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دراسات على العضلات خلف الجمجمة

لثعبان ابو السيور : بساموفيس سيبيلانس، رتبة : أوفيديا ـ عائلة كولبريدى

٣ـ العضلات المتصلة بالضلوع

عبدالحميد خليل، محمد وهبة ، ماجده الشابورى

في هذا البحث تمت دراسة العضلات المتصلة بالضلوع وعددها تسعة بيانها كالاتي :

١ـ العضلة الحرقفية الضلعية ورقمها (١٧).
٢ـ العضلة الضلعية الفقارية الظهرية ورقمها (٤) في الثعابين وغير ممثلة في السحالي
٣ـ العضلة الضلعية الجلدية الداخلية والخارجية ورقمها(٥) في الثعابين أ ، ب وغير ممثلة في السحالي.
٤ـ العضلة فوق الضلعة ورقمها ١٨ في الثعابين والسحالي.
٥ـ الضلعة العنقية الضلعة الفقارية ورقمها ٩ في السحالي والثعابين .
٦ـ الضلعة تحت الضلعة ورقمها ٢٤ في السحالي والثعابين.
٧ـ الضلعة الضلعية الفقارية البطنية ورقمها ٧ في الثعابين وغير ممثلة في السحالي .

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STUDIES ON THE POST-CRANIAL MYOLOGY OF PSAMMOPHIS SIBILANS (LINNAEUS), ORDER:OPHIDIA, FAMILY:COLUBRIDAE III- COSTAL MUSCULATURE

(With 22 Figs.)

By
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SUMMARY

The costal musculature or muscles responsible for the movements of the ribs are described in detalis. Nine muscles are present and are investigated. These muscles are: The iliocostal (17), dorsal costo-vertebral (op 4), outer and inner costo-cutaneous (op 5a & b), supracostal (18), cervical costo-vertebral (9), subcostal (24), ventral vertebro-costal (op 7) and tuberculo-costal (op 8).

INTRODUCTION

The costal muscles longitudinally extend between radial connective tissue septa (3) & (4), or lateral to connective tissue septum (4) or connects the successive ribs or lie ventral to those ribs. It was found preferable to deal with them as one group of muscles which have the same responsibility which is the movement of ribs. In fact, it is expected to find these muscles more developed and efficient in size, directions and numbers than the conditions in lizards.

RESULTS and DISCUSSION

The Ilio-costal muscle (Muscle numbered 17 in lizards and snaks) (Figs. 1,2e & f, 5,6,10,11 & 15).

Again, the units of that muscle are found all over the whole lenght of the vertebral column. Each unit, consists of a bundle of muscle fibres which originates on the third vertical connective tissue septum (C.S.3) and dead opposite to the lateral insertion of the dermo-costal (16). The muscular tissue of the unit extends anteriorly to cover the length of three to seven vertebrae, then it gives a long and fine insertion tendon. A sort of a sheath surrounds the insertion tendons of four successive units (Fig. 5) in the trunk region, and two successive units (Fig. 6) in the caudal region. However, in the trunk region the terminal insertion tendons of the four gathered units are independently inserted on a middle region of the ribs of the seventeenth to twentieth vertebrae infront successively.

It was noticed that in the middle of the muscular region of each unit there is found a sort of constriction (Fig. 11) which divides that muscular part into a cranial and caudal parts. The nature or functional significance of that constriction is not understood by the present

authors. The anterior cervical units are inserted together by a broad and thick tendon on the paroccipital process (Fig. 1).

The Dorsal costo-vertebral muscle (OP.4) (Figs. 2c,d,e & f, 5,6,8,9,10,12 & 15).

A similar muscle is not found in lizards. It consists of a series of units which starts on the fourth cervical vertebra and extends back all over the vertebral column below the ilio-costal (17) (Figs. 5 & 6). Each unit is a thick triangular sheet of muscle fibres which originates by its base on the dorso-lateral surface of a proximal region of a rib is directed antero-medially and is inserted by its neck, through a short and strong ligament on the prezygapophysis of the vertebra infront. In the caudal region the units of that muscle originate on the inner surfaces of the transverse processes (fused ribs). GASC (1967) and BELLAIRS (1969) mentioned that this muscle is a levator of the rib and named it "levator costae".

The Outer and inner costo-cutaneous muscle (OP.5a & b) (Figs. 3,4,5,10,13 & 15).

The above term is after BELLAIRS (1969), which denotes proximal and distal thin ribbon-like elements (a & b). Both elements start as from the fourth cervical rib up to the last trunk rib. Each of the proximal elements (a) (Fig. 15) originates on the proximal region of the distal part of a rib, median to the supracostal elements (18) and out of the fourth vertical connective tissue septum (C.S.4), extends postero-laterally to be inserted on the skin, in the region of the dorso-lateral scales. Each of those outer units covers three to six ribs dependent on its locality, being longest in the middle of the trunk region. Each of the inner or distal units (b) originates on a distal most region of the rib, extends antero-laterally and finally inserted on the skin in the region of the dorso-lateral scales, median to the outer elements. Each of the inner units is slightly shorter than an outer unit. Both outer and inner costo-cutaneous may act together in the forward and backward movements of the body ribs.

