AN INTRODUCTION TO THE STUDY OF SKELETAL CORRELATIONS IN THE N.Z. ROMNEY MARSH.

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P A R T 1.

FOREWORD.

When this work was undertaken it was quite impossible to have anticipated the difficulties that were encountered. It soon became apparent however, that the approach to a new study involved a great deal of work of a collateral nature, having little direct bearing on the actual object of the investigation. In particular it was necessary to become generally familiar with vcertain branches of statistical method and to become very fully acquainted with the real signigifance of certain mathematical devices.

Statistical studies consumed the greater proportion of the time available for this work with the result that only a portion of the information contained in the data could be extracted. Indeed, a complete analysis of the data collected and recorded, using the methods evolved in this paper, would itself involve many months' work.

However, since the development of the analytical methodology has no direct bearing on the subject of skeletal correlations the paper has been divided into two parts.

Part 1 deals with the measurements made and the interpretation and discussion of the correlation coefficients that were calculated.

In Part 11 has been collected, all those considerations which were essentially incidental to the investigation - that is, selection of material technique of measuring etc. and in particular, the discovery of appropriate analytical devices for treating the data.

AN INTRODUCTION TO THE STUDY OF SKELETAL CORRELATIONS IN THE N.Z. ROMNEY MARSH.

INTRODUCTION.

Correlation may be defined as the degree of inter-relationship that exists between any two variables and it is measured by a mathematical device which expresses the tendency of the two variables to fluctuate in sympathy. This means, in the present work, the interrelationship between the size or shape of one portion of the sheep's skeleton and the size or shape of another portion and the extent to which variations in one portion are attended by variations in another.

Correlation relating to the sheep has been regarded as divisible into two types -

(a) Correlation of external with internal characters - that is, correlation between conformation and such characters as fattening qualities, constitution etc.

(b) Correlation between various external characters, that is, relating to the relationships between the portions of the sheep's skeleton which together constitute what is known as conformation. This paper deals with this type of correlation and seeks to discover whether there is any relationship between the sizes of such portions, e.g. length of head and the length of pelvis, etc.

A knowledge of correlations of both types forms part of the "stock-in-trade" of the breeder and breed standards in regard to conformation, are defined by breed societies on the basis of supposed correlations of type (a) above. It is probable that this standard type defines with fair accuracy, the ideal sheep from the utility point of view and it most certainly does so to a much greater extent than do the so-called "perfect types" of dairy cattle defined by their respective breed societies. It would, perhaps, be desirable that a scientific investigation be undertaken with regard to this type of correlation in sheep with a view to defining type standards of

excellence with greater accuracy, but it was felt that, at present, the greater service to breeders would be provided by information on the relationships between the component parts of the skeleton as measurable on live sheep. It was hoped that this would assist the breeder to attain the standard laid down by the breed society - a standard which, probably, would not be greatly modified by a scientific investigation of the nature of that mentioned above.

A series of measurements were made on twenty Romney ewes from the Massey Agricultural College wool experimental flock and the data so obtained subjected to appropriate mathematical analysis.

The measurements were, in themselves, a matter of considerable difficulty and it was discovered that a great deal depended on the skill of the investigator. The difficulty of measuring live sheep will be quite apparent and considerable care and patience was necessary in order to attain a reasonable degree of accuracy.

The selection of appropriate mathematical devices for the analysis of the data also required lengthy consideration. The value of statistical method applied to biological data, is the subject of considerable controversy and there is no doubt that arbitrary/analytical methodology can be legitimately applied to such data, only when due regard is paid to the possible limitations of the methods employed. It is essential to remember that mathematical methods can only be regarded as convenient modes of expression, not as infallible devices for discovering natural laws. Utter familiarity with the data is a prerequisite to successful deductions from the results of mathematical analysis. It was necessary, therefore, to obtain an understanding of the more common statistical devices and an understanding of the information contained in the data collected, in order to select from the former, the method which most accurately expressed the facts contained in the latter.

