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Anatomical Study No. 60.

Some Comments on the Hump of African Cattle.

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Introduction.

As shown in Curson and Epstein's paper (1934), the parent stocks of African cattle are believed to have been

(*a*) *Hamitic Longhorn* with no hump,

(*b*) *Brachyceros*, also with no hump,

and (*c*) *Longhorned Zebu* (called Afrikander in South Africa) with a well-marked hump, which " does not fall abruptly on to withers, but slopes gradually " (Fig. 6).

Arising from the above are two chief intermixtures or types which have been described by Epstein (*The Origin of Africa's Indigenous Domestic Animals*, Chapter IV, in preparation) as follows: —

(I) *Shorthorned Zebu* (of many sub-types). This he considers to represent the influence while still in Asia of Brachyceros on the Longhorned Zebu. The type, like its longhorned relative, is also humped, but the structure differs in several respects from that of the Afrikander (Fig. 7).

And (II) *Sanga*.—Cattle of this type, occurring in Central and South Africa, are believed to be derived from the intermingling in North Africa of Hamitic Longhorn and Longhorned Zebu stocks. Sanga cattle, sometimes called Zebus, receive a separate section in Epstein's work referred to above. As in the case of the Shorthorned Zebu and Brachyceros types, the terms Sanga includes a large number of sub-types (Fig. 8).

The Object of the Study.

While osteological evidence undoubtedly supports Epstein's contention, there are facts in regard to the soft structures, especially the hump, which call for further consideration. It is therefore the purpose of this work to record observations made on the various forms of hump(1).

As will be seen from the subjoined extracts taken from another valuable contribution (*The Red Afrikander* also in preparation), Epstein says comparatively little that is helpful regarding the hump:

(*a*) " Zebu, in its original form (*i.e.* Longhorned) is distinguished from other species by its hump which consists of fat and muscle tissues ". It " represents an accumulation of reserve materials similar to the steatopygy of the Bushman and Hottentot women, the fat tail of various sheep and the humps of the camel and dromedary . . . In animals living in steppes (of Asia) the accumulations appear on those parts of the body where they will not impede free movement. The humps of the Zebu cattle point therefore to a steppe country as the place of their evolution " (p. 63).

(*b*) " The penetration into Africa by Semitic nomads with their Zebu cattle " resulted in " contact with the longhorned cattle of Egypt which had accompanied the Hamites on their migrations to the west and south ". A consequence of this impact " as far as the cattle were concerned " were changes mainly affecting " the length of the horns and size of the hump " (pp. 63 and 64).

And (*c*) " The hump which appears in African cattle even more frequently than gigantic horns . . . is simply a product of cross-breeding(2). The same result of variation as is obtained from the generation F2 onwards by crossing thin and fat tailed sheep is apparent in the formation of the hump in most African breeds of cattle. According to the degree of admixture of Zebu blood to the Hamitic cattle of primigenius type, the hump is developed to a greater or lesser extent, or often entirely missing " (p. 66). Indeed, there are breeds " in eastern, western, central and southern Africa, . . . which must be regarded as pure Zebus, although in some of these breeds the hump has almost entirely disappeared " (p. 66).

The chief points contained in the above are that the hump of the Longhorned Zebu (i) consists of fat and muscle tissues, (ii) became altered in size through admixture in North Africa with Hamitic Longhorn cattle (giving rise to Sanga cattle), and (iii) answers genetically in the same way as the crossing of thin and fat tailed sheep.

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(1) It must be emphasized that as far back as 1916 Hornby, H. E. (now Director of Veterinary Services, Tanganyika), had demonstrated that the hump of the Shorthorned Zebu was associated with the *M. rhomboideus*. He sent (letter 29/3/34) his notes to one of the authors (H. H. C.), and these have been placed in Departmental File 258/108.

(2) This statement obviously refers to the Sanga type.

C. Sheppard Cruz (1934), while not following the classification of Epstein, also does not consider that cattle of the Sanga type are " derived from near or remote progenitors of Afrikander blood ".

Our attitude is briefly thus. Whatever the origin of the Shorthorned Zebus and Sanga cattle, there are certain facts with regard to the humps which should be emphasised, *viz.* (*a*) the marked resemblance of Longhorned Zebu and Sanga as would be expected in the light of Epstein's theory, and (*b*) the striking difference between the humps of the Longhorned Zebu and Sanga types on the one hand and the hump of the Shorthorn Zebu on the other.

Furthermore, in view of the fact that animal husbandrymen frequently speak of " attached ", " loose ", and " modified " humps, terms of little anatomical value, it is particularly necessary to make descriptions of the hump available.

External Description of Hump.

(*a*) The official description of the Afrikander hump as published by the Afrikander Cattle Breeders Society of South Africa (Bosman, A. M. 1932) is given thus:—" Large prominent and set closely to withers ".

Viewed from the side the hump is situated in front of the withers. It occupies the posterior two-thirds of the upper border of the neck. The structure is somewhat pyramidal in shape and cranially it rises at an angle of about 40° to a rounded apex situated well in front of the point of the withers. From this rounded apex the hump falls at an angle of just over 30° on to the withers and merges with it to form a uniform and strong attachment.

Viewed from the front the hump appears to sit snugly over the upper border of the neck and is firmly attached to its sides, from which it rises steeply at an angle of about 60° to 65° to a rounded summit. For this reason the hump of the Afrikander is sometimes spoken of as being well attached.