The supracostal muscle (Muscle numbered 18 in lizards and snakes). (Figs. 1,4,5,7,10,11,14, & 15).

Units similar to those of the snake examined are sometimes found in lizards (KHALIL, et al. 1977), but in that case of lizards only three or four supracostal units are present in the anterior trunk region and are of a short extension. In the case of the snake examined the supracostal units are found in the form of a thick layer all over the cervical and trunk regions (Fig. 4) covering all of the dorsal surfaces of the distal portions of their ribs lateral to the fourth vertical connective tissue septum (C.S.4). The elements of each unit (Figs. 10 & 14) originate on the distal third of a rib. In fact, each of those supracostal units has three elements. The points of origin of the two median elements are very adjacent, while the points of insertion of the two lateral elements are very adjacent, thus the elements of each unit form an N-shape. The origin of the three elements belonging to one unit are on one rib while their points of insertion are located on the fifth rib infront, both origins and insertions are through short tendons. The N-shaped form assumed by those three elements makes the line of pull of the unit parallel to the longitudinal axis of the body. It should be noted that in the case of the cervical region the N-shaped form is not clear, but only muscle fibres which orginate on the ribs, together with the anterior three trunk units (Fig. 7) are inserted by a single ligament on the basioccipital (Fig. 1). Further, in the trunk region a fine muscle bundle extends between the tip of a rib and the tip of the second rib behind.

The intercostal muscle (Muscle numbered 18 in lizards and snakes) (Figs. 5,6,10,12,15 & 18).

It consists of a series of units that are found in the cervical, trunk and caudal regions (Figs. 5 & 6). It should be noticed in this respect, that the sacral and caudal transverse processes

are considered for descriptive purpose, to be fused ribs. In fact, the sacral and caudal intercostal musculature supports the above mentioned consideration. In the cervical and trunk regions each unit of the intercostal consists of muscle fibres that extend between the opposing sides of two successive ribs along all of their lengths from the proximal portions till the distal ends. In the trunk region the muscle fibres extending between the proximal portions of the ribs, are arranged in two layers (intercostal quadrangulaire of GASC, 1967).

The cervical costo-vertebral muscle (Muscle numbered 9 in lizards and snakes) (Figs. 2a & b,16 & 17).

That muscle could be considered as the anterior part of the intercostal (muscle numbered 18). Its fibres originate on the anterior surfaces of the distal ends of all the cervical ribs. However, due to the gradual increase in length of the cervical ribs towards the posterior direction (Fig. 16), the muscle fibres of that muscle extend anteriorly and fused together forming an elongated muscular neck that is inserted by a small tendon on th transverse process of the atlas (Fig. 2a). Also, some muscle fibres are inserted on the lateral surface of the centrum of the axis (Fig. 2b). Again, the pull of that muscle may serve in the forward movement of the ribs.

The subcostal muscle (Muscle numbered 24 in lizards and snakes) (Figs. 10,15,17,18 & 19).

It comprises a series of units which starts from the last cervical vertebra and end by the second sacral vertebra. Each unit consists of two component elements (Fig. 18), a superficial element (a) when dissecting from the ventral side, and a deeper element (b). Both elements originate on the midventral line of the vertebral column and both are more or less ribbon-like. The superficial element (a) is very thin, extends more lateral than anterior, crosses the rib infront and gets finally inserted onthe posterior surface of the rib of the second vertevra infront of the vertebra of origin. The deeper element (b) extends more anterior than lateral to cross three ribs and gets finally inserted on the posterior side of the rib of the fourth vertebra infront. On the opposite side of that place of insertion on the rib originates another similar ribbon (c) which extends antero-laterally crossing the rib infront to get finally inserted on the second rib infront near its distal end.

GASC (1967) homologized the inner elements with the internal oblique of lizards. The outer units (a) originiating on the sacral vertebrae (the inner units (b) are absent) have a very long line of origin and assume a more or less fan-shape. When one compares the anatomical conditions of the subcostals in lizards and snakes, one could discover the very great efficiency of the ophidian subcostals in pulling the ribs backwards.