When an endeavour was made to fulfil the intentions expressed in the above paragraph, it was soon discovered that the matter was going to involve a great deal of study on questions with no direct bearing on skeletal correlations. It was realised that the limitations attendant on the application of mathematics to livestock work were very real and further, there is the feeling that many research workers in Animal Husbandry have either been unaware of those limitations or have preferred to accept such methods/superficially in order to produce spectacular results. In this work, the choice had to be made whether methods should be adopted with no more than a cursory enquiry as to their value or whether a vast amount of time was to be spent in the study and consideration of the applicability of the simpler statistical devices to the material in hand. Further, the fact was fully appreciated that such study might do no more than confirm conclusions reached in a much more casual manner and in this event, the only return for the work would be an increased understanding of the matter by the author.

On the other hand, the scientific investigation of skeletal relationships in sheep is an entirely new field of research and it was felt, that the only course to pursue was one which would ensure that a firm foundation was laid for future work by a thorough examination of the analytical methodology.

The scope of this work was also restricted to some extent, by the fact that in many cases it is impossible to express in precise terms of measurement all that is apparent to an expert judge of sheep. For example, a judge may see in the facial expression of an animal, indications of a lack of robustness which will enable him to forecast with considerable accuracy, the weaknesses of general conformation to be expected; again a look of "nervous excitement" is frequently seen in animals of poor fattening ability. Such indefinable impressions would obviously be obtained only by expert observers and it would be quite impossible to express them in mathematical terms.

When all the measurements had been made, an enquiry was undertaken with a view to discovering the more common beliefs held by breeders relating to correlations. This enquiry was postponed until after the completion of the measurements because it was realised that preconceived ideas may often unconsciously bias an investigator in a particular direction. The aim of this work is neither to prove nor to disprove beliefs current among breeders but to approach the question with an open mind, unbiased by expected relationships.

THE MEASUREMENTS.

In the majority of cases, the measurements will require no more description than the names and the numbers which refer to the diagrams. The difficulties encountered in making the measurements have been discussed in Part 11 and in few cases, will additional remarks be necessary.

Figs 1 and 11 show the outline of a shorn ewe from the side and from the front; the reference points are shown by numbers. In order to avoid the confusion of too much detail on one diagram, a separate sketch (Fig 111) is given of the skeleton of a sheep, the actual points of reference being enclosed by small red circles. This sketch is not intended to be beyond criticism but is sufficiently accurate to show the position of reference points.

1. Width of Nose. Fig. 11. a ----- a.

In such small measurements as this, it is apparent that a very small actual error would be a large relative error. Actually this measurement was comparatively easy to make but most measurements of this size are not regarded with confidence.

2. Width between eyes; Fig 11; b ---- b.

3. Width of (outside) eye-setting Fig 11; c---c.

4. Width between ears. Fig. 11; d --- d.

This measure was made immediately in front of the ears.

5. Width between shoulders points Fig 11; e --- e.

This was a fairly difficult measurement to make and is therefore less reliable than most.

NOTE: The remainder of the measurements and their reference numbers are all to be found on Figs. 1 and 111.

6. Width between jaw points - point 5A on each side.

7. Length of face; 1 --- 2.

8. Length of head; 1 --- 4.

9. Length of lower jaw; 5 --- 6.

10. Poll to jaw angle; 3 --- 5A.

11. Length of neck; 4 --- 7.

This measurement was attempted but it was found quite impossible to obtain reliable results.

12. Length of shoulder-blade (scapula); 11 --- 12.

13. Breadth of scapula; 11 --- 17.

This measurement also proved unreliable owing to lack of clear definition of the posterior border of the blade, due to the fact that it was held so closely to the body.

14. Length of humerus; 12 --- 13.

It will be seen that this measurement actually includes more than the humerus proper as it is made to the point of the elbow (olecranon process) as indicated in the diagram.

15. Length of radius; 13 --- 14.

Strictly speaking this portion contains two bones, the radius and the ulna; the olecranon process (point 13) being part of the latter.

16. Length of fore-cannon; 14 --- 15.

This really includes the carpal bones of the joint. It would have been preferable for point 14 to be below rather than above the carpals but a more clearly defined point of reference was obtained in the position indicated.

17. Length of fore-pastern; 15 --- 16.

Not only was this measurement small (see remarks on width of nose) but also was very difficult to make. For similar reasons an attempt to measure pastern slope was also unsuccessful.