In the bull (Fig. 6) the hump is decidedly prominent, rising sometimes to 8 inches above the top-line. In oxen the structure is a little less prominent and in females it is relatively smaller still. The hump is well developed even in a foetus.

(*b*) Epstein (*The Origin of Africa's Indigenous Domestic Animals*) in referring to the Sanga type states that " the tendency to be humped is more general (than the tendency to gigantic horns). It is true that the hump is not equally well developed in all Sanga breeds. In some it almost reaches the size of the humps of Indian Zebu's (i.e. of Shorthorned type) . . . in others again, as in the cattle round Lake Chad, the majority are entirely humpless and only individual animals are humped ".

As shown above, he believes that " according to the degree of admixture of Zebu blood to the Hamitic Cattle . . ." so is " the hump developed to a greater or lesser extent, or often entirely missing ".

It is evident therefore that there is a wide variation in the size of Sanga humps, but as a typical example we may take the Ambo beast (Groenewald and Curson 1933 and Bisschop and Curson 1935). In the former paper the hump was described (in the cow) as being " small and set well forward on withers ". In the latter it was described (in Bull 5010) as follows:—" Situated in front of the withers and is well defined. Its anterior axial border passes up from the upper border of the neck to the apex of the hump at an angle of approximately 40°. From the apex to the withers the posterior axial border falls at an angle of about 30° to the horizontal. The hump is on the small size and is well attached to the neck ".

It is thus evident that apart from size, the similarity in external appearance of the hump of the Afrikander and Ambo breeds is striking.

(*c*) The hump of the *Shorthorned Zebu* (Fig. 7) is less constantly pyramidal than in the two previous types. Very frequently the structure is not only more prominent but also actually dome-shaped. Another common feature is the greater mobility of the hump especially the posterior part due to its fatty nature. Most striking of all features is the *more caudal situation* of the hump, a vertical line through the summit passing at least through two vertebrae behind a line similarly drawn in the Afrikander or Sanga types. In extreme cases of hump development the term " loose " may be applied, but it must be emphasised that anatomically it is nevertheless securely attached, particularly by the *M. trapezius*, as will be indicated subsequently. The size of the hump varies greatly.

In the description of Indian Zebus apart from a statement that " the hump is well developed in the bull " (Gunn 1909), no detailed account is available. Hornby writes (letter L/48/49 of Nov. 17th, 1934) " that a Zebu foetus has a well-marked hump ".

Source of Material for Study.

Apart from the illustrations which accompany this study, the authors have made observations on native types of cattle throughout Southern and Eastern Africa.

For dissecting purposes the source of material is also indicated in the explanations accompanying the various figures; but a special word of appreciation is due to Mr. H. E. Hornby, who sent Zebu (Shorthorned) humps from Tanganyika. To summarise, the anatomical observations were made on yearling bulls 5572 and 5736 (Afrikander), two humps of Shorthorned Zebu calves from Tanganyika, and the Ambo bull 5010 as representing the Sanga type. A Friesland bull obtained locally was also dissected and the features were similar to those shown in Figs. 9 and 13.

Description of the *Mm. Trapezius* and *Rhomboideus* in an Unhumped Animal (e.g. Friesland).

As the above muscles are primarily associated with hump formation, it is advisable to describe them in the unhumped beast. Thereafter the features of the humped types will be tabulated for comparison.

M. Trapezius.

As in the horse this is superficial and fan-shaped. Its fibres extend from the dorsal aspect of the cervico-thoracic region (atlas to about the tenth thoracic vertebra) to the scapula. As they descend, caudally from the cervical region and cranially from the thoracic, they converge and terminate in an aponeurosis, which is inserted into the *spina scapulae*. The cervical and thoracic portions are, however, not clearly separated. The attachment of the fibres along the mid-dorsal line becomes more intimate as one follows the origin of the muscle backwards. The cranial border is firmly adherent along its anterior half to the *M. cleidooccipitalis*, and posteriorly to the *M. omotransversarius*. The caudal border is attached by fascia to the *M. latissimus dorsi* which in this region is covered by the sheet-like *M. cutaneus scapulae et humeri.*

M. Rhomboideus.

This muscle may be divided into a *pars cervicalis* and a *pars thoracalis*, the former being most conspicuous and having fibres pursuing generally a longitudinal direction, whereas the latter is relatively insignificant and has fibres running obliquely downwards and backwards. The origin is the *pars occipitalis* of the *ligamentum nuchae* and its caudal prolongation, the *ligamentum supraspinale*, while the insertion is the medial surface of the *cartilago scapulae*. The cervical part is pointed cranially, but as one proceeds caudally so does the muscular tissue become expanded.

In the bull, even of the Brachyceros type, the above muscles as well as the *M. splenius* and *M. serratus ventralis*, are well developed, but it is only in special circumstances e.g. raising the head that a hump-like structure is obvious and when evident, it is always to be found in the *anterior* cervical region. It will be observed (Fig. 5) that no such hump-like elevation is apparent, but a definite dome-like structure would be quite evident if the head were elevated. This clearly muscular structure is strictly speaking not a hump in the usually accepted sense of the word, and is sometimes referred to as the crest.

An account having been given of the " humpless " beast, we may now tabulate the anatomical features encountered in the humped types.

Comparative Table concerning Humps of African Cattle Types.

