first two sacral and also receives a fasciculus from the third lumbar*. Differential features in the formation of this plexus in ruminants are not dealt with.

The author has, in course of his work on the horse, always found this plexus as formed by the last three lumbar and the first two sacral and as said by M'Fadyean, he has very frequently observed a branch from the third lumbar joining this plexus.

He has always found this plexus in the ruminant being formed by the 4th, 5th and 6th lumbar and the first and second sacral nerves.

37. DEVIATION IN THE DISPOSITION OF THE TERMINAL BRANCHES OF THE MEDIAN AND THE ULNAR NERVES—OX.

The following is the usual behaviour of the ulnar and the median nerves in the ox :—

The ulnar nerve divides at a variable distance down the forearm into Superficial (dorsal) and Deep (volar) branches. The former is continued as Antero-external digital nerve (lateral dorsal digital) on the external aspect of the outer digit. The deep branch descends down the carpus, supplies a branch to the suspensory ligament below the carpus and then unites with the outer branch of the median (lateral branch) and is continued down as postero-external digital nerve (lateral volar digital).

The median nerve divides at the distal part of the metacarpus into medial and lateral branches. The medial branch after detaching some twigs to the internal small digit, is then continued as the postero-internal digital nerve (medial volar digital nerve). This medial branch gives off a branch which joining a branch from the lateral branch of the median forms the common digital nerve. The lateral branch of the median is larger and it bifurcates. One division unites with a branch from the medial division of the median to form the common digital nerve as already said. The other division unites with the deep branch (volar branch) of the ulnar nerve to form the postero-external digital nerve.

The following observations were made in a subject on 11th October 1934 (Plate XLIX):—

1. The usual branch of the medial branch of the median that should join the lateral branch of the median to form the "common digital nerve" was absent.
2. The lateral branch of the median did not bifurcate. It did receive a slender branch from the deep division (volar) of the ulnar and then continued down as the common digital nerve. It did not receive a branch from the medial branch of the median towards the formation of this common digital nerve.
3. One of the branches of the superficial division (dorsal) of the ulnar nerve, detached at the superior border of the pisiform, had a communicating branch from the deep (volar) division of the ulnar joining it a little above the level of the external sesamoid of the outer digit. This united nerve then supplied the outer small digit.

38. ADDITIONAL NERVE TO PECTINEUS MUSCLE—OX.

Pectineus, usually, gets its nerve supply from the obturator nerve. This muscle, getting its additional nerve supply from the internal saphena nerve, has been observed and recorded by the author in two subjects (article No. 30).

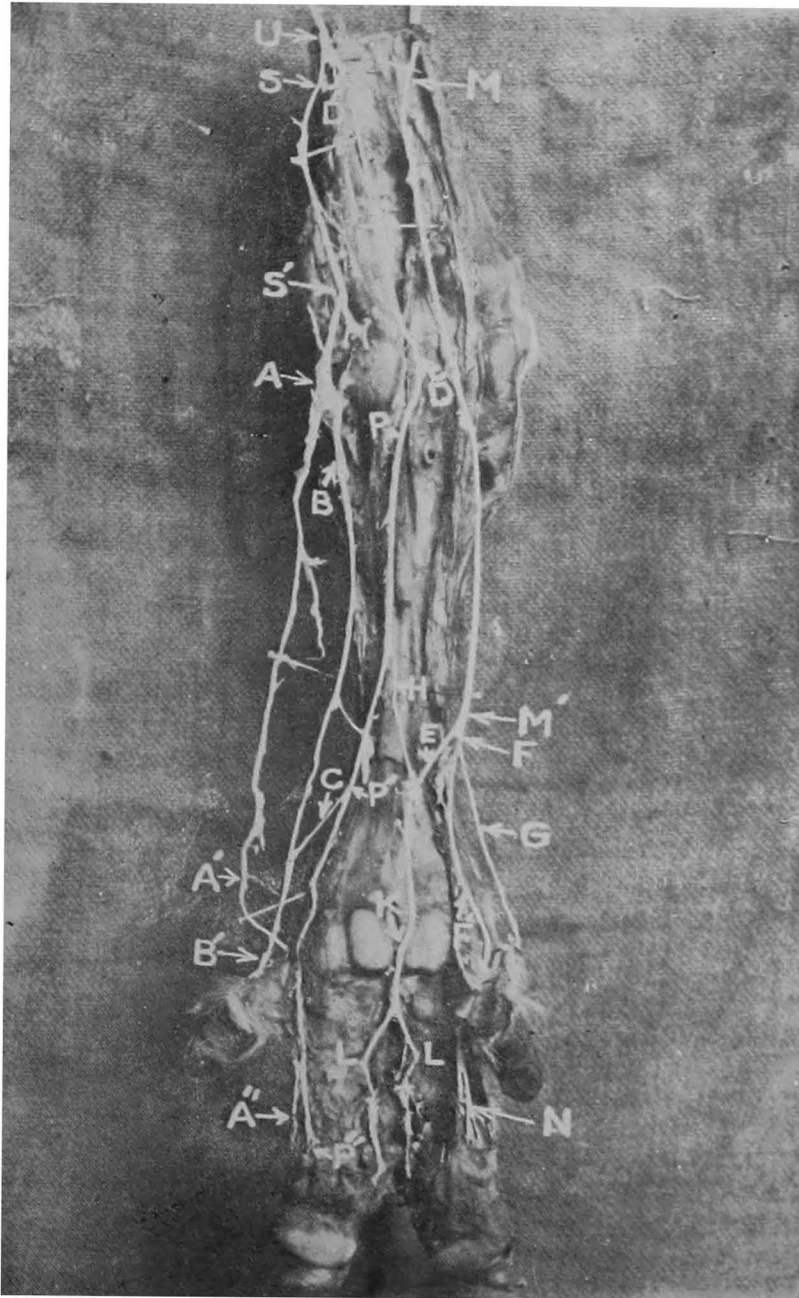
He had yet another subject wherein the pectineus, besides getting the usual nerve supply from the obturator, had also a number of branches at different levels from the internal saphena nerve in its downward course. These branches, derived from the internal saphena nerve to the Pectineus, were as follows:—

- (a) One large branch which was detached from the internal saphena nerve at its origin from its parent (the anterior crural nerve) reached the pectineus and terminated in it.
- (b) A muscular branch from the internal saphena nerve divided into two—one of which supplied the sartorius and the other terminated in the pectineus a little below the entrance of the first branch (a) referred to above.
- (c) The internal saphena nerve, just before it emerged between sartorius and Gracilis, detached a number of short branches and all these branches were distributed to the pectineus.