18. Length of pelvis (Hook to pin) 20 --- 22.

19. Hook to thurl 20 --- 21.

20. Thurl to pin; 21 --- 22.

A clearly defined point at the thurl (acetabulum) was difficult to obtain for the above two measurements and no great confidence should be placed in them.

21. Length of femur 21 --- 23.

The thurl point was easier to locate from this angle.

22. Length of tibia; 23 --- 24.

This is of the same type as the humerus etc. - the measuremen is named according to the principal bone but really includes more.

23. Length of hind cannon 24 --- 25.

24. Length of hind pastern; 25 --- 26.

This measurement like "fore pastern" was quite unreliable.

25. Length of thoracic vertebrae; 7 --- 9.

26. Length of loin; 9 --- 10.

27. Body depth; 8 --- 19.

Point 19 was located between the legs on the brisket.

28. Wither height; ground level to 8.

During all measuring the sheep were standing on a concrete floor.

29. Shoulder point to last rib; 12 --- 27.

30. Body width (at girth); 18.

That is, the width through the body at point 18.

31. Body width (at last rib) 27.

For obvious reasons this will be less reliable than the measurement immediately above.

32. Width of loin (front) at point 9.

33. Width of loin (rear).

This measurement was made immediately in front of the hooks.

34. Width between hooks.

This was taken from the outside boundary of each hook (point 20).

35. Width between pins.

This measure was not easy to make and was taken between the most posterior "points" of the pin bones (22).

36. Girth.

Taken behind the elbow.

37. Height to hook; ground level to 20.

38. Height to pin; ground level to 22.

39. Body Length; 12 --- 22.

40. Angle of hook.

This is the angle enclosed by the points 23 to 24 to 25. This measure is recorded but it is not felt that it can be relied on to any great extent but would be useful only in indicating future lines of investigation.

41. An endeavour was made to secure some expression of the development of the brisket but no reliable measure could be found.

42. It is necessary also that some method be evolved for measuring slopes (e.g. pelvis, shoulder, etc.) which will give reliable results. The method employed in this paper, although probably more accurate than direct measurement, is not considered to be entirely satisfactory.

THE MEASUREMENTS.