Feature.	Yearling Afrikander Bulls (5572 and 5736).	Shorthorned Zebu *e.g.* Tanganyika, (See Figs. 48 and 49, Duerst).[3]	Sanga bull *e.g.* Ambo 5010 (2 yrs. 4 months.).
M. trapezius.....	The muscle is well developed and may be arbitrarily divided into cervical and thoracic parts, the former overlying the hump and the latter caudal of the hump. (See Fig 10.)	The muscle is distinctly separable into a cervical and a thoracic portions, the latter being darker in colour and more strongly developed. The cervical portion instead of arising entirely from the funicular part (*pars occipitalis*) of the *ligamentum nuchae* is closely associated with hump development. In fact it may be considered as a superficial cranio-lateral anchor or attachment of the hump. The thoracic portion is well developed and except for a small cranial slip does not act as a stay. (See Fig 11.)	Here it is also arbitrarily divisible into cervical and thoracic portions. There is no development of adipose tissue resembling the hump of the Shorthorned Zebu. (See Fig 12.)
M. rhomboideus.....	The *M. rhomboideus* has distinct cervical and thoracic portions. The cervical part is extraordinarily well developed, and forms the hump. The thoracic part is made up of short muscular fibres having generally a ventro-caudal direction. (See Fig. 14.)	This is characterised by the entire absence of the longitudinally arranged cervical part (4). Instead, the anterior portion of the thoracic part is very much developed, in fact the fatty hump having not only a foundation, but also a framework of muscular tissue. The fibres run generally in a ventro-caudal direction, especially at the base of the hump. This structure is best described as a musculo-adipose development of the *M. rhomboideus, pars thoracalis* (anterior portion). (See Fig 15.)	The muscle is clearly represented as a cervical portion and as a thoracic portion. The former is markedly enlarged, in fact constitutes the hump. The fleshy fibres are disposed as a rule in a longitudinal direction. The thoracic part is relatively poorly developed and its fibres run in a ventro-caudal direction. (See Fig. 16.)
Situation of hump.....	The hump lies cranial to the *angulus cranialis* of the scapula over the 6th/7th cervical to 4th/5th thoracic vertebrae (*Crista spinosa*)—a cervico-thoracic hump.	Dorsal to the *margo vertebralis* of the *cartilago scapulae*. In terms of vertebrae it lies over the first to ninth thoracic vertebrae (*Crista spinosa*)—a thoracic hump.	From the sixth to seventh cervical vertebra caudally to the 4th/5th thoracic bone. The hump is definitely cranial to the *angulus cranialis* of the scapula—a cervico-thoracic hump.

(3) Two specimens, probably from bull calves, were kindly sent by Mr. H. E. Horuby, Director of Veterinary Services, Tanganyika.

(4) Since the cervical and thoracic parts of the *M. rhomboideus* are not separated by any well defined structure, *e.g.* of fibrous nature, it is of course possible to consider the hump of the Shorthorned Zebu as a development of the pars posterior of the cervical part of *M. rhomboideus*. Duerst (1931, p. 46) considers that a fusion of the two parts has taken place.

Discussion.

Epstein apparently believes that the hump of the Longhorned Zebu (Afrikander) represents an accumulation of reserve material as seen in the steatopygy of certain native women, the fat deposits of certain native sheep and the humps of the camel and dromedary. It is clear from our observations that the comparison is not applicable, for whereas in the cases of fat accumulation there is a storage of reserve energy *per se*, in the Afrikander this is not so. The same remark applies to the hump of the Sanga type.

Epstein is, however, perfectly correct if he extends the comparison to the hump of the Shorthorned Zebu, for here definitely there is fat storage. Hornby's comments, which would support Epstein, are as follows: "At birth the musculature is well marked, but as the animal develops this becomes more and more obscured by fat deposition. Even when the adult loses condition and the hump shrinks very greatly, the hump never regains the lean muscular state of calfhood—a certain amount of fat and fibrous tissue persist". (Letter L/48/49 of November 17th, 1934.)

In the description of the *M. rhomboideus* of the Shorthorned Zebu, reference is made to the muscular tissue acting as a framework of the hump. This disposition is well shown in Fig. 18, which should be compared with Figs. 17 and 19.

In the Afrikander and Sanga cattle, fat may also occur, but it is usually distributed in layers, first subcutaneous, then between the *M. trapezius* and *M. rhomboideus*, and finally beneath the latter. In an adult Afrikander bull the hump may weigh from Kg. 10 upwards.

From a perusal of the tabulated statement along with the corresponding figures, it is clear that (*a*) there is a great similarity both in situation and structure of the hump of the Longhorned Zebu and Ambo, and (*b*) there is a marked difference between the above humps and that of the Shorthorned Zebu. The apparent difference in the arrangement of the muscular fibres of the Longhorned Zebu and Ambo need not be seriously considered, for in the hump of Afrikander yearling bull 5572, the arrangement resembled that of the Ambo. It is of course evident that the drawings are diagrammatic and not to scale in view of the widely divergent ages of the subjects. See, however, Figures 17-19.

Relatively little seems to be known concerning the significance of the hump from an evolutionary point of view. While the intermixture of the Longhorned Zebu and Hamitic Longhorn undoubtedly gave rise to the Sanga type, the position is not so clear in regard to the Shorthorned Zebu. The importance of further investigation in this problem is emphasised.

Conclusion.

The result of this study suggests that humps may be classified:

(*a*) According to situation—cervico-thoracic and thoracic.

(*b*) According to structure—muscular and musculo-fatty.

(*c*) According to function—traction (locomotion) and storage of reserve fat.

It is interesting that some cattle have humps and others not.

