Contributions to Egyptian anthropometry. II, The comparative anthropometry of the most ancient and modern inhabitants / by Charles S. Myers.

CONTRIBUTIONS TO EGYPTIAN ANTHROPOMETRY.

II.—THE COMPARATIVE ANTHROPOMETRY OF THE MOST ANCIENT AND MODERN INHABITANTS.

BY

CHARLES S. MYERS.

PUBLISHED BY THE
Anthropological Institute of Great Britain and Ireland.
3, HANOVER SQUARE, LONDON, W.

CONTRIBUTIONS TO EGYPTIAN ANTHROPOMETRY. II.—THE COMPARATIVE ANTHROPOMETRY OF THE MOST ANCIENT AND MODERN INHABITANTS.

By Charles S. Myers.

A. Comparison of Measurements and Indices.

1. *Previous Work.*

In 1902, an attempt was made to investigate this problem for Egypt by the biometric workers under Professor Karl Pearson at University College, London.[1] But, as I shall show, the only material of which they could at that time make use was not fitted for the purpose. The data which I have since been able to collect throw a somewhat different and, I hope, a more trustworthy light on the subject.

Miss Fawcett and her collaborators had at their disposal Mr. Randall MacIver's measurements of about 100 skulls from Abydos, and their own more elaborate measurements of parts of some 400 skeletons belonging to a similar period, excavated by Professor Petrie at Naḳada. The date of this so-called "prehistoric" material may be approximately fixed at 5000 B.C. It was compared (α) with a collection of about eighty modern skulls from Cairo, and (β) with a collection of about 240 Theban skulls dating from a period nearly midway between the "prehistoric" and the present time. The measurements of these collections had been published in the German catalogue, issued as an offprint of the *Archiv für Anthropologie*.

Comparing the measurements and indices of the above groups of skulls from Naḳada, Thebes, and Cairo, the writers of the *Biometrika* memoir were impressed "with the striking likenesses between these three groups" (p. 432). "But," they added, "we are still forced to the conclusion that in certain characters a progressive evolution has taken place, for these characters are substantially changed . . . . The most noteworthy of these changing characters are the decreasing [skull] length (L), the increasing [skull] breadth (B), the increasing frontal breadth (B′), the increasing auricular height (OH), and the increasing total facial height (GH) for the males" (pp. 432–433). To these they also add the diminishing cranial capacity (C).

The following table gives the measurements which are under discussion:—

[1] "A second study of the variation and correlation of the human skull, with special reference to the Naqada Crania," by Cicely D. Fawcett, B.Sc., assisted by Alice Lee, D.Sc., and others. *Biometrika*, 1902, I, pp. 408–467.

Series.	L.	B.	B′.	OH.	GH.	C.
Naḳada ("prehistoric")	185·13	134·87	91·06	115·59	112·02	1381·0
Thebes ("ancient") ...	181·94	136·63	93·83	114·34	114·31	1387·63
Cairo ("modern") ...	179·11	136·51	94·08	116·07	115·74	1356·1

Now, closer examination raises grave doubts as to the reality of these so-called "changing characters." Indeed one of them we can clearly reject at once. In auricular height (OH) the modern and "prehistoric" series differ only by half a millimetre, an amount far too small to have any significance. As regards two of the characters, skull-breadth (B) and total facial height (GH), I have not been able to make absolutely certain of the modern material which is here chosen for comparison. In Table V(*a*) of the *Biometrika* memoir, for example, the mean skull breadth of the modern Cairene series is given as 136·76, in Table IX as 136·51. The number of skulls in the series is stated to be fifty-nine. I have obtained the breadth measurements of forty-seven modern Cairene male skulls from the Leipzig collection; I notice also a few others in the Munich collection, which may have gone to make up the fifty-nine. The standard deviation[1] of this series of forty-seven in skull-breadth is 6·67. If we assume that it is about the same for the larger series of fifty-nine, then the probable error of the difference of the Naḳada and Cairene series in mean breadth is $\pm 0{\cdot}71$, which is little less than half of the found difference $(136{\cdot}51 - 134{\cdot}87) = 1{\cdot}64$. If the same supposition holds with the total facial height, the differences in each case are not large enough to be with certainty significant. We have, moreover, to remember that the measurements in the two series were made in the one case by German and in the other by British observers, and that a resulting average difference of a millimetre is by no means unlikely.