The ventral vertebro-costal muscle (OP.7) (Figs. 2d & f, 10,20,21 & 22)

This muscle has no homologue in lizards. The units of that muscle start on the fifth cervical vertebra and extend all over the dorsal and caudal vertebrae. In the case of the cervical and trunk regions the units of the ventral vertebrocostal (OP.7) are found in the form of thin ribbons, each of which units (Fig. 20) originates by a strong and relatively long tendon on the lateral side of the hypapophysis (Fig. 2d & f) and is inserted on the very proximal region of the ventral side of the rib of the fourth vertebra behind. However, in the case of the caudal region the unit of that muscle is thicker than that of the trunk region and has the same origin but it is inserted on the transverse process (fused rib and not a diapophysis) of the second vertebra behind (Fig. 21). It should be noticed that those muscle units pull the ribs forward antagonistic to the action of the subcostal (24). AUFFENBERG (1961) named this muscle costo-vertebro-costalis.

The tuberculo-costal muscle (OP.8) (Figs. 10,12,18 & 20)

This is again, a characteristic ophidian muscle. Its units extend from the fourth cervical rib to the last trunk rib. Each unit (Figs. 12 & 20) is a thick short ribbon of muscle fibres which originates on the head of one rib and is inserted on the neck of the rib next behind. Again, those units can have some efficiency in pulling the rib forwards.

REFERENCES

Auffenberg, W. (1961): Additional remarks on the evolution of trunk musculature in snakes. The American Midland Naturalist. Vol. 65(1), 1-16.

Bellairs, A. (1969): The life of reptiles. Vol. 1 Weidenfeld and Nicolson, London.

Gasc, J.P. (1967): Introduction a l'étude de la musculature axiale des Squamates Serpentiformes. Mem. Mus. Nat. Hist. Paris 48, 69-125.

Khalil, A.; Wahba, M.T. and Shawki, N.A. (1977): The post-Cranial myology of Uromastyx aegyptia (Forskäl), Order: Lacertilia, Family: Agamidae. Bull. Fac. Sci. Assiut Univ. 6(2), 1-79.

EXPLANATION OF LETTERING

ANT. anterior; AT. = atlas; AX. = axis; B.OC. = basioccipital; CEN. = centrum; C.M. = cranial muscles; C.S.(1-6) = first to sixth connective tissue septa. C.V.(3-8) = third to eighth cervical vertebrae; DEN. = dentary; D.R. = dorsal rib.; D.R.(51-55) = fifty first to fifty fifth dorsal ribs; D.S. = dorsal scale; D.V. = dorsal vertebra; E.OC. = exoccipital; FO. MAG. = foramen magnum; HYP. = hypapophysis; I.S. = inner side of the skin; L.16 = ligament of origin of muscle numbered sixteen; MAS.1 = masticatory one; MAS.2 = masticatory two; M.D.L. = mid-dorsal line; M.V.L. = mid-ventral line; N.A. = neural arch; N.S. = neural spine; OD.P. = odontoid process; OC.CO. = occipital condyle; OP.1-OP.8 = first to eighth ophidian muscles; P.OC.P. = paroccipital process; PR. = parietal; PR.Z. = prezygapophysis; PT. = pterygoid; PT.Z. = postzygapophysis; QU. = quadrate; S.TM. = supratemporal; T.16 = tendon of insertion of muscle numbered sixteen; T.P. = transverse process; TU. = tubera;

EXPLANATION OF FIGURES

Fig. (1): Posterior view of the skull (after Kamal and Hammouda 1967) showing muscles attachments on that region.

Fig. (2):

A. Lateral view of the atlas showing the attachments of muscles numbered (1,9,10 & 13).

B. Lateral view of the axis showing the attachments of muscles numbered (1,2,9,13 & 15).

C. Dorsal view of a trunk vertebra showing the attachments of muscles numbered (2,16, OP.1, OP.2, OP.3 & OP.4).

D. Lateral view of a trunk vertebra showing the attachments of muscles numbered (2,13,15,16, OP.1, OP.2, OP.3, OP.4 & OP.7).

E. Dorsal view of a caudal vertebra showing the attachments of muscles numbered (2,16,17, OP.1, OP.2, OP.3 & OP.4).

III- COSTAL MUSCULATURE

F. Lateral view of a caudal vertebra showing the attachments of muscles numbered (2,15,16,17, OP.2, OP.3, OP.4 & OP.7).

Fig. (3): Dorsal view of the head, neck and the anterior part of the trunk region showing the topology of muscles numbered (Mas. 1, Mas. 2, 1,8,16,17 & OP.5).

Fig. (4): Lateral view of the head and neck regions showing the topology of muscles numbered (Mas. 1, Mas. 2, 1,8,16,17,18 & OP.5a).

Fig. (5): Dorsal view of some trunk vertebrae showing muscles numbered (2,15,16,17,18, OP.1, OP.2, OP.3, OP.4 & OP.5).

Fig. (6): Dorsal view of some caudal vertebrae showing muscles numbered (2,15,16,17,18, OP.1, OP.2, OP.3 & OP.4).

Fig. (7): Ventro-lateral view of the neck and the anterior part of the trunk region showing the toology of muscles numbered (1,10,13a,16,17 & 18).