The similarity of the humps of the Afrikander and Sanga types, being cervico-thoracic and muscular is noteworthy in view of Epstein's theory that the latter is derived from the intermixture of the Longhorned Zebu and Hamitic Longhorn. The dissimilarity between the above humps and that of the Shorthorned Zebu is striking. As just stated little is known regarding the significance of the hump from an evolutionary point of view.

ACKNOWLEDGEMENTS.

We appreciate the gift of material by Mr. H. E. Hornby, Director of Veterinary Services, Mpapwa, Tanganyika, the co-operation of Dr. J. Botelho, Director of Veterinary Services, Mozambique, and his assistant, Dr. Sheppard Cruz, both of Lourenço Marques, and the use of Dr. H. Epstein's unpublished work on native cattle.

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APPENDIX(5).

USEFUL REFERENCES IN STUDYING AFRICAN CATTLE.

AFRIKANDERS.

1. MACDONALD (1904). The Africander Breed of Cattle. *Transvaal Agr. Jl.*, III (9), Oct.

2. HOLM, A. (1912). Africander Cattle. *Agr. Jl. Union of South Africa*, IV, p. 687, Nov.

(5) For previous lists see Appendix 3 of Groenewald and Curson (1933) and the Appendix in Bisschop and Curson (1935).

3. HOLM, A. (1916). Report on Cattle Feeding Experiments. *Bull.* 15 *of* 1916, *Dept. of Agr.*

4. HOLM, A. (1917). Second Report on Cattle Feeding Experiments. *Bull.* 5 *of* 1917, *Dept. of Agr., Union of S.A.*

5. HOLM, A. (1918). Third Report on Cattle Feeding Experiments. *Bull.* 8 *of* 1918.

6. CILLIERS, A. A. (1919). Afrikander Beeste. *Die Landbouw-weekblad,* Dec. 17th, 1919, p. 893.

7. BOSMAN, A. M. (19—). Die Punte van die Afrikanerbees. *Die Landbouw-weekblad,* No. 14, p. 461.

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9. BOSMAN, A. M. (1934). The Origin of the Afrikander Cattle of South Africa. *Jl. Dept. Agr. Union of South Africa,* Nov.

10. REINECKE, T. G. W. (1934). Africander Cattle. *Jl. Dept. Agr,* viii, p. 583.

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12. REINECKE, T. G. W. (1931). Africander Cattle. *Farming in South Africa,* VI (64), July.

13. BOSMAN, G. J. (1928). A Grand Old Man in Africander Cattle Breeding. *Farming in South Africa,* III (29), Aug.

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ADDENDUM.

A copy of Anatomical Study, No. 60, was submitted to Dr. H. Epstein who, in a letter to the Director of Veterinary Services, dated 1st August, 1935, made the following comments:—

> "Their (i.e. Messrs. Curson and Bisschop) conclusions lead to the question whether the similarity of the humps of the Afrikander and Sanga types proves the former also a Sanga breed. On the basis of osteological comparison I am still inclined to deny this. Curson and Bisschop also seem te deny it, stating on p. 627 'The intermixture of the Longhorned Zebu and Hamitic Longhorn undoubtedly gave rise to the Sanga type' and on p. 623 'certain facts which should be emphasised, *viz.* (*a*) the marked resemblance of Longhorned Zebu and Sanga as would be expected in the light of Epstein's theory'. If, however, this similarity does not prove that the Africander carries Egyptian Longhorn blood, but merely that cattle of Afrikander type have contributed to the evolution of the Sanga, the dissimilarity between the above humps and that of the Shorthorned Zebu calls for an explanation.
>
> It is possible that, after the African Longhorned Zebu had branched off the main stem, a few thousand years more of domestication under the climatic conditions of Asia have led there to a gradual change (higher evolutionary specialisation?) in the structure of the Zebu hump.

Investigations of the foetal humps (6) of Afrikanders and Shorthorned Zebus would probably answer this question, since it can be taken for granted that, if the hump of the Shorthorned Zebu was originally also cervico-thoracic and muscular, this would appear in one of the foetal stages.

The second conclusion—one which I favour less than the former—is that the influence of Brachyceros blood on the Zebu may have given rise to a change in the hump structure. To investigate this, it would be necessary to compare the humps of Shorthorned Zebus with those of the rare longhorned breds occurring in southern India. The picture of the skull of such a beast resembling the Afrikander skull to an extraordinary degree, is produced by Duerst in his *Animal Remains from the Excavations at Anau*. I do not wish to imply that long or short horns in Zebus have any relation to the structure of the hump. I merely want to state that in some less accessible parts of southern India longhorned Zebu breeds may exist that have preserved their original structure for thousands of years, just as the 'Afrikanders' ancestors have. But I realise that it would be very difficult to carry out such investigations.

Finally, both factors combined, the long period of domestication in Asia and the influence of Brachyceros cattle, may have caused the change in the structure of the hump."

Fig. 1.—African Brachyceros Cow and Bull Calf. (Curson and Epstein 1934.)
[*Photo: Dr. P. J. du Toit.*

(6) Mr. Hornby, on being approached as to whether the foetus of a Shorthorned Zebu had a thoracic or servico-thoracic hump, replies (letter L 250/10 of 25/11/35): " I have just had a look at a new-born slightly premature Zebu calf. There was a definite though small hump which was thoracic in position. It was also musculo-fatty in that although no actual fat was present, the course of the muscle fibres was not clear ". The Afrikander foetus definitely has a cervico-thoracic hump of muscular structure.

Fig. 2.—Longhorned Zebu—Africander—Cow and Bull Calf. (Epstein 1933.)