Turning now to the minimum frontal breadth (B′), we deal with a measurement which is not easily taken with precision. Errors due to the personal equation of the observer are specially likely to arise. The same kind of error is notoriously still more prevalent in the determination of skull capacity. As Dr. Lee and Professor Pearson have themselves elsewhere noted, "two different experimenters

[1] The standard deviation, σ, is an index which gauges the average individual variation of the members of a series from the mean, A, of that series. If n be the number of members and if Σx be the sum of the individual differences from the mean, $\sigma = \sqrt{\frac{\Sigma x^2}{n}}$. The coefficient of variability, C, is a hundred times the ratio of the standard deviation to the mean, $= \frac{100\,\sigma}{A}$. The probable error of the mean is $\pm\ 0{\cdot}6745\ \frac{\sigma}{\sqrt{n}}$, that of the standard deviation is $\pm\ 0{\cdot}6745 \frac{\sigma}{\sqrt{2n}}$, and that of the coefficient of variability is $\pm\ 0{\cdot}6745\ \frac{C}{\sqrt{2n}}$ approximately. The probable error of the difference of two means is the square root of the sum of squares of the probable errors of the means.

may give a mean skull-capacity for a series which differs by 15 to 40 cub. centims."[1] We can therefore draw no conclusion when two series measured by different observers differ by (1381—1356=) 25 cub. centims.

The difference in skull length between the Naḳada and the Cairene series, a difference of 6·02 mm., is the one measurement which certainly looks significant. But I find that the standard deviation of the Cairene skulls from their mean skull-length reaches the high figure of 8·02,[2] while that of the Naḳada series is 5·75. In other words, the series of "prehistoric" skulls is being compared with a most heterogeneous modern series from a crowded city, for the purposes of determining what changes the Egyptian population has undergone. This procedure is obviously inadmissible. It would be as fair to compare the people of an ancient Scottish town with the mixed population of modern London, in order to discover the significant changes brought about by evolution or racial admixture during the past few thousand years!

In the *Biometrika* memoir, it will be noted that the Cairene skulls are stated to be "almost certainly Coptic." No evidence is offered for this statement, and I can find none. At all events, one does not need great familiarity with *fellahin* grave-robbers to be sceptical.

A comparison of the Naḳada with the Theban series is open to a similar objection, for the mixed population of ancient Thebes—with its circumference of twelve miles and its hundred gates—must be altogether incomparable with the inhabitants of a small prehistoric town like Naḳada.

2. *The Present Material.*

Unfortunately, no more suitable material for this biologically interesting comparison existed than the above, until an opportunity was given me during the years 1901–2 to obtain anthropometric data from the troops of the Egyptian army. By recording the birthplace of the parents of each soldier, I was able to group and subsequently to study the measurements of the soldiers according to their *provenance.*

I am thus able to furnish data obtained from the people dwelling in the contiguous provinces of Ḳena and Girga, and to compare them with the Naḳada statistics which have been so carefully elaborated by Professor Pearson's school of workers.

The *fellahin* conscripts of Ḳena and Girga whom I measured came for the most part from small river-side villages, the most northern and southern of which lie about 250 miles apart and equi-distant from the Naḳada site. In other words, these modern people live under similar conditions and *in the same region of the valley of the Nile* as did their Naḳada ancestors about 5000 B.C.

[1] *Phil. Trans. Roy. Soc.*, 1901, vol. cxcvi, p. 228.

[2] In a series composed of Australian, Guanche, Eskimo, and Chinese skulls, as heterogeneous as can be imagined, the standard deviation in head-length amounts to 8·389! (*Man*, 1903, p. 31.) The standard deviations of the head-breadth and cephalic index of the Cairene skulls are likewise great; but throughout the probable error of these constants is high owing to the relatively small size of the series.

The following table shows the cephalic index and the head-measurements, taken in the "prehistoric" series on the skull, and in the modern series on the living head:—

Series.	Head-length.		Head-breadth.		Cephalic Index.	
	No.	Mean.	No.	Mean.	No.	Mean.
Naḳada ("prehistoric")... ...	139	185·13	139	134·87	130	72·99
Ḳena ("modern")	53	194·79	53	143·91	53	73·94
Girga „	83	194·53	83	144·33	83	74·25
Ḳena and Girga ("modern") ...	136	194·63	136	144·16	136	74·13

The difference between these measurements of "prehistoric" and modern people must be almost wholly due to the disturbing influence of the thickness of the scalp. For the results of Welcker's investigations upon thirteen male subjects[1] show that the average thickness of the scalp at the middle of the forehead is 4·3 mm., and that at the back of the head it is 6·8 mm. As, however, the hair of by far the greater number of my Egyptian subjects had been closely cropped, it will be a fair procedure to subtract 10 mm. from the head-length and 10·5 mm. from the head-breadth. We may also deduct a proportionate figure, 1·6, from the cephalic index. The figures then become:—

Series.	No.	Head-length.	Head-breadth.	Cephalic Index.
Naḳada ("prehistoric")	139	185·13	134·87	72·99
Ḳena and Girga ("modern")... ...	136	184·63	133·66	72·53

Whence I conclude that there is no essential difference between the head dimensions[2] *of the "prehistoric" and those of the modern population of this region of Upper Egypt.*

But this procedure of reducing measurements of the living in order to make them comparable with those of the dried skeleton is obviously attended with danger. Before we can legitimately pursue further conclusions in this subject, we must await a collection of modern skulls from Naḳada or some neighbouring region.