Fig. (8): Dorsal view of some trunk vertebrae showing muscles numbered (16, OP.1, OP.3 & OP.4).

Fig. (9): Lateral view of some trunk vertebrae showing muscles numbered (2,16,17, OP.2, OP.3, OP.4, OP.5 & OP.8).

Fig. (10): Dorso-lateral view of a right trunk rib showing the attachments of muscles numbered (17,18,23,24, OP.4, OP.7 & OP.8).

Fig. (11): Dorso-lateral view of some trunk vertebrae showing muscles numberd (15,16,17,18 & OP.5), and the relation between muscles numbered (15,16 & 17) via the vertival connective tissue septa (C.S.2 & C.S.3).

Fig. (12): Lateral view of some trunk vertebrae showing muscles numbered (18, OP.4 & OP.8).

Fig. (13): Lateral view of some trunk vertebrae showing the two elements of muscle numbered (OP.5) and their association with body scales.

Fig. (14): Dorso-lateral view of some trunk vertebrae showing muscles numbered (18 & OP.5).

Fig. (15): Dorso-lateral view of the trunk musculature showing muscles numbered (2,15,16,17,18, 24, OP.1, OP.2, OP.3, OP.4, OP.5 & OP.8).

Fig. (16): Lateral view of the cervical region showing muscle numbered (9).

Fig. (17): Ventral view of the neck and the anterior part of the trunk region showing muscles numbered (9,10,13,18,23 & 24).

Fig. (18): Ventral view of some trunk vertebrae showing muscles numbered (18,23,24, OP.4 & OP.8).

Fig. (19): Ventral view of the posterior part of the trunk region showing muscles numbered (18,23 & 24)

Fig. (20): Ventral view of some trunk vertebrae showing muscles numbered (OP.7 & OP.8).

Fig. (21): Ventral view of some caudal vertebrae showing muscles numbered (18 & OP.7).

Fig. (22): Transverse hand sections in the caudal region showing the vertical connective tissue septa (C.S.1-C.S.6).

A. In the anterior part.
B. In the middle part.
C. In the posterior part.

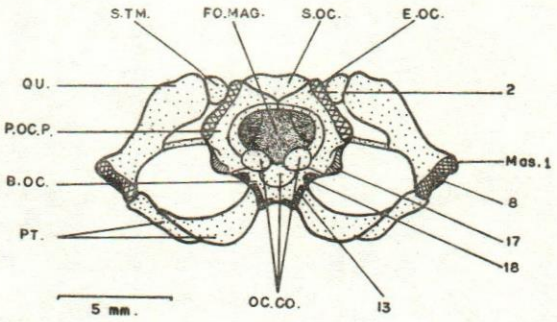
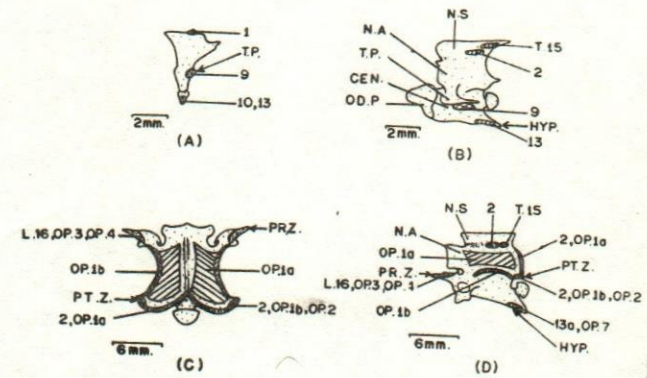