Fig. 3.—Shorthorned Zebu—Masai Ugogo—Cow and Bull Calf. (McCall 1928.)

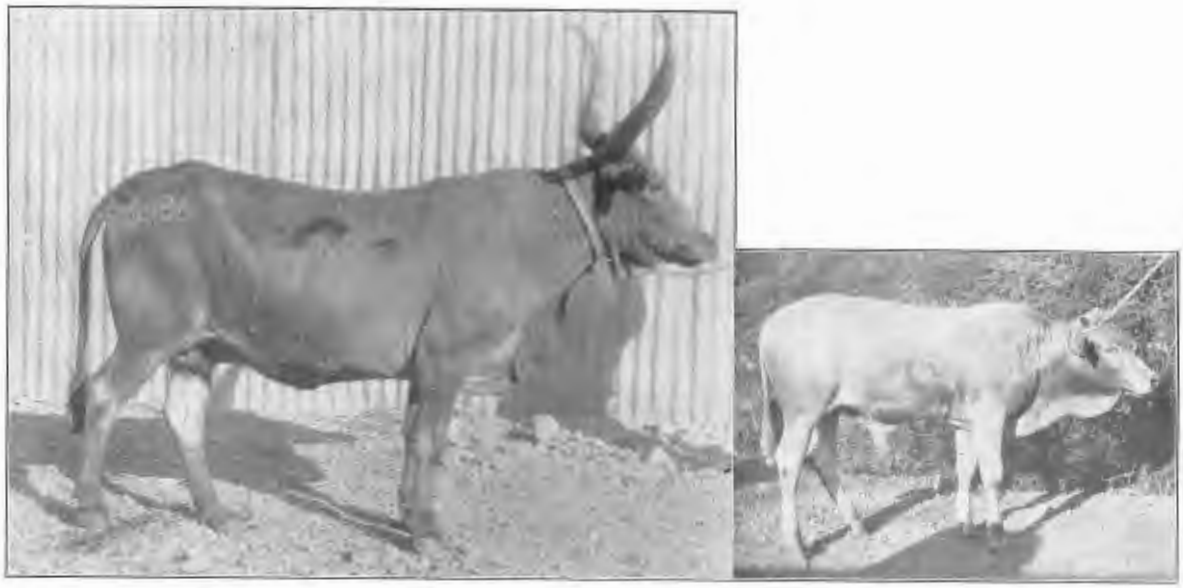

Fig. 4.—South African Sanga—Ambo—Cow 3586 and Bull Calf 5010, 7 months. (Groenewald and Curson 1933.)
[*Photo: T. Meyer.*

Fig. 5.—African Brachyceros Bull, 3½ years, weight 350 lb., beside pure-bred Lincoln Bull. (Henderson 1928.)

Fig. 6.—Longhorned Zebu—Afrikander—Bull 4327. [*Photo: T. Meyer.*

Fig. 7.—Shorthorned Zebu—Golden Dun Mkalama—Bull, 2 years. (McCall 1928.)

Fig. 8.—South African Sanga—Ambo—Bull 5010. [*Photo: T. Meyer.*

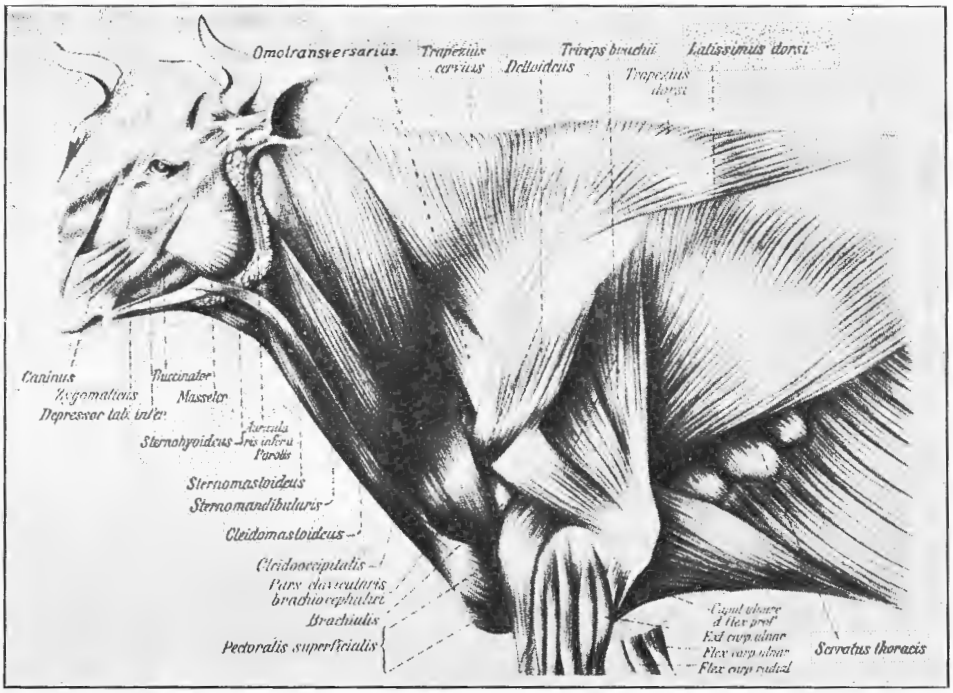

Fig. 9.—Cow of European Brachyceros type. Figure taken from Martin's *Anatomie der Haustiere*, iii Band, Fig. 131, page 238d. There is no hump. Superficial Dissection.