FIG 1

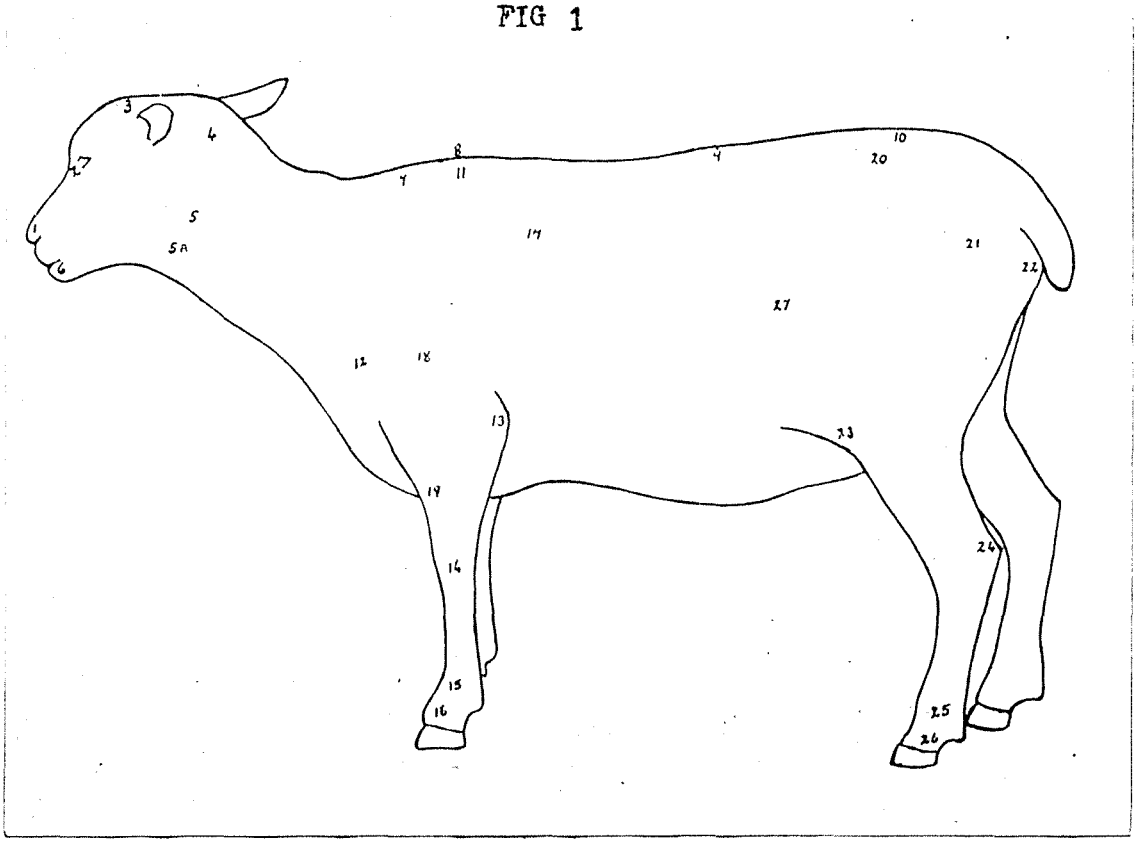
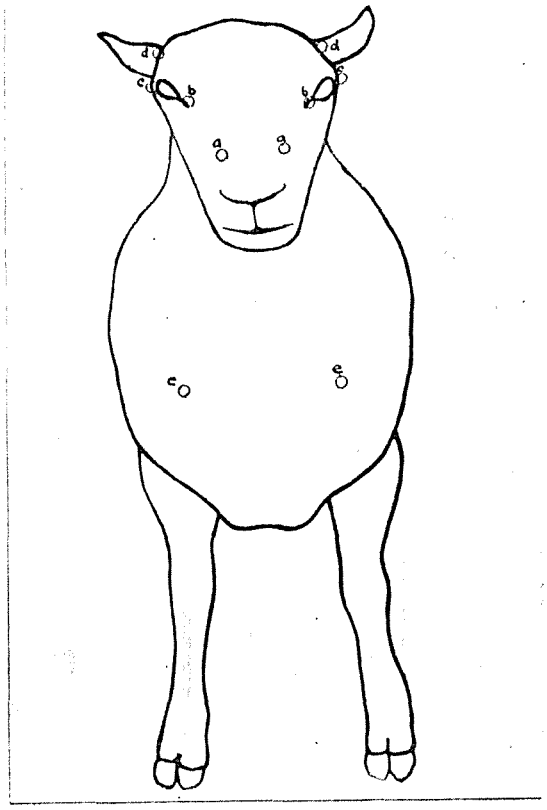
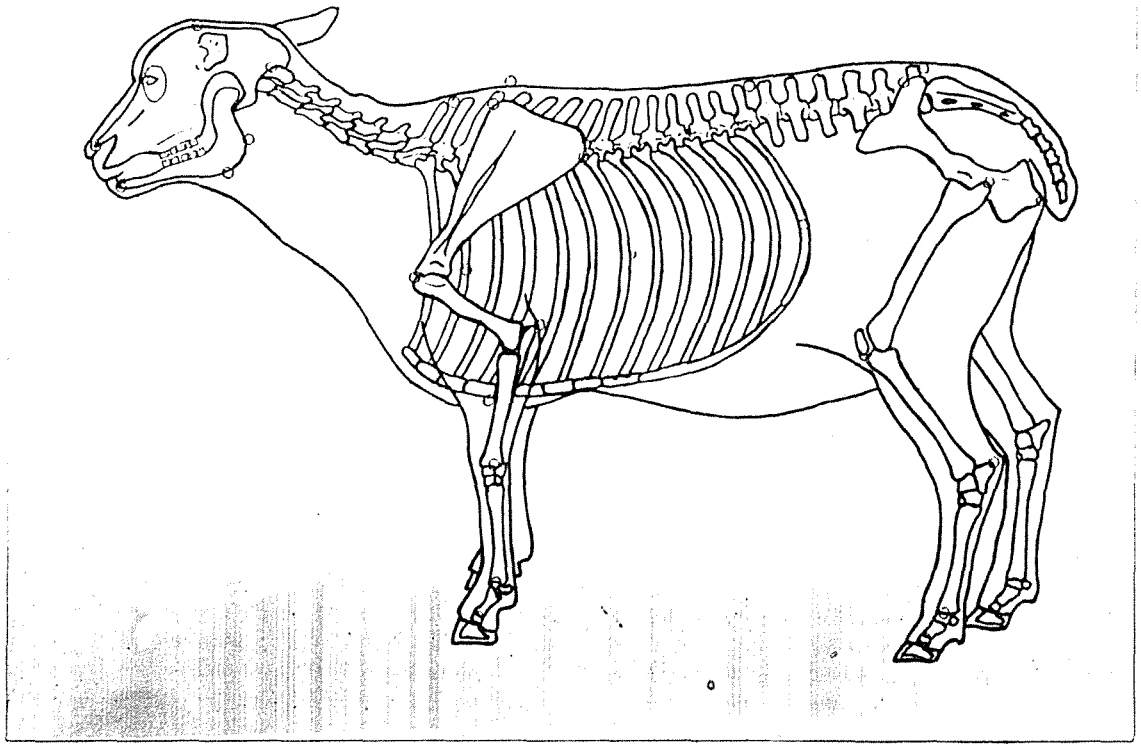