Fig. 1



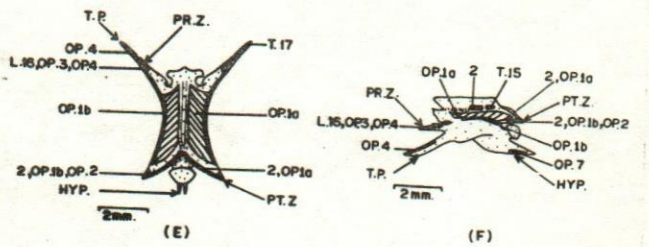


Fig. 2

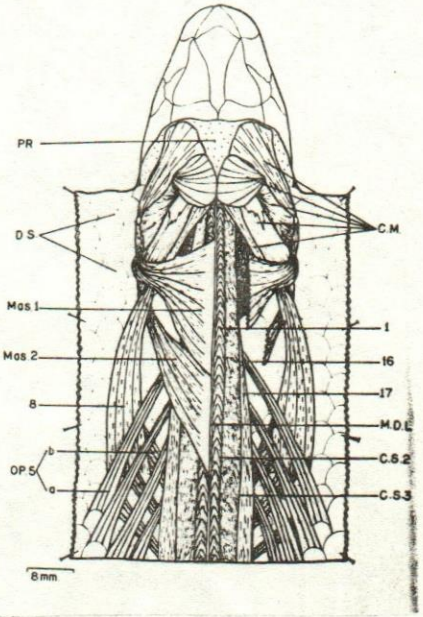
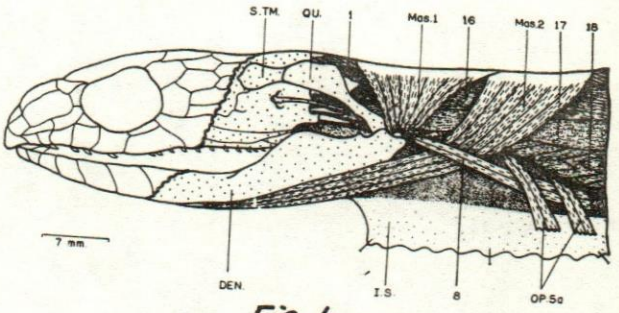


Fig. 3



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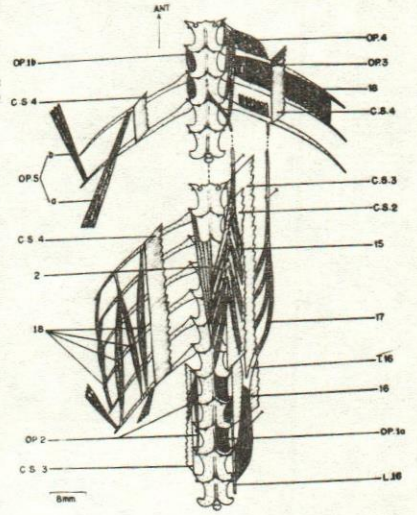
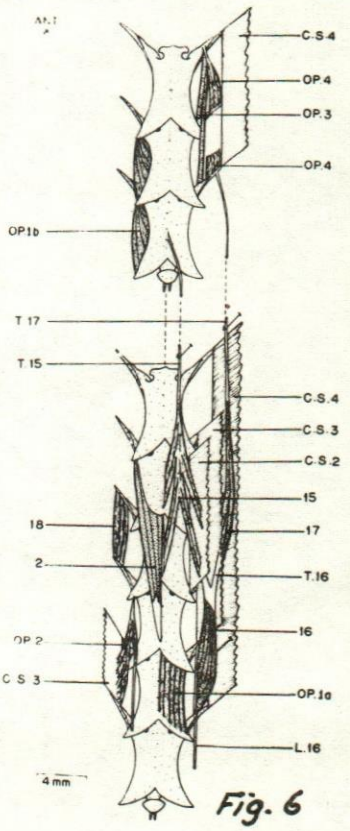


Fig. 5



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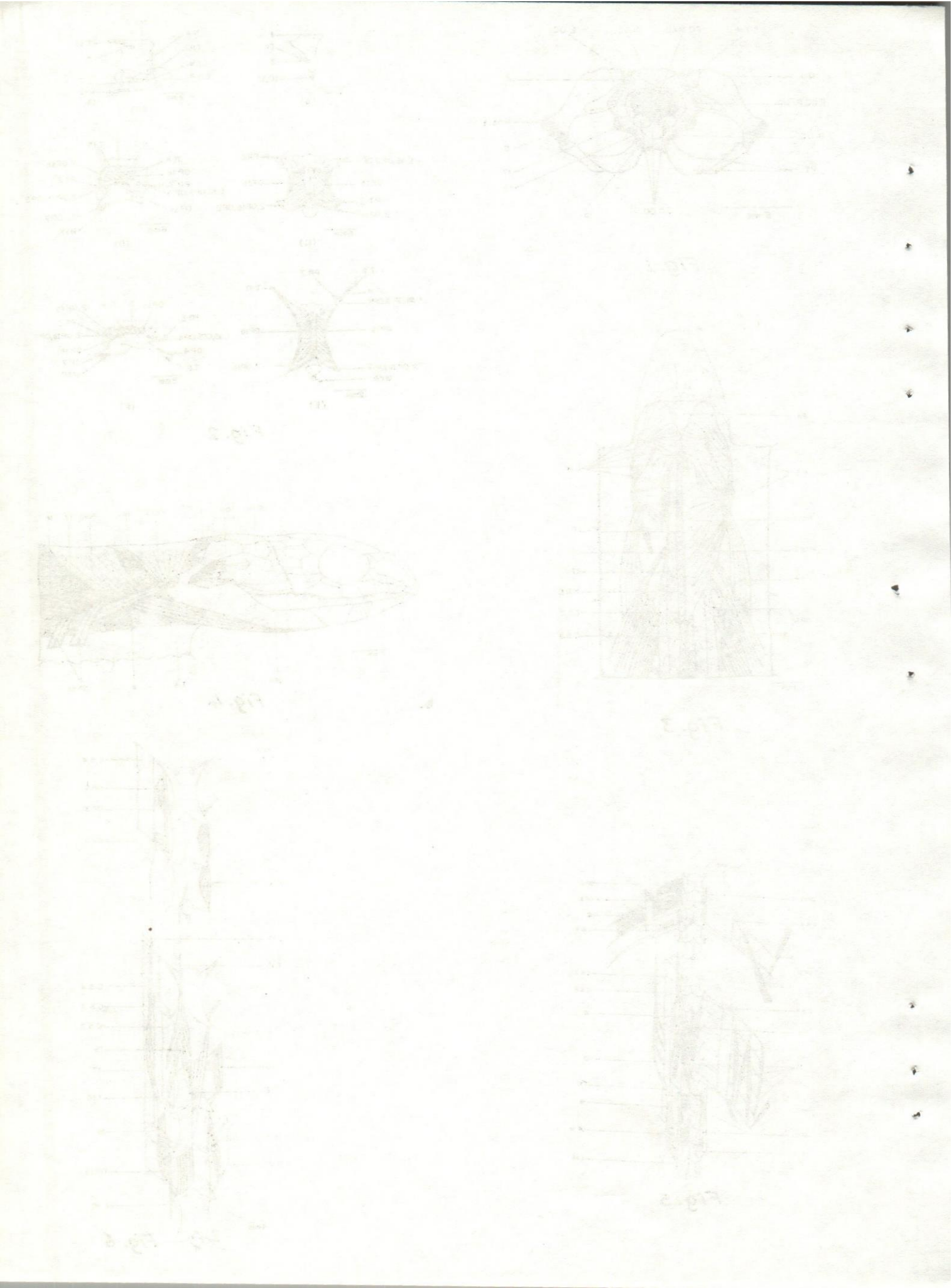