[1] Schiller's *Schädel und Todtenmaske*, Braunschweig, 1883, quoted by Lee and Pearson (*loc. cit.* p. 251).

[2] The auricular heights measured on the skull and on the living head, differ by a hitherto unobserved and undetermined amount, which must mainly depend on the pressure exerted on the living subject.

B. COMPARISON OF VARIABILITY.

An interesting study is yet open to us, namely, a comparison of the homogeneity of the modern with that of the ancient population of the same district. The question arises, Are there wider deviations from the average measurements among the modern than among the ancient inhabitants? Or, has the homogeneity, so far as it is determinable by variability, remained constant in spite of conjectural evolutionary changes and the later admixture of invading peoples? The replies to this inquiry are embodied in the following table, which gives the standard deviations (σ) and the coefficients of variability (C), each with its probable error,[1] for certain head-measurements. If we can generalise from these measurements, *it is evident that the homogeneity of the Egyptians of this district is the same to-day as it was seven thousand years ago.*

Series.	Head-length.			Head-breadth.		
	No.	σ.	C.	No.	σ.	C.
Naḳada	139	5·75 ± 0·23	3·17 ± 0·13	139	4·60 ± 0·19	3·29 ± 0·13
Ḳena and Girga	136	5·83 ± 0·24	3·00 ± 0·12	136	4·31 ± 0·18	2·99 ± 0·12

Series.	Cephalic Index.			Auricular Height.		
	No.	σ.	C.	No.	σ.	C.
Naḳada	130	2·80 ± 0·12	3·83 ± 0·16	140	4·46 ± 0·18	3·86 ± 0·16
Ḳena and Girga	136	3·04 ± 0·12	4·10 ± 0·17	64	4·47 ± 0·27	3·07 ± 0·18

Series.	Horizontal Circumference.			Upper Facial Index.		
	No.	σ.	C.	No.	σ.	C.
Naḳada	118	13·00 ± 0·57	2·54 ± 0·11	76	4·52 ± 0·25	6·41 ± 0·35
Ḳena and Girga	57	13·38 ± 0·84	2·45 ± 0·15	135	3·14 ± 0·13	6·53 ± 0·27

The head-measurements that I have chosen seem to me those which are least open to objection in a comparison of the dimensions of the living head and

[1] See note on page 81 for an explanation of these constants.

the skull. The nasal index, for example, would be quite inadmissible. Its absolute value is about half again as great upon the living as upon the dead: on the "prehistoric" skulls it averages 51·08, among the Ḳena and Girga folk 78·22. There is hence a marked disagreement in standard deviations (4·18 and 7·68 respectively), which, however, is largely corrected in the coefficients of variability, 8·18 and 9·82. If, however, we bear in mind how much more variable must be the breadth of the cartilaginous nostrils than the width of the bony nasal aperture, we shall still hesitate to make a comparison in variability between the nasal breadth-measurements or nasal indices derived from the living body and those derived from the skull. Measurements upon the long bones are equally inadmissible for comparison, first, because they are taken only with approximate accuracy on the living; secondly, because the modern conscripts are especially chosen for their physique.

An objection may here be met that in the Naḳada series we are dealing with a mixed male population of children, youths and men, while the Ḳena and Girga troops are a body of adults *specially selected* owing to their stature and chest-measurements, and consequently yielding a very erroneous conception of the variability of the *entire* male population at the present day. I shall be able to show that this objection has in reality no weight.

In the first place, there is hardly reason to suppose that a significant correlation exists between stature and the above head-measurements, less still between stature and cephalic and facial indices. Further, we have no historical evidence of the absorption of a specially tall or short race into Egypt, distinguished by other physical characteristics from the previous inhabitants. Nor, so far as I know, have we evidence that the tall individuals of a district are less variable in head and face indices than the general population.

Secondly, a vast number of the Egyptian soldiers are young adults ranging in age from eighteen to twenty-five, while in the Naḳada series the male average is not disturbed by a single child's skull below the age of fifteen.

In the third place, I have expressly calculated the averages of several head-measurements from thirty-five of the tallest of the Naḳada individuals, who may thus be reasonably considered comparable with the selected conscripts of the modern Egyptian army.[1] And I find that neither in average dimensions nor in the variability of those dimensions are they perceptibly different from the general male Naḳada population.

C. Comparison of Frequency-Distributions.

The following diagrams show the distribution of the various measurements of head-length, head-breadth, auricular height, cephalic index, upper facial height and nasal height:—

[1] This procedure is fortunately possible, thanks to Dr. Warren's excellent monograph on the Naḳada skeletons (*Phil. Trans. Roy. Soc.*, 1898, vol. clxxxix, pp. 135–227), which enables the anthropologist to select the crania which have a correspondingly great tibial length.