FIG. 11



THE MEASUREMENTS.

FIG 111



[ALL SKETCHES BY AUTHOR.]

SKELETAL CORRELATIONS IN THE N.Z. ROMNEY MARSH.

MEASUREMENTS.	893	E37	E676	743	E558	E544	x921	E20	E589	E168	E240	E10	E119	E36	E886	E25	E184	1076	E564	E11
1. Width of nose	2.1	2.0	2.0	2.2	2.2	2.1	2.0	2.1	2.0	2.1	1.9	2.1	2.0	2.1	2.1	2.0	2.0	2.0	2.0	2.2
2. Width between eyes	2.2	2.7	2.7	2.8	3.2	2.8	2.7	2.6	2.6	2.7	2.8	2.6	2.7	2.8	2.8	2.8	2.7	2.6	2.8	2.7
3. Width outside eye-setting	4.8	5.3	4.9	5.3	5.3	5.0	5.1	5.2	5.2	5.3	5.1	5.0	5.2	5.2	5.2	5.2	5.1	5.2	5.0	5.0
4. Width between ears	3.8	3.9	3.8	4.1	3.9	4.0	3.7	4.2	4.0	4.0	3.9	4.0	4.1	3.8	3.9	4.1	3.8	3.9	4.2	3.8
5. Width between points of jaw	3.6	3.4	3.7	3.8	3.6	3.5	3.6	3.3	3.6	3.5	3.2	3.5	3.3	3.2	3.6	3.8	3.3	3.7	3.8	3.6
6. Length of face	5.1	5.3	4.8	5.3	5.5	5.2	4.7	5.4	4.9	5.1	5.1	5.3	5.1	5.2	5.2	5.2	4.7	4.9	5.1	5.3
7. Length of head	9.8	10.0	9.6	10.3	10.3	10.1	9.4	10.4	9.6	10.3	9.6	10.1	9.6	10.1	10.2	10.0	9.5	9.8	10.1	10.3
8. Length of Lower Jaw	7.3	8.2	7.4	7.7	7.8	7.7	7.7	7.9	7.6	7.6	7.7	7.4	8.0	7.6	7.9	7.7	7.7	7.7	8.0	7.8
9. Poll to jaw angle	5.8	6.1	6.0	6.2	6.0	5.8	6.0	6.3	6.0	5.7	5.9	5.6	5.9	5.8	6.0	6.0	5.3	6.1	6.0	6.0
10. Length of shoulder blade	8.3	8.2	8.1	8.9	8.4	8.2	8.0	9.0	8.5	8 3	8.0	8.5	8.0	8.4	8.8	8.2	8.2	8.2	8.6	8.3
11. Length of humerus	6.9	6.7	6.3	7.1	6.9	7.1	6.9	6.9	7.0	6.9	6.7	6.9	6.3	7.0	6.5	6.8	7.3	6.8	7.2	7.3
12. Length of radius	7.0	7.7	7.3	7.9	7.7	7.8	7.1	7.7	7.2	7.7	7.2	7.3	7.3	7.3	7.8	7.6	7.4	7.4	7.9	7.3
13. Length of fore-cannon	5.0	5.4	4.8	5.3	5.3	5.5	5.3	5.5	5.3	5.2	5.1	5.3	5.1	5.3	5.5	5.3	5.2	5.3	5.4	5.5
14. Length of pelvis	8.7	9.3	9.0	9.2	9.2	9.0	8.9	9.8	8.8	9.1	8.9	9.4	8.8	9.1	9.3	9.1	9.2	9.1	9.8	9.5
15. Hook to thurl	4.8	5.0	4.5	5.0	5.2	5.0	-	5.2	4.5	5.1	4.3	5.0	4.8	5.3	5.2	5.2	5.2	5.5	5.1	5.0
16. Thurl to pin	4.8	4.7	4.6	5.0	5.2	5.0	4.6	5.0	4.6	5.1	4.4	5.0	4.4	4.8	5.0	4.7	4.8	4.8	5.2	5.0
17. Length of femur	7.3	7.8	7.5	7.2	7.4	7.6	7.4	7.8	7.3	7.4	7.3	7.2	6.8	7.7	7.9	7.8	7.7	7.4	8.1	7.6
18. Length of tibia	10.0	10.4	10.3	10.3	10.3	10.3	10.0	10.7	9.7	10.2	9.6	9.9	9.3	10.2	10.3	10.4	10.0	10.0	10.8	9.7