NOTE.—In the two subjects referred to in article No. 30, the pectineus received in each one of these two subjects, a single branch from the internal saphena nerve. But in the third subject referred to in this article (No. 38) this muscle received some long and several short branches and hence this record.

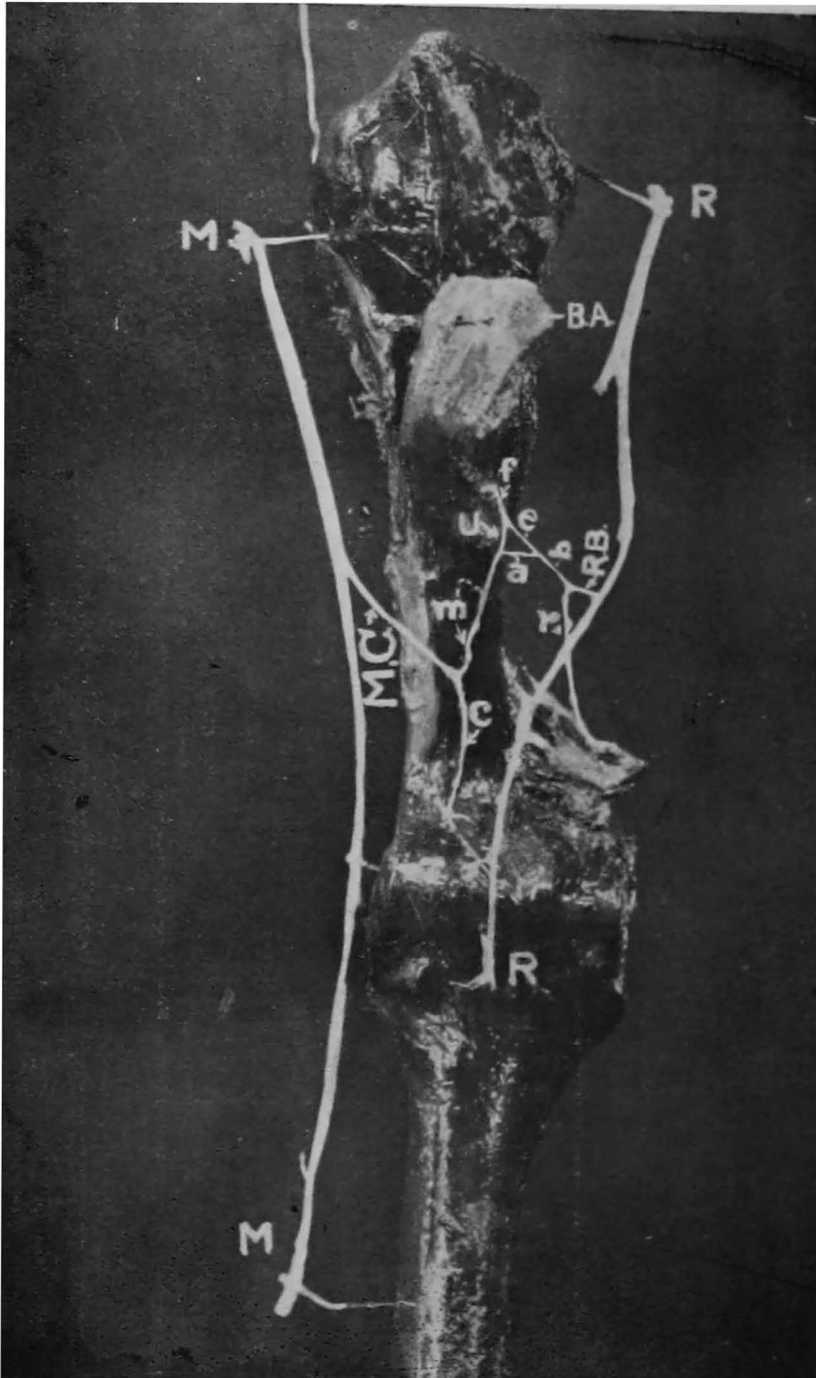
39. ADDITIONAL NERVE TO OBTURATOR INTERNUS MUSCLE—OX.

Though this muscle is generally supplied by a slender branch from the sciatic, the author has recorded in his article No. 31 that it received in one subject of the ox-type (1933), an additional branch from the obturator nerve.



U : Ulnar nerve ; S. S' : superficial division of Ulnar ; D. D' : deep division of ulnar ; A. A'. A'' : Antero-external digital nerve ; P. P'. P'' : Postero-external digital nerve ; B : branch from A terminating in the external small digit ; C : branch from P joining B ; M. M' : median nerve ; E : external branch of median ; F : internal branch of median ; G : branch from F terminating in the internal small digit ; N : continuation of F as Postero-internal digital nerve ; H : branch from D joining F ; K : common digital nerve ; L. L' : Proper digital nerves.

(By the courtesy of the Editor, Indian Veterinary Journal.)



M. M : Median nerve ; M. C : Musculo-cutaneous nerve from M. dividing into (m) muscular and (c) cutaneous branches ; R. R : Radial nerve ; R. B : branch from radial dividing into (r) a branch to extensor metacarpi magnus and (b) again dividing into (a) and (e) of which the short branch (a) joins (m) of M. C and forms U. ; The longer branch (e) joins then U. and the common cord (f) formed by the branches of M. C and R. enters the muscle B. A : Brachialis anticus.

Of the many subjects that came under observation during 1934, he has again observed the above condition in another subject.

In both the above subjects, the branch from the obturator nerve to this muscle was found detached just as the nerve (obturator) was passing through the foramen Ovale. After detachment from the obturator nerve, this branch ran for a distance of about $\frac{3}{4}$ of an inch, entered the anterior part of this muscle, then branched and supplied it. In both these cases, the usual slender branch from the sciatic nerve was also found supplying this muscle.

40. NERVE TO BRACHIALIS ANTICUS—OX.

Brachialis anticus, is usually supplied by the muscular branch of the "Musculo-cutaneous" which is a branch of the median nerve. Though the Radial nerve lies in the musculo-spiral groove and along the border of this muscle in its downward course, it does not usually detach any branch to this muscle. Though Sisson has observed that this muscle is frequently supplied by the Radial also, the author with that condition for the first time in one subject of *the ruminant type in 1934. The usual branch of the musculo-cutaneous of the median and this additional branch from the radial entered this muscle in this subject separately without having any connection with each other.

But, in a subject that came under observation, in 1935, a further peculiarity was noted in this that the branches of the radial united with the muscular branch of the musculo-cutaneous of the median in the musculo-spiral groove before reaching the muscle and the common cord resulting from the union of these branches then entered the brachialis anticus. (Plate LI.)