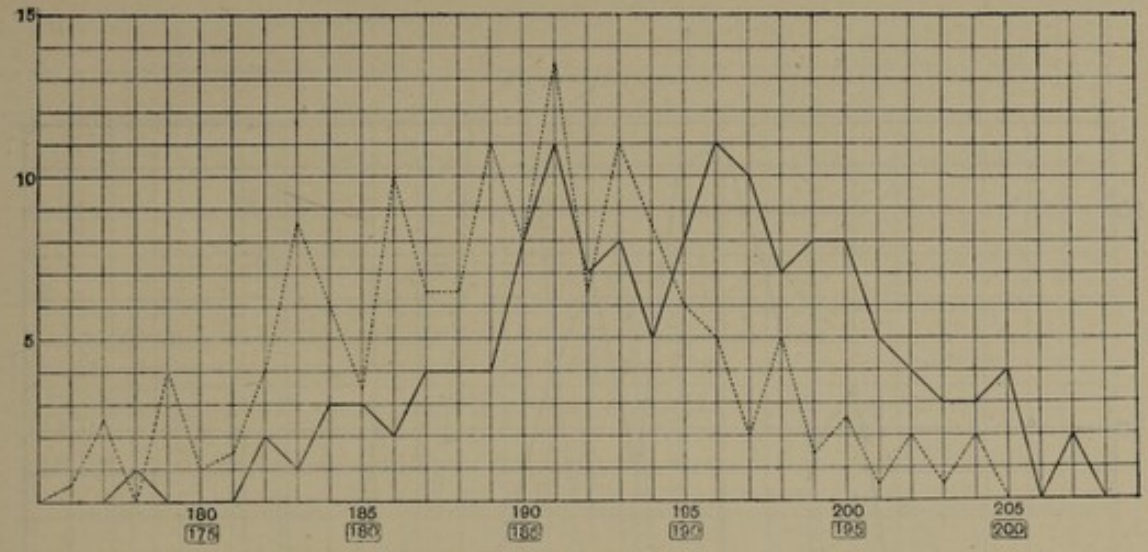

FIG. 1. HEAD-LENGTH.

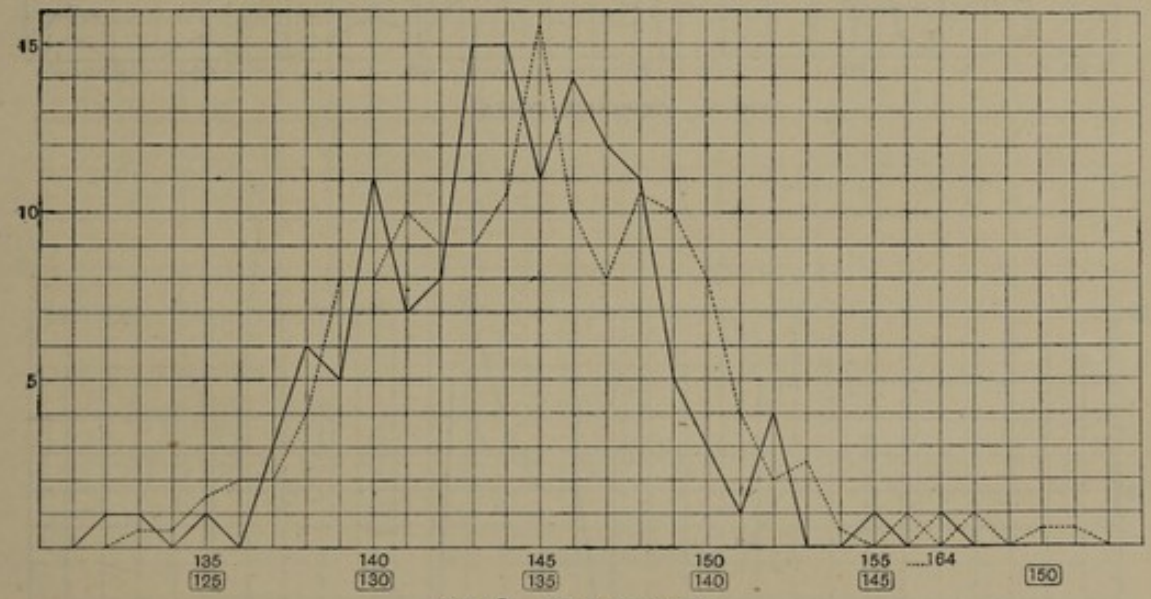

FIG. 2. HEAD-BREADTH.