19. Length of hind cannon	5.8	6.2	5.8	6.1	6.3	6.4	6.2	6.3	6.2	6.1	6.2	6.3	5.7	6.5	6.2	6.2	5.8	6.1	6.4	6.1
20. Length of thoracic vertebrae	9.5	10.7	9.9	11.8	9.8	10.7	9.8	10.9	10.6	10.2	10.6	10.0	10.3	10.0	10.0	10.3	10.6	10.9	10.8	10.6
21. Length of loin	7.8	8.1	7.4	8.3	8.2	7.8	7.5	8.0	8.3	7.8	7.4	8.6	7.8	7.7	7.8	8.5	7.6	7.5	8.2	7.6
22. Body depth	11.4	12.0	11.5	12.3	11.9	12.1	11.5	13.0	11.8	12.2	12.0	11.8	11.7	12.2	11.8	12.3	12.2	12.1	11.9	11.8
23. Wither height	23.9	25.0	23.7	24.7	24.4	24.1	22.2	25.8	24.5	24.1	24.8	24.9	23.4	23.9	25.2	24.8	23.1	24.8	25.1	25.6
24. Shoulder pt. to last rib	13.5	14.0	14.0	14.6	13.7	13.5	13.7	14.3	13.8	14.0	14.2	13.0	13.2	13.8	14.5	14.4	14.0	14.0	14.6	14.3
25. Width between shoulder pts	7.6	7.5	7.2	7.7	8.2	7.4	7.0	7.6	7.8	7.6	7.8	7.6	7.2	7.4	7.6	6.9	7.0	7.3	7.8	7.7
26. Width of body, (girth)	7.3	7.2	6.9	7.2	6.8	7.2	6.5	6.9	6.8	8.2	7.1	7.4	6.8	7.0	7.8	7.6	7.4	7.2	7.3	7.8
27. Width of body(last rib)	10.3	10.5	10.7	9.6	9.8	9.7	9.4	11.5	9.0	10.7	10.5	10.3	10.3	10.7	10.6	10.6	10.1	10.5	10.2	10.6
28. Width of loin (front)	4.7	5.2	5.0	5.1	5.0	5.2	4.4	5.3	5.0	5.3	4.9	5.0	4.9	5.3	5.9	5.0	5.0	4.9	5.0	5.0
29. Width of loin (rear)	5.3	6.2	5.8	6.1	6.0	6.2	5.5	6.3	6.0	6.3	6.2	6.1	6.1	6.0	6.9	6.2	6.0	6.0	6.1	6.3
30. Width between hooks	7.9	8.3	8.2	7.8	7.9	8.0	7.4	8.2	7.7	7.9	7.6	7.8	7.8	7.7	8.2	8.2	8.0	7.9	8.2	7.9
31. Width between pins	2.7	2.5	2.8	2.4	2.7	2.4	2.2	2.4	2.2	2.4	2.3	2.6	2.2	2.5	2.4	2.3	2.3	2.2	2.3	2.7
32. Girth.	34.0	33.8	33.3	34.8	33.4	34.2	30.8	34.5	33.5	36.0	33.2	33.5	34.0	34.0	35.3	35.8	34.3	34.2	35.3	34.5
33. Height to hook	24.4	25.3	24.7	24.6	25.4	25.0	24.3	26.6	25.5	25.0	24.8	24.9	23.4	24.2	25.2	25.2	23.9	24.2	25.8	24.5
34. Height to pin	19.7	22.0	20.4	21.8	20.3	20.5	20.1	20.8	21.2	20.6	20.2	19.7	18.4	19.8	20.2	19.8	19.4	20.8	21.3	19.5
35. Body length	26.0	29.2	27.5	30.0	29.0	28.7	27.8	29.0	27.2	28.7	27.2	28.0	27.1	28.7	29.1	29.2	28.2	28.2	30.0	28.8
36. Angle of hock (in degrees)	122	133	128	122	131	128	120	127			131	125	122	132	125	127	123	118	133	124
37. Size index	27.1	28.3	27.3	28.5	28.1	28.0	26.3	29.0	27.7	28.5	27.5	27.8	27.0	27.7	28.7	28.8	27.4	27.9	29.1	28.4