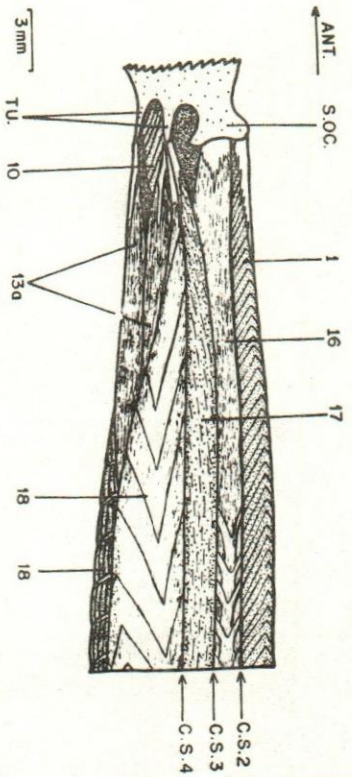


Fig. 7

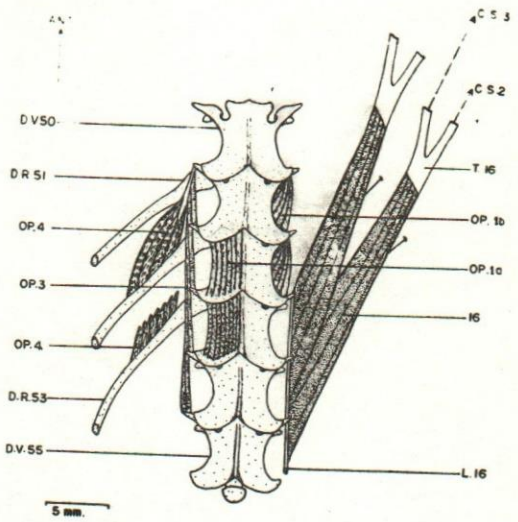
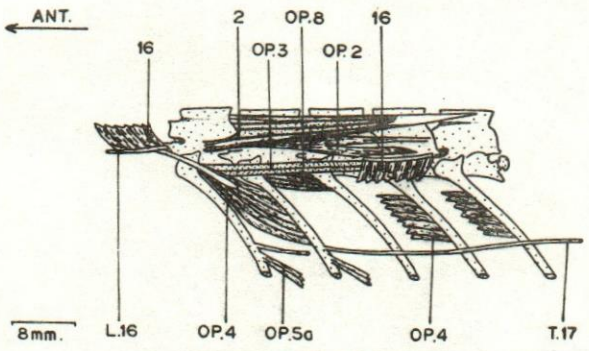


Fig. 8



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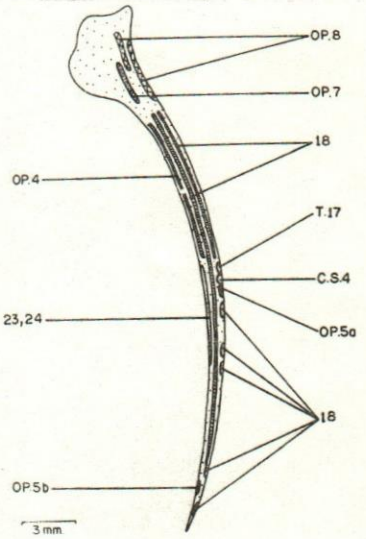