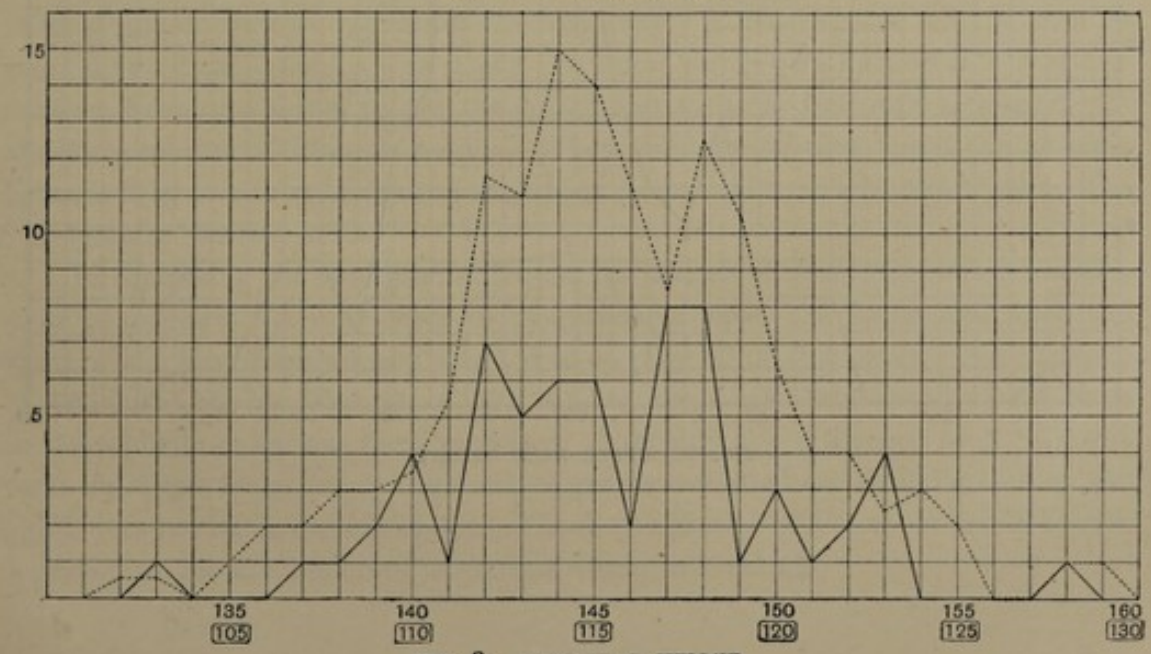

FIG. 3. AURICULAR HEIGHT.

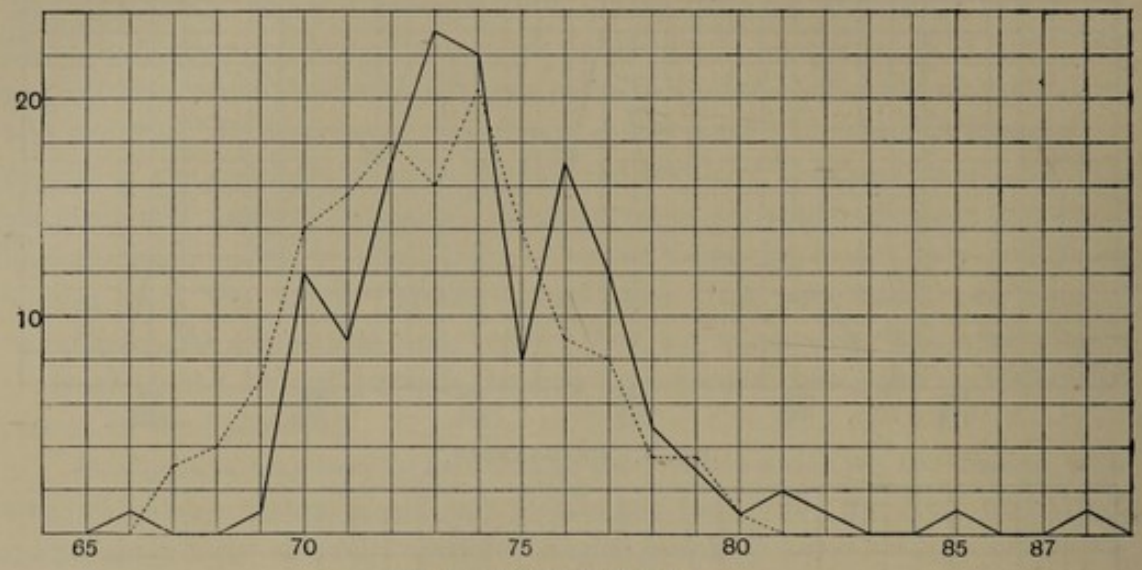

FIG. 4. CEPHALIC INDEX.