41. NERVE TO OBTURATOR INTERNUS (OX)—A FURTHER PECULIARITY.

That this muscle was found supplied in two subjects by the obturator nerve besides the usual branch from the sciatic, has been recorded by the author in his articles 31 and 39.

A further peculiarity was noted in the nerve supply to this muscle in a third subject during 1934. The obturator internus muscle, in this subject instead of getting its usual nerve supply direct from the sciatic, received from one of the branches of the united nerve formed by the union of third and fourth sacral nerves (Branch O of P'—Plate LII). Again, this muscle in this third subject also received a branch from the obturator nerve.

* (Article No. 28, Plate XLVIII.)

42. DEVIATION IN THE DISPOSITION OF THE FIRST FOUR SACRAL NERVES AND THEIR BRANCHES—OX.

The usual behaviour of the ventral branches of the first four sacral nerves is as follows :—

The first and the second nerves are the largest and unite with each other and with those of the last three lumbar to form the lumbo-sacral plexus.

The ventral branches of the third and the fourth are connected with each other and the majority of their fibres go to form the Pudic and the Posterior Hæmorrhoidal nerves. The former after pursuing a flexuous course becomes the dorsal nerve of the penis. When in the pelvis it anastomoses with the posterior hæmorrhoidal nerve. It gives branches to the urethra, ischio-cavernus muscle, bladder, rectum and skin and muscles of the anus. In the female, it terminates in vulva and clitoris.

The posterior hæmorrhoidal nerve anastomoses with the pudic nerve and supplies rectum, anus and skin surrounding it. In the female it supplies vulva also.

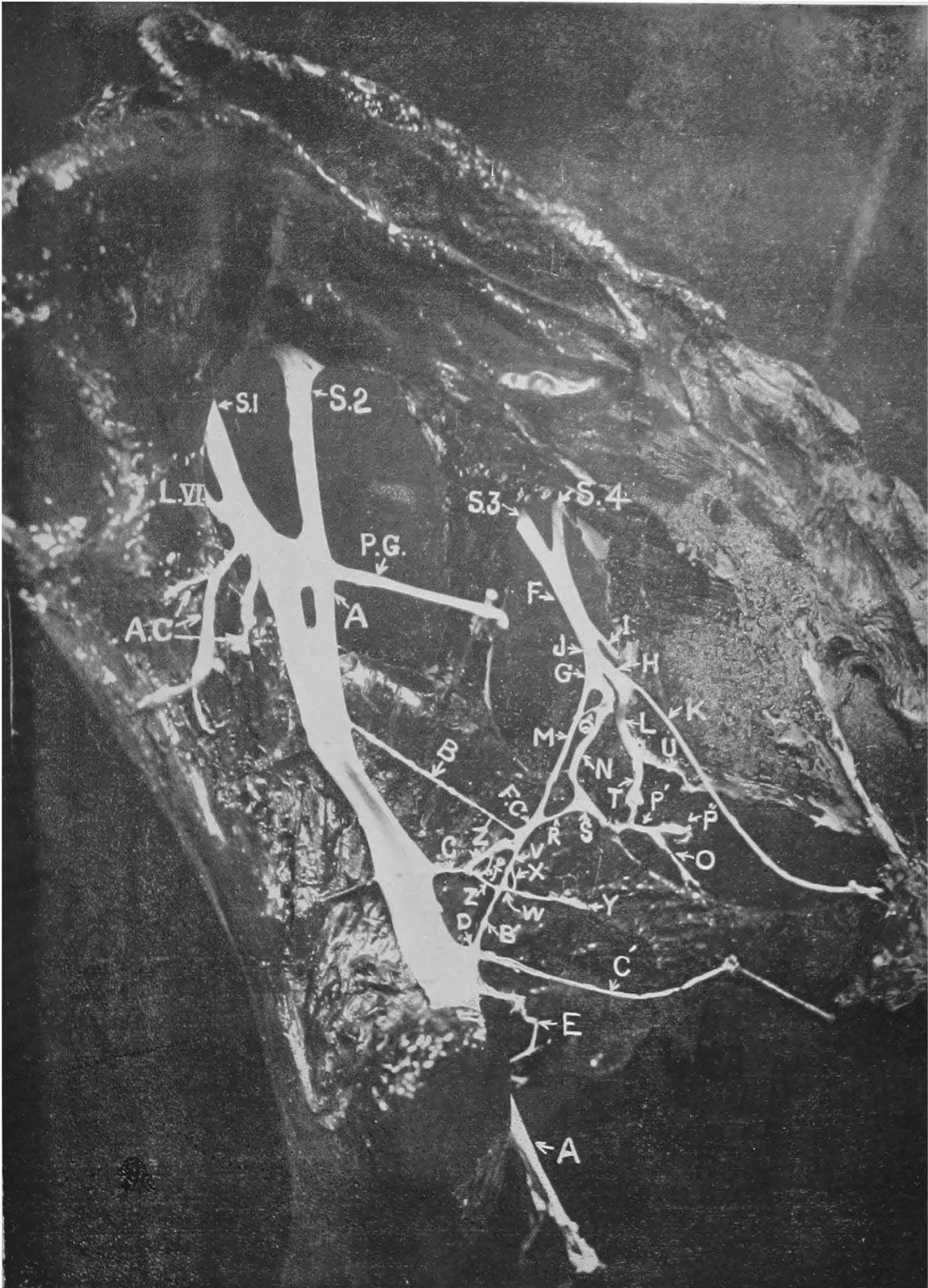
In one male subject of the ox-type that came under observation in 1934, the following behaviour of the sacral nerves was noticed :—

(Plate LII.)

The sciatic nerve A formed by the inferior primary branches of the 6th lumbar and the first two sacral nerves (L. VI, S. 1 and S. 2) as it descended on the deep gluteus muscle, detached from its posterior face four branches (B, C, D and E) at different levels—all between the greater and lesser sacro-sciatic foramina.

The inferior branches of the third and fourth sacral nerves (S. 3 and S. 4) united together and formed a common nerve (F) and this then divided into two branches J and I. The branch (I) continued backwards on the deep face of the sacro-sciatic ligament and took the position of the posterior hæmorrhoidal nerve; while the branch (J) again divided into G and H. The branch G divided into M and N and these two (M and N) were connected by a short connecting branch Q. The branch H divided into K and L, of which the branch K reached the posterior part of the combined biceps femoris and superficial gluteus at the level of the tuber ischii and terminated in it; and the branch L divided into T and U and this branch U first placed itself on the superficial face of the sacro-sciatic ligament and then got on to the deep face of it by passing on the inferior border of this ligament at the lesser sacro-sciatic foramen and anastomosed with the branch (I) of F already referred to and thus contributed towards the posterior hæmorrhoidal nerve. The branch T continued down and joined a branch S of N.

