THE UNIVERSITY OF MINNESOTA

GRADUATE SCHOOL

Report

of

Committee on Thesis

The undersigned, acting as a Committee of the Graduate School, have read the accompanying thesis submitted by Leroy Adelbert Calkins for the degree of Master of Science in Obstetrics and Gynecology They approve it as a thesis meeting the requirements of the Graduate School of the University of Minnesota, and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science in Obstetrics and Gynecology.

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June 1920 R. D. Mussey

THE UNIVERSITY OF MINNESOTA

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Report

of

Committee on Examination

This is to certify that we the undersigned, as a committee of the Graduate School, have given Leroy Adelbert Calkins final oral examination for the degree of Master of Science in Obstetrics and Gynecology We recommend that the degree of Master of Science in Obstetrics and Gynecology be conferred upon the candidate.

Minneapolis, Minnesota

June 1920

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THE GROWTH OF THE FETAL HEAD FROM THE OBSTETRIC VIEWPOINT

A Thesis Submitted to the
Faculty of the Graduate School of the
University of Minnesota

by

Leroy A. Calkins

In partial fulfillment of the requirements
for the degree of
Master of Science
in
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I N T R O D U C T I O N .

The determination of the exact relationship between powers, passages, and passenger is fundamental to complete obstetrical analysis. The driving force necessary is, in a general way, dependent upon the relationship of passenger to passage. It is within present knowledge and practice to determine the size and nature of the passage. As much cannot be said of determination of the form and size of the passenger. The many attempts in this direction, including X-ray measurements of the fetal head, have met with defeat. Questions of viability, maturity, and possible disproportion between child and pelvis must go unanswered, unless determinable in some other manner. Perhaps no little of this uncertainty is due to an imperfect knowledge of fetal growth. The present study was therefore undertaken with the idea of determining the nature of general body growth in fetal life, finding the average birth changes, and perfecting a method for determining the exact size of the fetus in utero. It is the aim of this paper to represent the part of this study of fetal growth which deals with the prenatal changes in the form and dimensions of the head.

The writer wishes to express his great appreciation to Dr. J. C. Litzenberg for his general supervision, to Dr. R. E. Scammon for his specific advice, and to both for their continued interest in this work.

MATERIAL AND METHODS

The material used in the present study consisted of some four-hundred preserved human fetuses of the collections of the Department of Anatomy and the Department of Obstetrics and Gynecology of the School of Medicine of the University of Minnesota. These were first carefully surveyed with the view to making use of only heads which were not obviously abnormal either in contour, or in size. It was found that some few specimens had been flattened posteriorly or laterally during preservation, either from too crowded quarters or from some other, less apparent, cause. Moreover, three were obviously hydrocephalic and one, microcephalic. Another was acromegalic and another a negro. A few were found to be very soft and, hence, not desirable subjects for anthropometric study. All such undesirable specimens were eliminated. The selected group numbered three hundred and thirty-nine (339) specimens, ranging from 23 mm. to 544 mm. standing height. It was found that attempts to measure the different diameters and circumferences of specimens below 23 mm. standing height were attended with such a degree of uncertainty as to make the findings of little value. No specimens above 550 mm. standing height were used because of a grave doubt lest they might be distinctly post mature and that they would not represent the usual newborn characteristics. The series included six pairs of twins denoted by (2), and one set of triplets (#3045).

These specimens, arranged in groups at 5 cm. intervals, were distributed according to the following table:-

Up to 49	mm.	standing	height	- 17 specimens.
50 - 99	"	"	"	- 29 "
100 - 149	"	"	"	- 45 "
150 - 199	"	"	"	- 27 "
200 - 249	"	"	"	- 50 "
250 - 299	"	"	"	- 46 "
300 - 349	"	"	"	- 34 "
350 - 399	"	"	"	- 31 "
400 - 449	"	"	"	- 21 "
450 - 499	"	"	"	- 17 "
500 - 549	"	"	"	- 22 " .