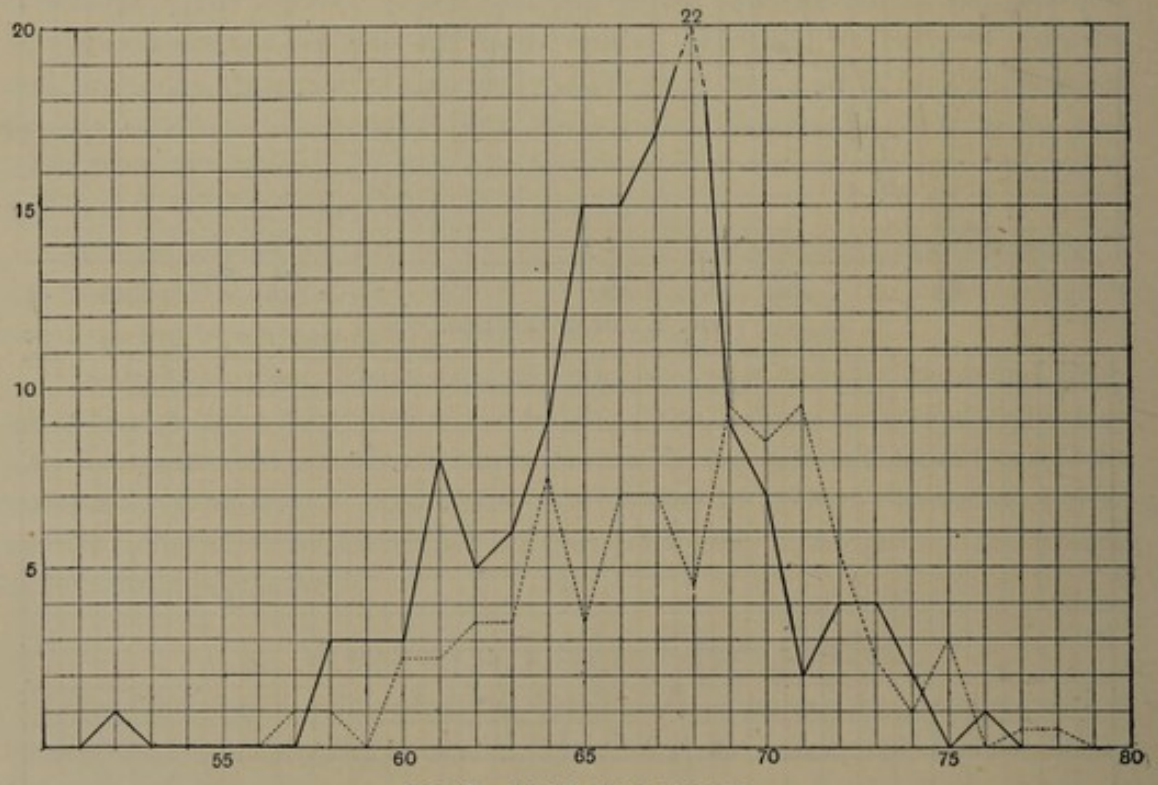

FIG. 5. UPPER FACE HEIGHT.