The branch M of G, after it was connected to N by the communicating branch Q, ran downwards and forwards and joined the fasciculus FC; the branch N of G divided into (1) a small branch R which also joined the fasciculus FC and (2) a large branch S which inclining backwards was joined by the branch T of L and a nerve F' resulting from this union entered the pelvis once again through the



L VI: 6th Lumbar nerve; S. 1: 1st sacral nerve; S. 2: 2nd sacral nerve; A. C: anterior gluteals; P. G: posterior gluteals; B, C, D and E: branches of the sciatic nerve; S. 3: 3rd sacral nerve; S. 4: 4th sacral nerve; P: Pudic nerve; O: nerve to obturator internus muscle; F. C: fasciculus formed by the meeting of the branches B, Z' and V of the sciatic and the branches M and R derived from the united nerve formed by the 3rd and 4th sacrals.

anterior part of the lesser sacro-sciatic foramen. This nerve P' at its entrance into the pelvis, detached a branch O, which on reaching the outer border of the obturator internus muscle (external part of this muscle lying close to the lesser sacro-sciatic foramen) divided into two branches both of which were distributed to this muscle.

The nerve P', after detaching this branch O, entered pelvis and became the pudic nerve P''.

The branch B of the sciatic nerve joined the fasciculus FC.

The branch C of the sciatic, after a short course backwards, divided into two branches Z and Z'. The branch Z', after being connected with the branch Z by a communicating branch (f), joined the fasciculus FC, while the branch Z joined a branch V of D.

The branch D of the sciatic divided immediately after its origin from the sciatic into two branches (B' and C') of which the branch C' took a backward course and terminated in the combined biceps femoris and superficial gluteus below the level of the tuber ischii and the branch B' went upwards and divided into two branches V and W and just at the point of the division it was joined by Z of C. The branch W divided into X and Y, of which X joined V and Y terminated in the deep gluteus muscle. The branch V, after it was joined by X, continued upwards and joined the fasciculus FC.

The branch E of the sciatic went downwards and backwards and terminated in the Quadratus femoris.

NOTE.—A five-sided flattened fasciculus FC is seen formed in this subject by the meeting of the branches M and R (from the branches of the 3rd and 4th sacrals) and B, Z' and V from the sciatic and its branches.

The formation of nervous plexuses and a fasciculus by the meeting of the various branches of the sciatic in this region, with branches from the nerve formed by the union of the 3rd and 4th sacral nerves and repeated division and anastomosis of the branches are especial features in this subject. This condition has never been noticed until now and hence this record.

Another feature worthy of note in this subject is that the obturator internus muscle instead of getting its usual nerve supply direct from the sciatic nerve, gets it from one of the branches of the united nerve formed by the 3rd and the 4th sacrals.

43 (1). YET ANOTHER VARIATION IN THE ORIGIN OF THE ARTERY OF THE CORD.

Artery of the cord (external spermatic or cremasteric artery) is very variable in its origin and Sisson has observed that it may spring from either the aorta, external iliac, circumflex iliac or even the internal iliac artery.

The author has recorded in his article No. 23 his finding of a further variation in its origin in a subject in which this vessel was found arising from the Prepubic artery before the latter divided into Posterior Abdominal and External pudic arteries.

He has in the course of his work during 1934 found in two subjects of the o-type, yet another variation in its origin. In these two subjects, this artery of the cord sprang from the posterior abdominal artery which is one of the terminal branches

of the prepubic artery. This artery of the cord in this subject besides, as usual, supplying the structures of the spermatic cord gave off a slender branch which terminated in the Rectus abdominus. (Plate LIII.)

43 (2). TWO UNUSUAL BRANCHES OF THE DEEP FEMORAL (PROFUNDA) ARTERY.

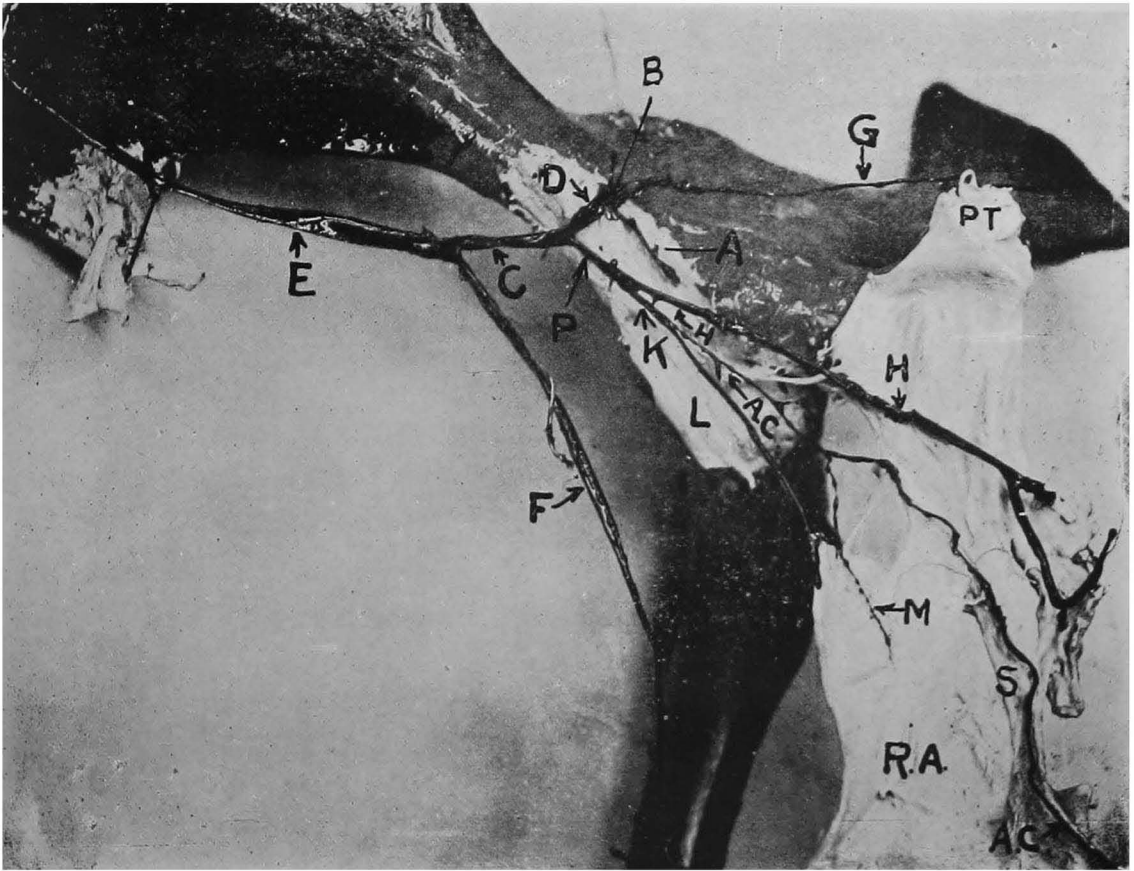
Again, in the same subject referred to in (1) of this article (43), the deep femoral artery arose from a common trunk with the prepubic artery and, just at its origin, this deep femoral artery gave off a branch which divided in its turn into Superior and Inferior branches. The superior (A) terminated in the inferior part of the iliacus muscle at the level of the iliac shaft, while the Inferior (G) ran downwards and backwards and was found distributed to the common prepubic tendon of the abdominal muscles. (Plate LIII.)