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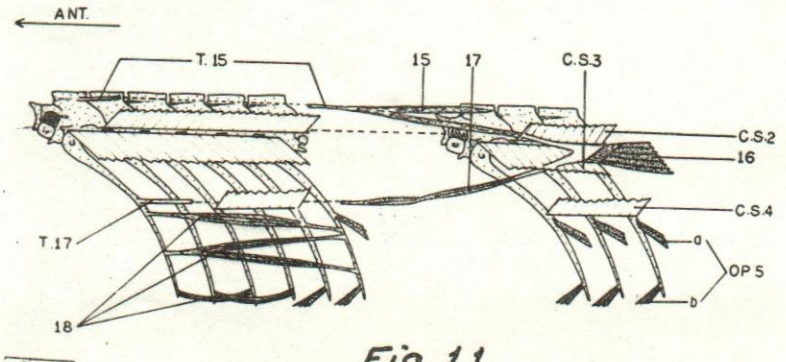

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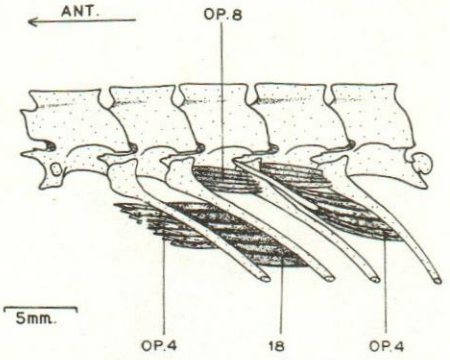

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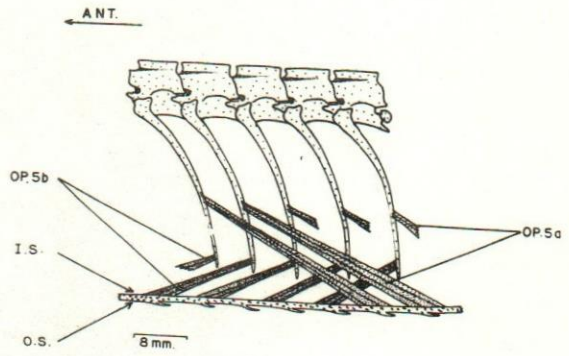

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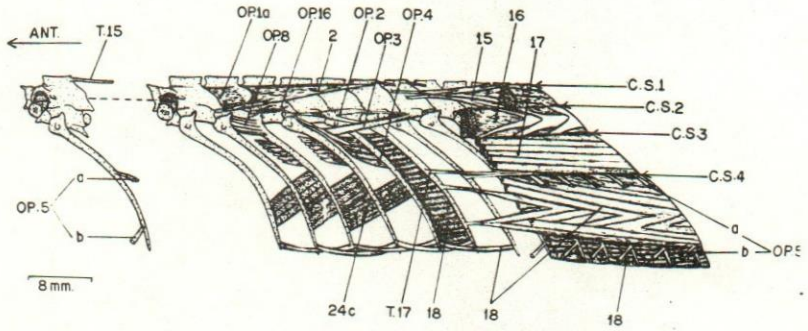

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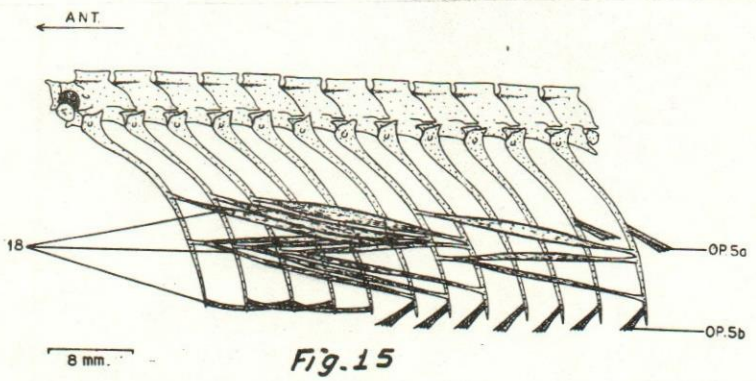

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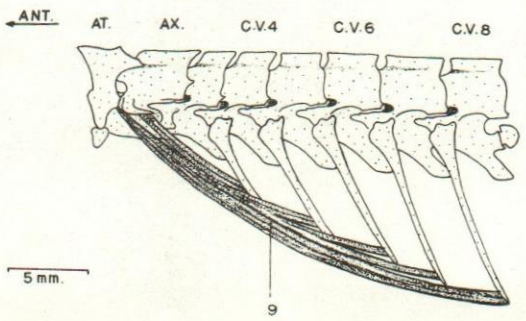