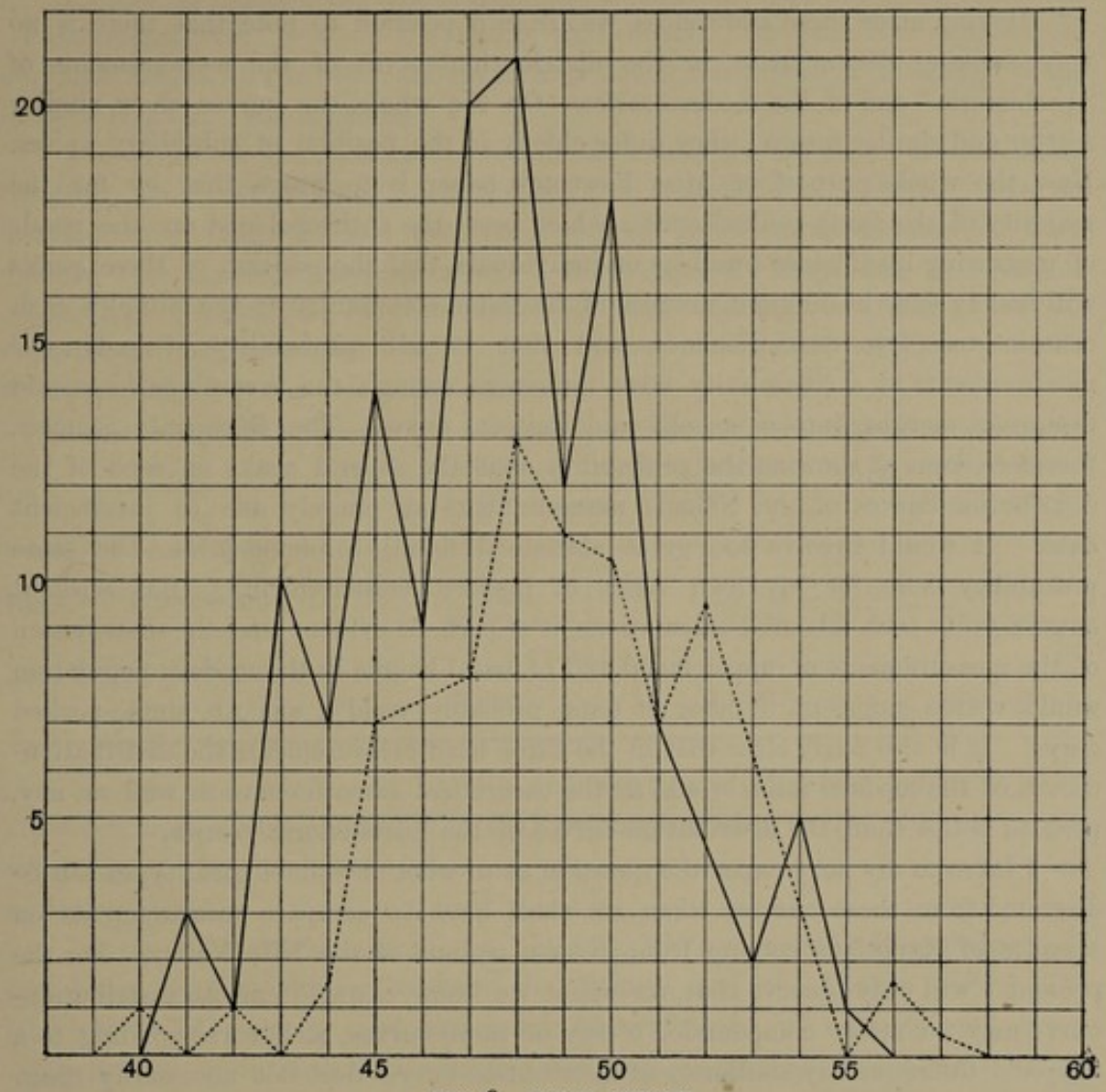

FIG. 6. NASAL HEIGHT.

As usual, the horizontal line or abscissa represents the measurement, the vertical line or ordinate represents the frequency. Each diagram will be seen to contain two distributions. The strong line refers to my own measurements of the modern Ḳena and Girga people, the dotted line to Miss Fawcett's measurements of the "prehistoric" Naḳada people. Where, in order to save space, the abscissa is marked by two rows of figures, the upper refers to the modern, the lower to the "prehistoric" series.

In comparing the two distribution-curves in each of these diagrams, allowance must be made for the differences in measurement upon the living and upon the skull, which have been already referred to on page 83 of this paper. A difference of 10 mm. in the head-length, of 10·5 mm. in the head-breadth, and of 1·6 units in the cephalic index was there premised. Probably the difference to be allowed for in the upper facial and in the nasal height, as measured on the living and on the skull, does not exceed a millimetre. The determination of the upper facial height, however, on the skull is often inaccurate owing to breakage.

Having made these allowances, we are in a position to note that there is no very striking dissimilarity in the distribution-curves of the measurements of "prehistoric" and of the modern series. On the whole, the curves show similar scatter and similar means: they differ chiefly in the position of subsidiary apices. Now, the whole purport of Miss Fawcett's paper is to prove that by far the majority of the many-peaked curves which beset the anthropologist are the result of measuring insufficient numbers of individuals, that the position of these peaks will widely vary in different samples of the same community if the samples each contain too few measurements, and that in all probability if only our measurements of a community were numerous enough the several peaks would disappear, merging into a smooth and uniform curve. The *Biometrika* memoir, therefore, aims at showing the probability that the several peaks on each of the distribution-curves of the Naḳada measurements are merely due to insufficient data. It would involve too great statistical detail to demonstrate the same probability here for my own series of modern measurements.[1] But without entering into such laboured calculations, it is perhaps evident that the distribution of the measurements of upper facial and of nasal height in the modern population would, with a sufficient number of data, probably yield a smooth, single-peaked curve. It is also fairly clear that in the three head-measurements the distribution-curves of the modern series would fit the theoretical smooth curve as well as, nay, perhaps better than, the distribution-curves of the "prehistoric" series.

I leave to my next paper the question as to whether ethnological types can be dissected from these curves, when we shall have to compare measurements on samples of Egyptians coming from diverse regions of the Nile Valley. For the present I will only observe that, for aught we know, a single smooth distribution-curve may be really compounded of two or more curves, each corresponding to a "type." Consequently similarity of distribution-curve does not necessarily mean similarity of type.

D. Comparison of Correlation.

It is a matter of interest to find out whether pairs of measurements are differently correlated in the "prehistoric" and in the modern people. The degree of correlation of any two quantities in a series may be measured by Professor Pearson's coefficient of correlation.[2]

[1] The authors of the *Biometrika* memoir select the breadth of the female Naḳada skulls in order to determine the goodness of fit of the many-peaked observed distribution to the smooth theoretical distributions. Assuming that the skulls, of which these were a sample, truly obey the normal (binomial) distribution, they find (p. 454) that a more peaked polygon than that observed would result in 83 out of 100 trial samples. I have made a similar calculation for the modern Girga and Ḳena head-breadths. I find that the probability figure is here 72, as compared with 83 of the Naḳada distribution.

[2] This coefficient, r, is obtained by adding together algebraically the series of products, xy of the two differences between the members of each pair of measurements in the series and

I have calculated the coefficients of correlation between three pairs of measurements, viz., between the length and breadth, between the length and auricular height, and between the breadth and auricular height of the heads of the modern Ḳena and Girga people.