44 (1). INDEPENDENT BRANCH (NERVE) TO CORACO-BRACHIALIS.

Common "Nerve to coraco-brachialis and Coraco-radialis" arises from either the anterior root of the median or from the united nerve (immediately after the union of the anterior and posterior roots), passes between the two insertions of the coraco-brachialis and terminates in the coraco-radialis. Just as it is passing under the coraco-brachialis, it detaches some small branches to this muscle. The above is the usual disposition of this nerve to these two muscles both in the horse and the ox-types.

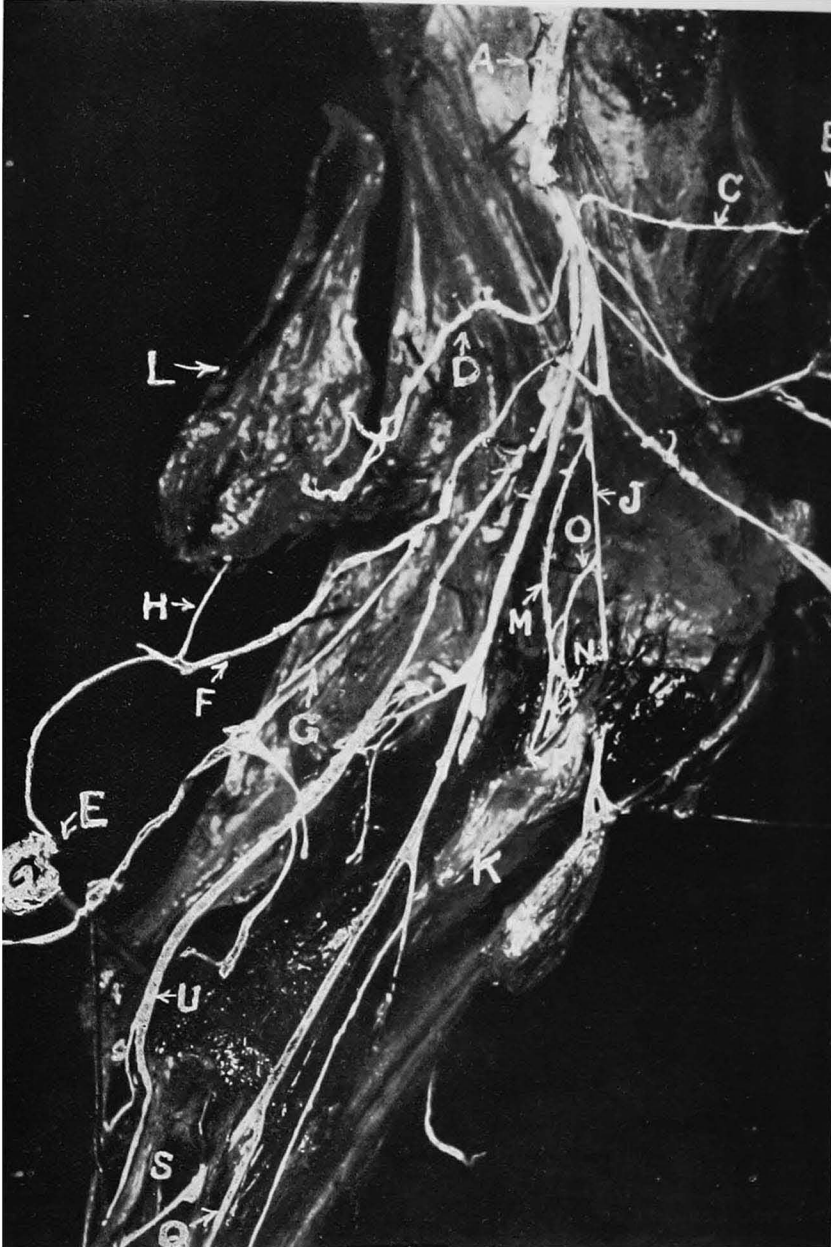
Though the author has recorded a number of cases in the horse type (article No. 2—Plate XXXII, fig. 2) in which he found a "Nerve to coraco-brachialis" independent of this common "Nerve to coraco-brachialis and Coraco-radialis", he had never observed this condition in the ox-type until now.

But, in one subject for the first time in 1934, the author found the coraco-brachialis getting an independent branch besides its usual supply from the common nerve. In this subject, the common "nerve to coraco-brachialis and coraco-radialis" and the independent "branch to coraco-brachialis" both arose from the anterior root of the median. This nerve, as it ran behind the upper part of the coraco-brachialis (below the level of the shoulder-joint), detached a number of short branches and then divided into two and both these entered the posterior border of this muscle. The common nerve as usual passed under this muscle between its two insertions. But before reaching this muscle to pass under it, it detached a long branch which divided into a number of short branches which anastomosed with the branches of the independent nerve referred to above and formed almost a sort of nerve network. This long branch of the common nerve, after contributing the anastomotic branches, entered the posterior border of the coraco-brachialis. It is thus seen that the coraco-brachialis in this subject, besides getting the supply



E: external Iliac artery; F: Femoral artery; C: common trunk from E, dividing into P: Prepubic and D: Deep femoral arteries; B: a branch from D. dividing into branch A to Iliacus muscle-L and branch G to Prepubic tendon-P. T; H: external Pudic artery; K: posterior abdominal artery; A. C: artery of the cord from K; R. A: rectus abdominis; M: branch from A. C to R. A; S: inguinal canal opened out showing the structures of the cord.

PLATE LIV.