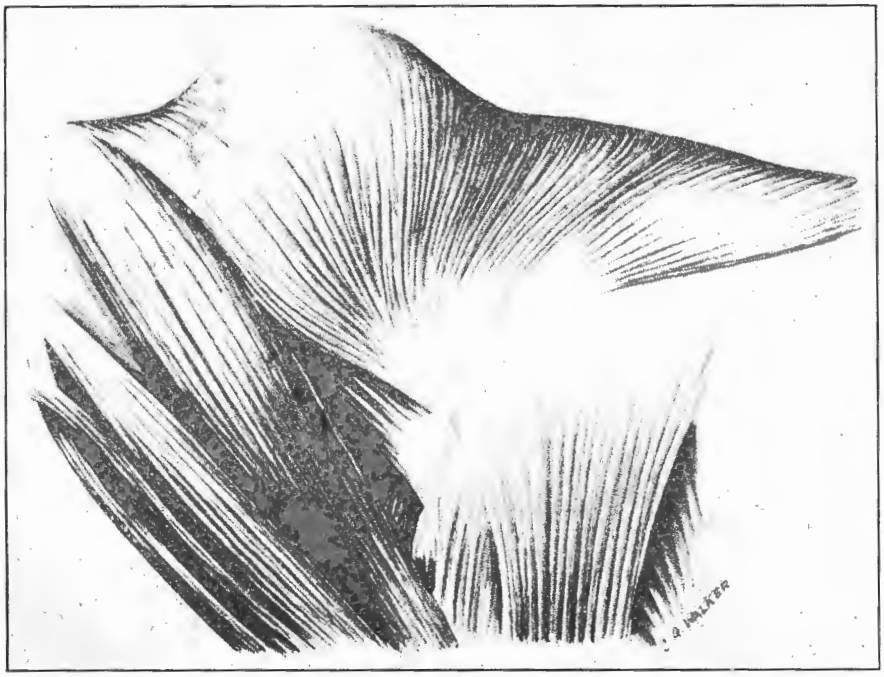

Fig. 10.—Longhorned Zebu—Afrikander—Bull 5736, showing *cervico-thoracic* hump with skin removed but *M. trapezius* intact.

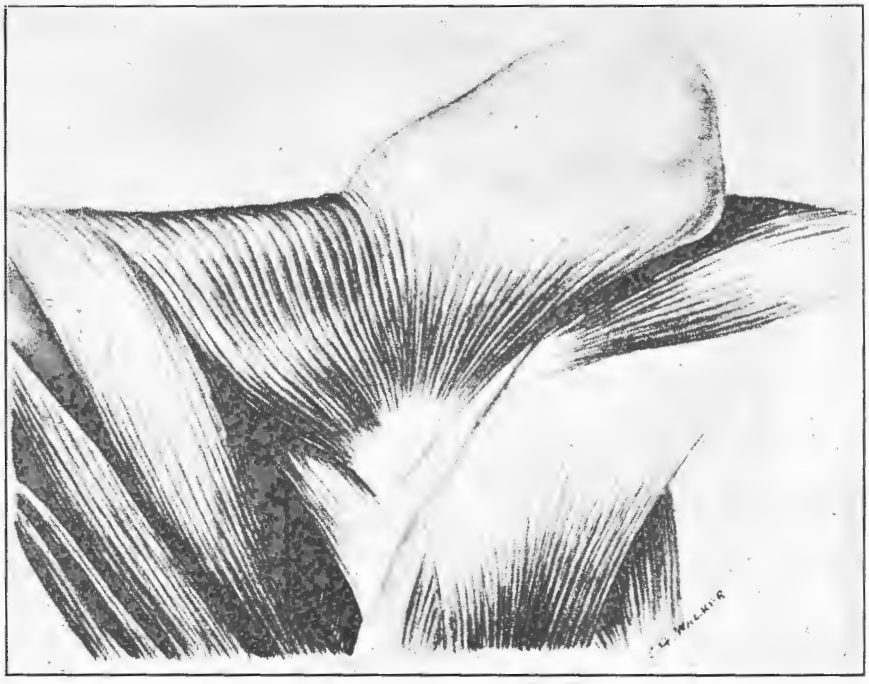

Fig. 11.—Shorthorned Zebu—Tanganyika—Bull Calf (Hornby), showing *thoracic* hump with skin removed but *M. trapezius* intact.

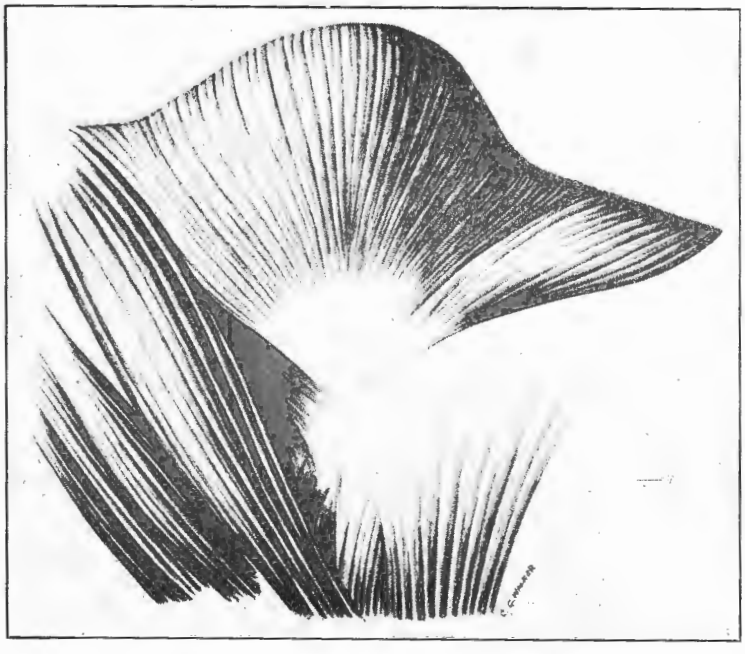

Fig. 12.—South African Sanga—Ambo—Bull 5010, 2 years 4 months, showing *cervico-thoracic* hump with skin removed but *M. trapezius* intact.