The writers of the *Biometrika* memoir calculated the coefficient of correlation between skull length and breadth of the "prehistoric" series. But as, unfortunately, they did not take the *auricular* height into consideration when dealing with correlated measurements, I have expressly calculated the Naḳada coefficients of correlation between skull-length and auricular height and between skull-breadth and auricular height.[1] The various coefficients and their probable errors are shown in the following table:—

Series.	No.	Correlation L. and B.	No.	Correlation L. and Au. H.	No.	Correlation B. and Au. H.
Naḳada ("prehistoric") ...	139	0·344 ± 0·050	64	0·404 ± 0·071	64	0·174 ± 0·082
Ḳena and Girga ("modern")	136	0·082 ± 0·057	64	0·237 ± 0·080	64	0·379 ± 0·072

We see that length and breadth and length and auricular height of skull are much more closely correlated in the "prehistoric" than in the modern people, while the reverse relation holds in the correlation of skull breadth and auricular height.

In the *Biometrika* memoir, the only similar comparison of coefficients of correlation is that drawn between the Naḳada and the Theban series. The correlations of capacity and horizontal circumference, of capacity and inter-auricular arc, of inter-auricular arc and horizontal circumference, of the skull are compared; with the result that "the historic Egyptians [*i.e.* the Thebans] show in every case higher correlation" (p. 459). The correlations which I now publish show how much caution is needed in basing general conclusions as to the relative closeness of correlation on a few coefficients only. It would be useless to attempt to explain the above irregularity of correlation until more and larger series have been investigated.

their respective average, and by dividing this sum by the product of the respective standard deviations (σ_1, σ_2) and by the number (n) of pairs of measurements in the series. Thus $r = \frac{\Sigma xy}{n\sigma_1\sigma_2}$. It becomes unity when the correlation is perfect, zero when there is no correlation, and positive or negative according as the correlated members vary in the same or in opposite directions. The probable error of this coefficient is obtained from the formula $\frac{0{\cdot}6745(1 - r^2)}{\sqrt{n}}$.

[1] The correlations between total cranial height and other measurements are published in the *Biometrika* memoir. But as the total cranial height cannot be determined on the living head, these data are not available in the present comparison.

SUMMARY.

1. There is no evidence that the "prehistoric" and modern population of southern Upper Egypt differ in physical measurement.
2. The homogeneity of the "prehistoric," as determinable by standard deviation, is the same as that of the modern population inhabiting like regions of the Nile Valley.
3. The relative correlation of cranial measurements in the "prehistoric" and modern population shows great irregularity.

[*Reprinted from the Journal of the Anthropological Institute, Vol. XXXV, January–June*, 1905.]

Harrison and Sons, Printers in Ordinary to His Majesty, St. Martin's Lane, London.

ANTHROPOLOGICAL INSTITUTE OF GREAT BRITAIN AND IRELAND.

This Institute was established in 1871 by the amalgamation of the older Anthropological Society and Ethnological Society. It has for its object the promotion of the Science of Mankind—Anthropology—by the accumulation of observations bearing on man's past history and present state in all parts of the globe. It investigates, in a rigorously exact manner, everything that can throw light upon the laws of man's nature: his origin, history, and capabilities of progressive development and civilisation. It studies him structurally and psychologically, under the several types in which he is found in various regions; and comparatively, in relation to the rest of the animal kingdom. The ultimate object of the Institute, therefore, is to build up a Science of Man on a basis of well-ascertained fact, and logically deduced inference. As means to this end, the Council of the Institute has adopted a plan of operations, the principal heads of which are as follow:—

1. Meetings for the reading of papers and for discussion of anthropological questions.
2. The issue of a Journal containing Reports of the Proceedings at the Meetings, with other matters of anthropological interest.
3. The appointment of Local Correspondents in all parts of the world to collect information, and to aid the Institute in its operations.
4. The maintenance of a library, which contains sets of all the principal Anthropological Journals published in the United Kingdom or elsewhere, besides a large and valuable collection of books of reference, travels and researches, an extensive collection of photographs and lantern slides, and much unpublished material for the use of students of Anthropology. Fellows residing in the country, as well as in London, can borrow books from the library.
5. The appointment of Committees to conduct special investigations, as occasion offers, in the various branches of Anthropology.
6. Co-operation with the British Association for the Advancement of Science, and with foreign scientific societies in anthropological investigations; co-operation with individuals and institutions in aid of explorations and in the establishment of local centres of anthropological study; and, generally, the stimulation of individual and local efforts to further the objects of the Institute.

The annual subscription is Two Guineas, which is due on election (unless such election takes place in the month of November or December) and on the 1st of January in each succeeding year. A Member may at any time compound his future subscriptions by the payment of £21.

Persons who wish to become Fellows of the Institute are requested to communicate with the Secretary, 3, Hanover Square, W.