A : Brachial Plexus ; B : Sterno-thyro-hyoideus ; C : branch from anterior root of median to B ; D : Usual nerve to Latissimus dorsi-L ; E : section of Panniculus carnosus behind the shoulder and arm ; L : latissimus dorsi ; F : nerve to panniculus ; G : subcutaneous thoracic nerve ; H : branch from F to L ; J : nerve to coraco-radialis from anterior root of median ; K : coraco-brachialis muscle ; M : independent nerve to K from the anterior root of the median ; O : branch of J ; N : nerve network formed by the branches from O and M ; P : point of entrance of M and O into K ; Q : median ; U : ulnar ; S : superficial flexor showing the branches from Q and U getting into it.

from the usual "common nerve", also received a direct independent branch from the anterior root of the median. (Plate LIV.)

NOTE.—This is the first instance in which the author found in the ox-type an independent nerve to this muscle and a nerve network formation between the branches of the independent "nerve to coraco-brachialis" and the "common nerve" (on the upper part of the internal face of the shaft of the humerus). He had never observed this network formation in those cases of the horse-type where he had observed the presence of an independent "nerve to coraco-brachialis".

44 (2). ADDITIONAL NERVE TO LATISSIMUS DORSI.

(In the same subject referred to in (1) of this article 44.)

Usually, the latissimus dorsi muscle gets its nerve supply from one of the branches of the brachial plexus, its fibres being derived from the 8th cervical and the 1st dorsal nerves.

This muscle in this subject, besides getting this usual supply from the brachial plexus, was found to get another nerve and this nerve entered the lower part of the latissimus dorsi at its place of attachment to the posterior deep pectoral. This additional nerve was a branch detached from the "nerve to panniculus behind the shoulder and arm" which is formed by a branch from the Subcutaneous thoracic nerve with the 2nd and 3rd perforating intercostal nerves. (Plate LIV.)

NOTE.—This is the first time (either in the horse or the ox) that such an additional nerve was found entering this muscle and hence this record.

44 (3). NERVE TO STERNO-THYRO-HYOIDEUS—OX.

(In the same subject as in 44 (1) and (2).)

The usual nerve supply to this muscle is from the inferior branches of the 1st and 2nd cervical nerves. But in this subject, some of the branches from the anterior root of the median entered the lower part of this muscle (at its origin). This branch originated from the anterior root of the median a little above the origin of the fibres supplying the anterior superficial pectoral. (Plate LIV.)

44 (4). The superficial flexor of the digit of the fore limb of this subject received its nerve supply both from the ulnar and median nerves. (This is the third subject in which this condition was observed.) (Articles 27 and 35.) (Plate LIV.)

45. VARIATION IN THE ORIGIN AND DISTRIBUTION OF THE INFERIOR CERVICAL ARTERIES.

This vessel in the ox, usually, corresponds to the ascending branch of that vessel in the horse. The author has recorded in his article No. 25 that it was found wanting in one subject and that in this subject its place was taken up by one of the branches of the external thoracic artery.

As to its origin, it is usually an extra-thoracic branch of the Axillary (Brachial-*sisson*) artery. Sometimes its origin was found to be intra-thoracic, when it was found to come off from the anterior face of the axillary artery before the latter emerged out of the thoracic cavity. Sometimes it was found to come off by a common trunk with the external thoracic artery.

But in a subject of the ox-type, this inferior cervical artery or that which took its place was found (1934) arising almost close to but a little anterior to the origin of the common trunk of the dorso-cervical et vertebral on the right side. This vessel, after originating in the manner described, emerged out of the thoracic cavity winding round the anterior border of the first rib, continued its course upwards placing itself between *mastoido-humeralis* and *subscapulo-hyoideus*, supplying these muscles and the prescapular lymphatic gland and finally terminated in the *supra-spinatus* muscle.

NOTE.—Its origin so close to the common trunk and its supply to the *supraspinatus* muscle are the unusual features.

The inferior cervical artery on the left side of this subject, sprang from the left axillary artery at the same level as the internal thoracic artery, but from its anterior face a little before the axillary artery emerged out of the thoracic cavity. The origin of the left inferior cervical artery was thus about an inch anterior to the origin of the common trunk of the left dorso-cervical et vertebral artery. (Plate LV.)

46. UNUSUAL BEHAVIOUR OF THE ANTERIOR AND POSTERIOR COMMON DIGITAL ARTERIES IN A HIND LIMB—OX.

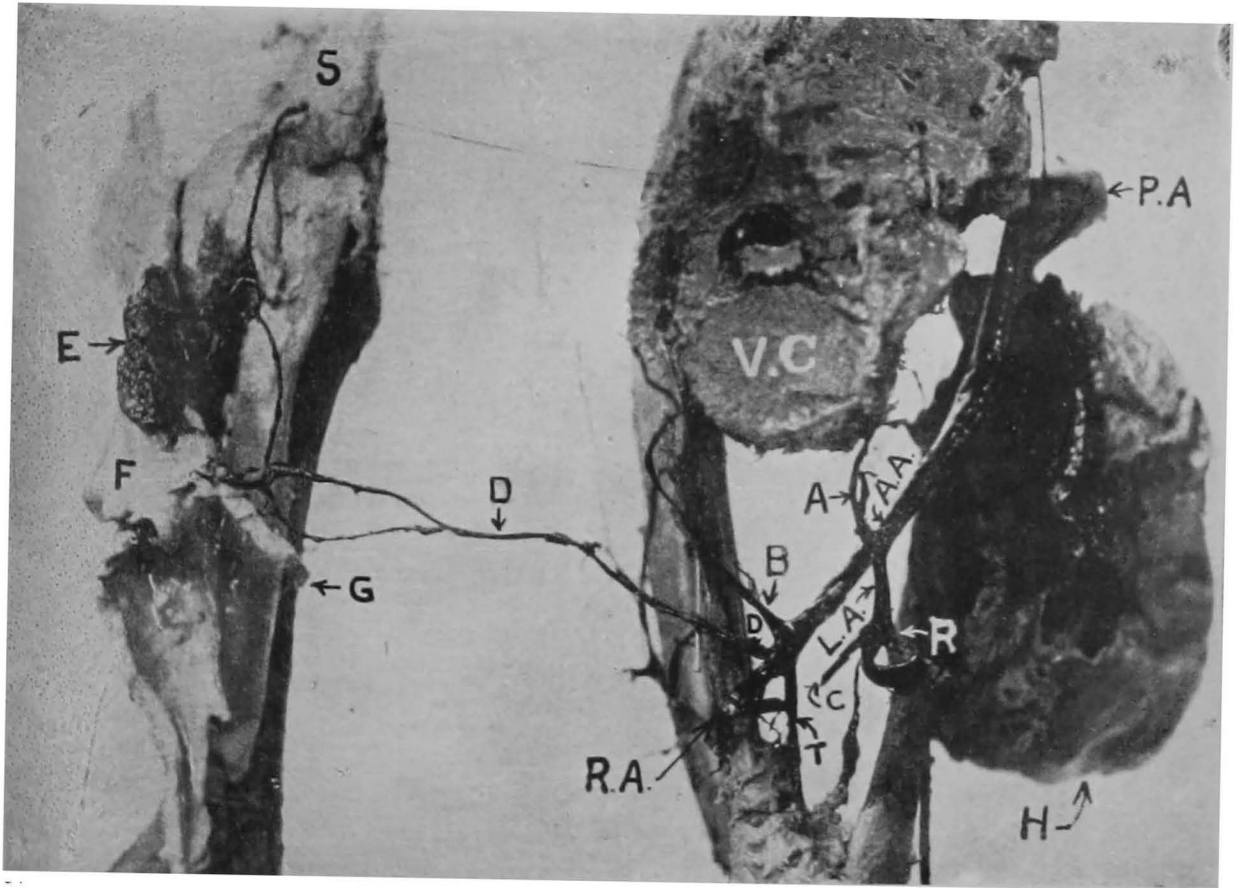
Each of these usually divides into external and internal branches and the like branches of these two common digital arteries unite to form Proper digital arteries (internal and external.)