THE RESULTS.

It is apparent that the maximum number of correlation coefficients that could be calculated from the data collected, would number many hundreds and since the time involved in the preliminary work was so great it was, unfortunately, necessary to limit the number of coefficients calculated.

As was mentioned earlier in this paper, an enquiry was made to discover the more common opinions held by breeders in regard to skeletal correlations. As a result of this enquiry, it appeared that the majority of ideas were concerned with the relation of various parts of the body to the length of the cannon and to head measurements.

It seemed appropriate, therefore, in selecting the limited number of coefficients to be calculated at present, to compute those which were apparently of greatest interest to breeders, viz. those relating to the cannon and to head measurements.

The general principles involved in the interpretation of the coefficients, are discussed in those sections (Part 11) which concern the development of suitable analytical devices for treating the data. The application of these principles to particular cases will not, therefore, require to be considered here in detail.

The results are summarised in tabular form below. As discussed in Part 11 the significance of a correlation coefficient depends on its relation to its probable error and in this work a simple expedient was adopted to save time from unnecessary calculation. As a result, the lowest significant coefficient was found to be $\pm$ 0.47. The effect of error of measurement is, however, to reduce the coefficients below their true value; it will be seen in the discussion that for this reason, coefficients smaller than $\pm$ 0.47 are regarded as significant.

TABLE 1.

CORRELATION COEFFICIENTS (r) BETWEEN "THE SIZE INDEX" AND VARIOUS MEASUREMENTS; WITH THE PERCENTAGE INDEPENDENT VARIABILITY (P.I.V.) OF THE LATTER.+

MEASUREMENT	r.	P.I.V.
(1) Length of head	+0.81	59%
(2) Length of face	+0.62	79%
(3) Width (outside) eye-setting	+0.33	94%
(4) Width between ears	+0.65	76%
(5) Poll to jaw	+0.36	93%
(6) Length of fore-cannon	+0.59	81%
(7) Wither height	+0.82	57%
(8) Body Depth	+.62	78%
(9) Length of shoulder-blade	+0.67	74%
(10) Shoulder slope	-0.30	95%
(11) Girth	+0.79	61%
(12) Length thoracic vertebrae	+0.47	88%
(13) Width body (at girth)	+0.54	84%
(14) Width body (at last rib)	+0.39	92%
(15) Height to hook	+0.69	72%
(16) Hind cannon	+0.47	88%
(17) Body length	+0.78	62%
(18) Length of pelvis	+0.75	66%
(19) Length of loin	+0.49	87%
(20) Width between hooks	+0.66	75%
(21) Pelvis slope	-0.02	100%
(22) Ratio head length to width of (outside) eye-setting	+0.44	89%

+ The "percentage independent variability" is obtained by using Sumner's factor (see Part 11).