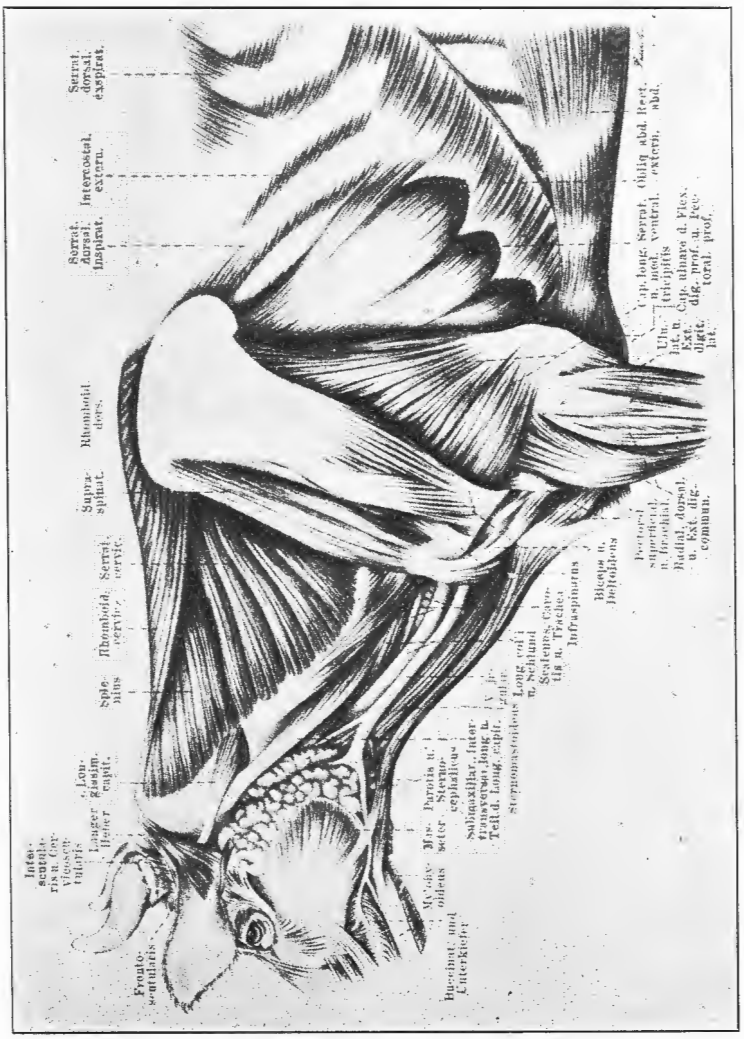

Fig. 13.—Cow of European Branchyceros type. Figure taken from Martin's *Anatomie der Haustiere*, iii Band, Fig. 132, p. 238e. There is no hump—deep dissection.

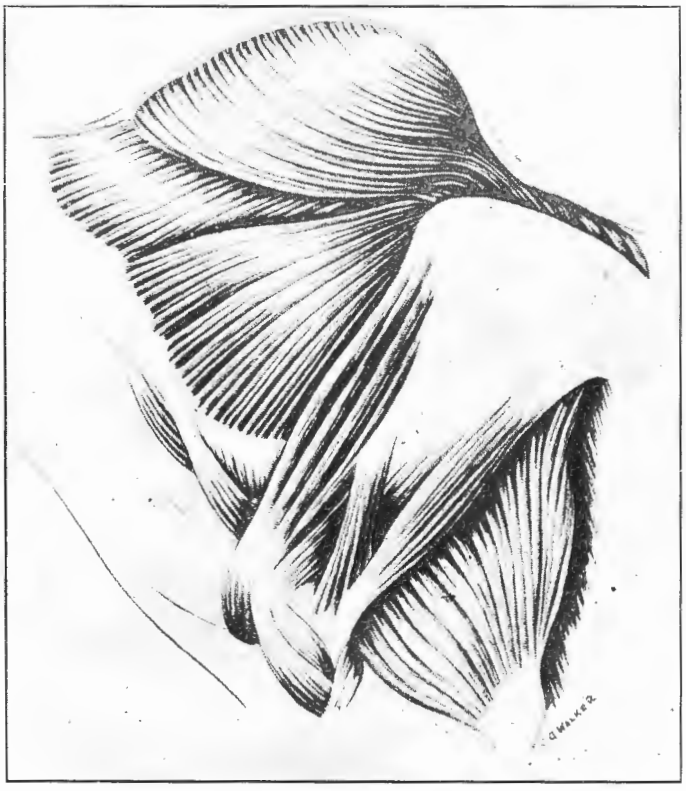

Fig. 14.—Longhorned Zebu—Afrikander—Bull 5736, showing *cervico-thoracic* hump after removal of *M. trapezius*.