But in a subject (1934), the anterior common digital artery joined the posterior common digital artery instead of each dividing into external and internal branches as said above and then this united artery divided into proper digital arteries. (Plate LVI.)

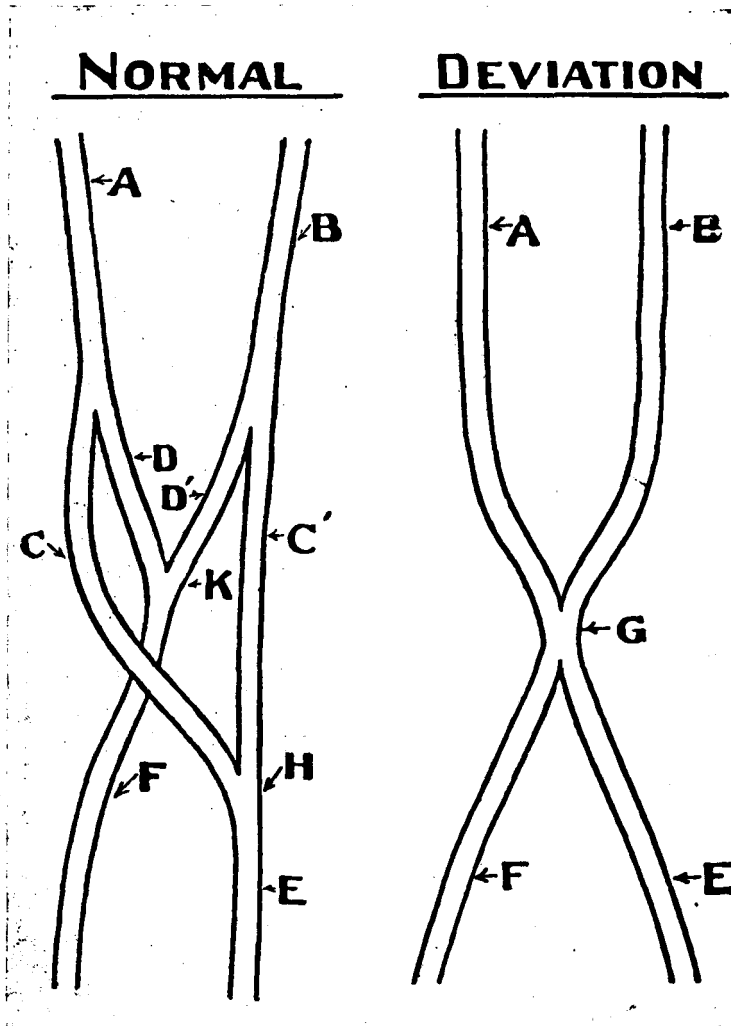
47 (1). FURTHER PECULIARITY IN THE DISPOSITION OF THE BRONCHIAL AND ŒSOPHAGEAL ARTERIES—OX.

Bronchial and Œsophageal arteries in the ox usually arise as independent branches from the thoracic aorta. These do not arise as independent branches in the horse but as a common trunk—"broncho-Œsophageal artery", which arising from the thoracic aorta divides into Bronchial and Œsophageal arteries.

The author has already discussed his findings on these vessels in two subjects of the ox-type in his article No. 19 and he has suggested therein that the bron-



A: left common trunk; **B:** right common trunk; **C:** left inferior cervical artery; **D:** right inferior cervical artery; **E:** preescapular lymphatic gland; **F:** mastoido-humeralis; **G:** omo-hyoideus; **S:** supraspinatus; **H:** heart; **A. A:** anterior aorta; **L. A:** left axillary; **R. A:** right axillary; **T:** right internal thoracic; **R:** left internal thoracic; **V. C:** vertebral column; **P. A:** posterior Aorta.



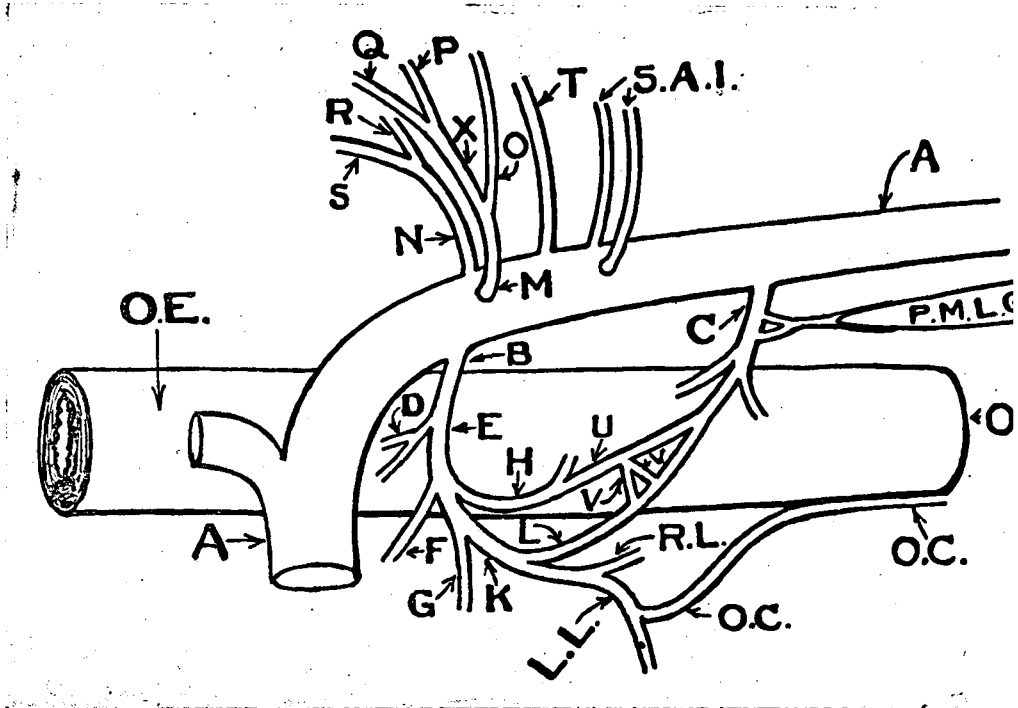
Normal :