TABLE 11.

GROSS AND NET CORRELATION COEFFICIENTS BETWEEN "LENGTH OF FORE CANNON" AND OTHER MEASUREMENTS.

	MEASUREMENT.	GROSS r.	NET r.
(1)	Length of face.	+0.48	+0.18
(2)	Length of head	+0.59	+0.24
(3)	Poll to jaw	+0.27	+0.08
(4)	Length of pelvis	+0.60	+0.30
(5)	Length of hind-cannon	+0.69	+0.58
(6)	Length of thoracic vertebrae	+0.39	+0.16
(7)	Length of loin	+0.33	+0.06
(8)	Body depth	+0.47	+0.16
(9)	Wither height	+0.52	+0.08
(10)	Width body (at girth)	+0.22	-0.15
(11)	Width body (at last rib)	-0.01	-0.32
(12)	Width between hooks	+0.18	-0.35
(13)	Girth	+0.25	-0.44
(14)	Width of (outside) eye setting	+0.34	+0.19
(15)	Body Length	+0.66	+0.40
(16)	Pelvis slope	-0.03	-0.02
(17)	Shoulder slope	-0.13	+0.06

TABLE 111.

GROSS AND NET CORRELATION COEFFICIENTS BETWEEN "LENGTH OF HEAD" AND OTHER MEASUREMENTS.

	Measurement	Gross.r	Net.r
(1)	Length of face	+0.84	+0.73
(2)	Body depth	+0.51	+0.02
(3)	Width body (at girth)	+0.48	+0.09
(4)	Width body (last rib)	+0.36	+0.08
(5)	Shoulder slope	-0.28	-0.07
(6)	Pelvis length	+0.64	+0.10

TABLE 1V

GROSS AND NET CORRELATION COEFFICIENTS BETWEEN "WIDTH OF (OUTSIDE) EYE-SETTING" AND OTHER MEASUREMENTS.

	Measurement	Gross r.	Net r.
(1)	Width between ears	+0.28	+0.09
(2)	Width body (at girth)	+0.02	-0.20
(3)	Width body (at last rib)	-0.01	-0.16
(4)	Width between hooks.	-0.02	-0.34

TABLE V

GROSS AND NET CORRELATION COEFFICIENTS BETWEEN THE RATIO OF "HEAD LENGTH" TO "WIDTH OF (OUTSIDE) EYE-SETTING" AND OTHER MEASUREMENTS.

	Measurement	Gross r.	Net r.
(1)	Fore cannon	+0.24	-0.03
(2)	Body depth	+0.02	-0.36
(3)	Body width (at girth)	+0.40	+0.21
(4)	Body width (at last rib)	+0.32	+0.18
(5)	Width between hooks	+0.36	+0.10

TABLE V1.

GROSS AND NET CORRELATION COEFFICIENTS BETWEEN "WIDTH BETWEEN EARS" AND OTHER MEASUREMENTS.

	Measurement	Gross r.	Net r.
(1)	Body width (at girth)	+0.09	-0.41
(2)	Body width (at last rib)	+0.14	-0.16
(3)	Width between hooks	+0.36	-0.12

TABLE V11.

GROSS AND NET CORRELATION COEFFICIENTS BETWEEN "POLL TO JAW" AND OTHER MEASUREMENTS.

	Measurement	Gross r.	Net r.
(1)	Body depth	+0.20	-0.03
(2)	Girth	-0.02	-0.53.

TABLE V111

SUNDRY GROSS CORRELATIONS.

1.	Length of head - wither height	+0.69
	" " " - girth	+0.60
	" " " - height to hook.	+0.53
2.	Length of pelvis - wither height	+0.65
	" " " girth	+0.38
	" " " height to hook	+0.59
	" " " body length	+0.74
3.	Wither height - Height to hook	+0.64
	" " girth	+0.54
	" " body length	+0.46
	" " scapula	+0.59
	" " humerus	+0.13
	" " radius	+0.46
	" " fore cannon	+0.52
	" " shoulder slope	-0.55
4.	Height to hook - body length	+0.44
	" " femur	+0.61
	" " tibia	+0.67
	" " hind cannon	+0.57
5.	Girth - body length	+0.49
	" height to hook	+0.25