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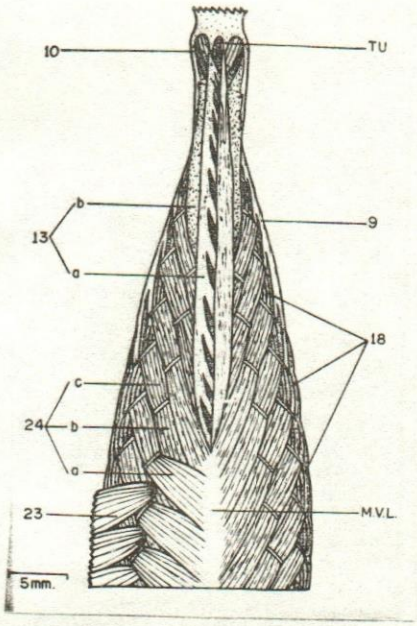
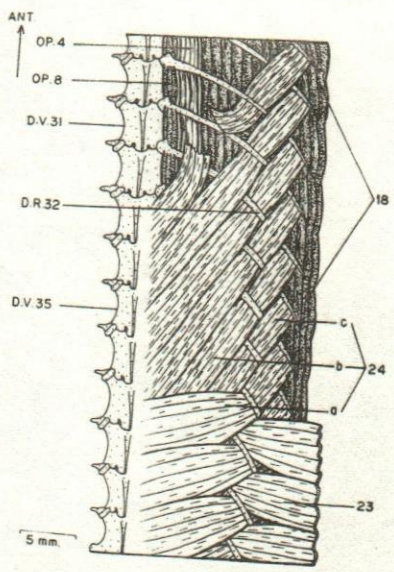


Fig. 17



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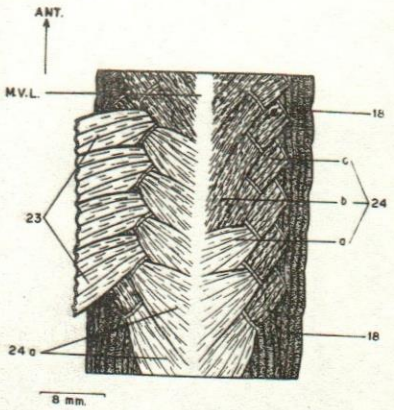

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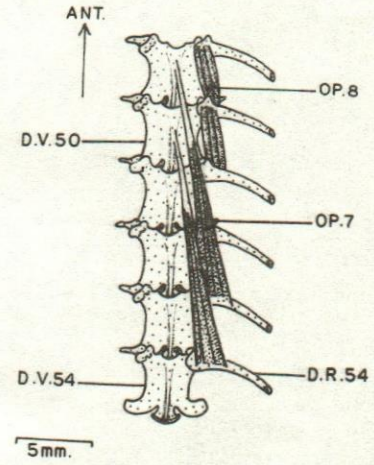

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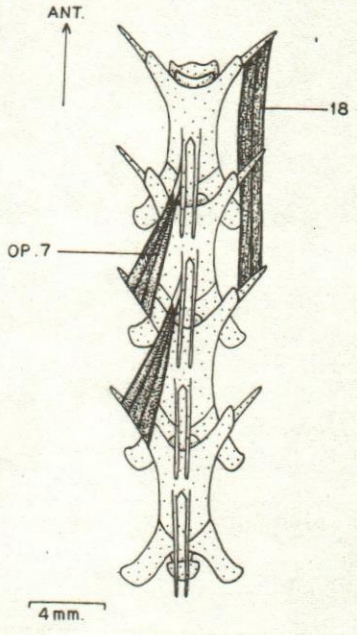

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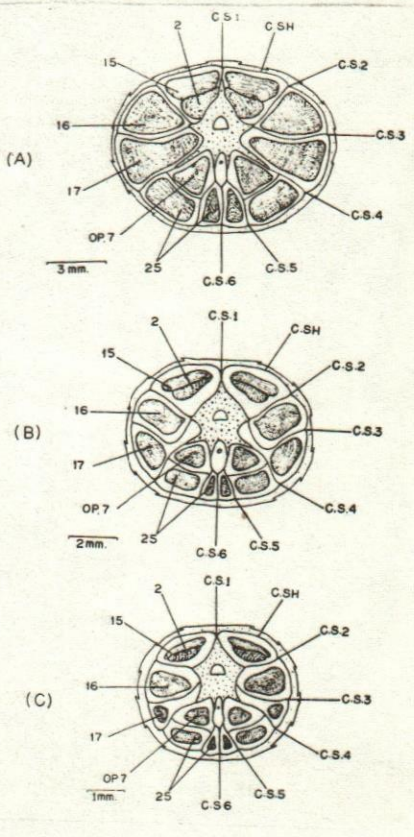

Fig. 22