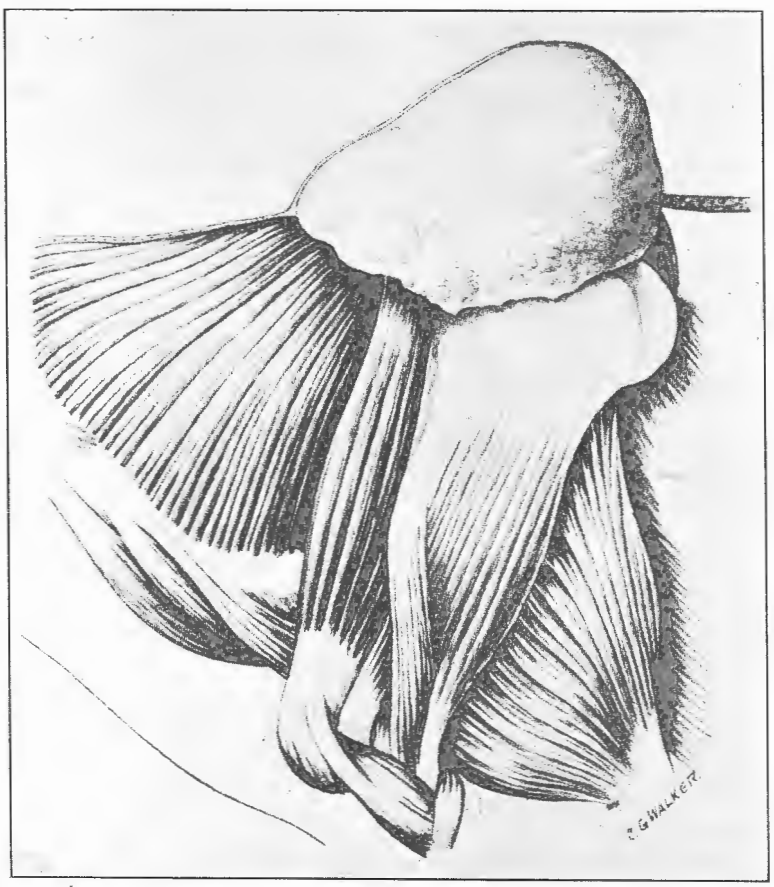

Fig 15.—Shorthorned Zebu—Tanganyika—Bull Calf (Hornby), showing *thoracic* hump with *M. trapezius* removed. It will be observed that the *M. rhomboideus* is quite different from that in Brachyceros, Longhorned Zebu or South African Sanga type (*e.g.* Ambo).

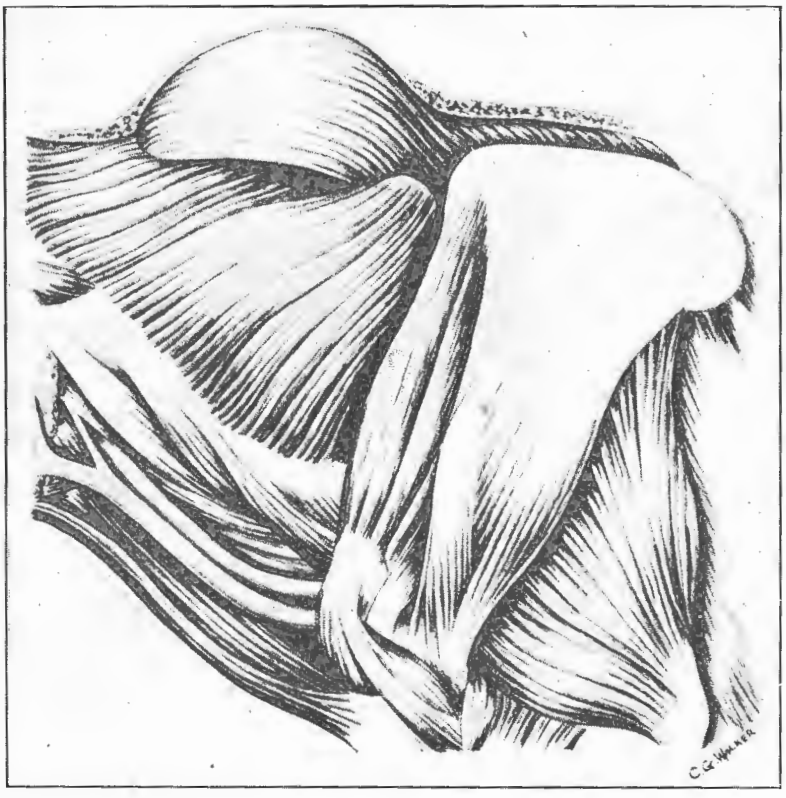

Fig. 16.—South African Sanga—Ambo—Bull 5010, showing *cervico-thoracic* hump itself with *M. trapezius* removed.

Fig. 17.—Transverse section (at summit) of hump of Longhorned Zebu—Afrikander—Bull 5572 over 2nd thoracic vertebra (II) T=*M. trapezius*; R=*M. rhomboideus*; S=*M. serratus ventralis*; SP=*M. splenius*, N=*L. nuchae*. Cranial View, ⅔ Natural size.

Fig. 18.—Transverse section (at summit) of hump of Shorthorned Zebu, Bull Calf (Hornby), over 4th thoracic vertebra. (IV). Distorted appearance due to tight packing in drum. Cranial view. 1½ Natural size.

Fig. 19.—Transverse section (at summit) of hump of South African Sanga—Ambo—Bull 5010 over approximately 2nd thoracic vertebra. Cranial view. ½ Natural size. Letters have same meaning as in Fig. 17.