A : anterior common digital artery ; B : posterior common digital artery ; C, C' : external branches of the anterior and posterior common digital arteries respectively ; D, D' : internal branches of the anterior and posterior common digital arteries respectively ; K : union of D and D' ; H : union of C and C' ; F : internal proper digital artery ; E : external proper digital artery.

Deviation :

A : anterior common digital artery ; B : posterior common digital artery ; G : union of A and B ; F : internal proper digital artery ; E : external proper digital artery.

PLATE LVII.



O. E. : Oesophagus ; A : Thoracic aorta ; B : Broncho-oesophageal artery dividing into D : oesophageal bronchial arteries ; F : a branch from E to left lung ; H : a posterior branch of medium size from E to oesophagus ; G : an anterior slender branch from the E to the left lung ; K : the middle large branch of E ; L : a branch from K to anastomose with a branch from the oesophageal artery ; V : connecting branches between the two anastomosis ; L. L. : left bronchial to left lung ; R. L. : right bronchial to right lung ; O. C. : branch from L. L. gaining the under face of the oesophagus ; C : oesophageal artery ; P. M. L. G. : posterior mediastinal lymphatic gland ; M : the left 1st aortic intercostal and its division ; O : 6th intercostal artery ; P : branch of X-5th intercostal artery ; Q : branch of X-4th intercostal artery ; I : first aortic intercostal ; R : branch of N-5th intercostal artery ; S : branch of N-4th intercostal artery ; T : single vessel on the right side (6th intercostal-right) ; S. A. I. : second pair of aortic intercostals.

chial artery of one and the œsophageal artery of the other of these two subjects may each be taken as the Broncho-œsophageal artery as they were noticed to bear a resemblance to the Broncho-œsophageal artery of the horse.

In a subject that came under observation during 1935, the following further peculiarity was noticed in the disposition of these two vessels :—

Bronchial artery.—At the usual position of the bronchial artery of the ox, *i.e.* just at the level of the first aortic intercostal artery there came off a branch from the ventral face of the thoracic aorta and the author names it for the sake of convenience as Broncho-œsophageal artery. This divided immediately after its origin into two branches—anterior and posterior and these branches are named as œsophageal and bronchial respectively. The anterior or the œsophageal branch divided into two branches and both these terminated in the wall of the œsophagus at the place where the thoracic aorta is in contact with the œsophagus. The posterior or the bronchial branch, first detached a branch to the left lung and then divided into three branches :—(a) a narrow anterior branch which entered the left lung, (b) a medium sized branch which became œsophageal and a branch from this anastomosed with one of the branches of the œsophageal artery (which was detached as an independent branch in its usual position) about three inches behind the main branch referred to, from the aorta ; (c) The middle—the largest branch descended backwards between the trachea and the œsophagus and detached another œsophageal branch which also anastomosed with another branch of the independent œsophageal artery. This anastomosis and that referred to in (b) were connected by communicating branches. This middle branch then reached the bifurcation of the trachea and divided into right and left bronchial arteries each of which reached the corresponding lung. The left bronchial, before reaching the left lung, detached yet another œsophageal branch which ran backwards on the under face of the œsophagus in company with the inferior œsophageal continuation of the vagi.

œsophageal artery.—The usual independent œsophageal artery was there and it sprang from the thoracic aorta at the usual place. It, as usual, supplied the posterior mediastinal lymphatic gland and the œsophagus. But some of the branches it gave off for the œsophagus, anastomosed with the branches of the bronchial artery, on the left face of the œsophagus.

NOTE.—(1) The first branch though it sprang from the thoracic aorta at the position of the usual bronchial artery, it detached a number of œsophageal branches and hence it must be termed as broncho-œsophageal artery.

(2) The œsophageal artery as usual sprang from the thoracic aorta as an independent branch, but it detached some branches which anastomosed with the œsophageal branches of the bronchial artery. This kind of anastomosis was observed for the first time.

The most interesting and unusual features here were :—(a) the anastomosis formed between the branches of the œsophageal artery and the œsophageal branches of the bronchial artery, (b) the continuation of a branch—an œsophageal branch from the left bronchial artery backwards in company with the inferior œsophageal continuation of the vagi and (c) the left lung getting two small branches in addition to the usual left bronchial artery. (Plate LVII).

47 (2). DEVIATION IN THE ORIGIN OF SOME OF THE INTERCOSTAL ARTERIES.

(in the same subject referred to in article No. 47(1)).

There are thirteen pairs of intercostal arteries in the ox. Usually, the first comes off from the dorsal artery, the next four from the sub-costal artery and the remaining eight from the aorta directly.

But the following deviation was observed in a subject (1935):—The first pair:—The first one on the left divided immediately after its origin from the aorta into two divergent branches—Anterior and Posterior. The anterior on reaching the surface of the Longus colli divided into two branches which became the 4th and the 5th intercostal arteries; while the posterior branch became the 6th intercostal artery.

It is therefore seen that the left sub-costal artery supplied only second and third intercostal arteries and that the 4th and the 5th were derived, though indirectly, from the aorta.

The first one on the right went up to Longus colli and divided into two branches which became the 4th and 5th intercostal arteries.

About half an inch behind this first one on the right side, there arose a single unpaired vessel from the aorta in a line with the rest and it became the 6th intercostal artery.

The right sub-costal artery also supplied only 2nd and 3rd intercostal arteries and the 4th and the 5th intercostal arteries were therefore derived indirectly from the aorta as on the left side.

The first on the left supplied the 6th intercostal artery also, but that on the right did not do so. This was compensated for by the unpaired vessel referred to (Plate LVII).

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