This offered a quite satisfactory series except in the last three groups, each of which have rather too few specimens. Additions to the series at this point would be very desirable.

Practically all of the fetuses had been preserved in one of two ways. Those specimens which would be satisfactorily hardened in 10 per cent formalin were so dealt with. Those over 30 to 35 centimeters standing height were first injected thru the umbilical vein with a 10 per cent solution of formalin containing 1 per cent of chromic acid. The amount injected varied according to necessity in the judgment of the embalmer, Mr. M. Larson. Usually about 30 per cent of the body weight was used. These specimens were then kept in 10 per cent formalin. In order that variability in the effects of preservation might not alter the figures, no specimens were used which had been in the preservative less than six months. Many of them were two or more years old.

The instruments used in making the measurements consisted of a steel meter tape, a brass bound wooden meter-stick, and a sliding caliper, made of steel and accurately constructed. All of these were calibrated in millimeters and they checked with one another very closely. The caliper carried a vernier scale,

making possible readings to tenths of a millimeter where desirable. The arms of the caliper had sharp points on one side, flat bars on the other.

The linear measurements were usually taken with the calipers, - the exceptions will be spoken of later. The circumferences were taken with the steel tape except where the readings were 100 mm. or less. In these instances a heavy inelastic linen thread was wound around the part at the proper place and the over-lapping ends cut across by a sharp cataract scissors. The resulting circlet of thread was then measured with the caliper or tape. All readings were recorded in millimeters.

The measurements taken on each specimen were ten of the so-called obstetrical measurements of the head along with the sitting and standing height. In a few of the specimens the lower jaw had previously been removed, thus prohibiting some of the measurements. In a few others some of the distances were not taken because of the presence of a large caput succedanum or for some other, equally good, reason.

The measurements taken, and the technique employed in each, were as follows:-

1 - Sitting height or crown-rump (C.R.) was taken with the body in an extended attitude (as one would sit erect) with the chin and thighs as nearly as possible at right angles with the body. The readings were taken with the sliding caliper except where the specimens were too long. For these a sliding caliper, in effect, was made from the meter stick laid parallel to the body and a perpendicular bar applied to it at the proper place. No compression was exercised in taking the readings.

2 - Standing height or crown-heel (C.H.) was found by adding trochanter-to-heel, less trochanter-to-rump, to the sitting height, in each case care being exercised to find the center of the trochanter. In those specimens in which it was found impossible to extend the legs on the thighs the trochanter-to-heel measurement was taken in two segments. Trochanter to the center of the lateral surface of the knee joint was first taken and to this was added the distance from the latter point to the heel. These two measurements were taken uniformly along the right side of the body and were all checked at least once to insure the highest possible degree of accuracy.

3 - Head length on the occipito-frontal diameter (O.F.) was taken from glabella to inion, the longest diameter without respect to the horizontal.

4 - Suboccipito - Frontal diameter (S.O.F.) was taken from as near as possible the most depressed part of the superior portion of the occipital bone, in most instances over the obstetrical joint, to the most distant point over the frontal bones.

5 - Suboccipito- Bregmatic diameter (S.O.B.) was found by taking a similar measurement whose second point was the median point of the coronal suture.

6 - Occipito - mental diameter (O.M.) was measured as menton to inion.

7 - Head width or Bi-Parietal diameter (Bi.-P.) was always the greatest width of the head above the external auditory meati. This was found, almost always, over the parietal eminences.

8 - Horizontal head circumference (H.H.C.) was taken around

glabella and inion.

9 - Suboccipito-Frontal circumference (S.O.F.C.) was taken around the points over which the corresponding diameter was measured.

10 - Suboccipito-Bregmatic circumference (S.O.B.C.) was also found in a similar manner to the corresponding diameter.

11 - Occipito-Mental circumference (O.M.C.) was taken around menton and inion.

12 - A circumference, designated as "Large circumference" (L.C.) was taken around menton and superior tip of occipital bone. This is not the largest circumference of the head as Ballantyne ('90) and others have shown. It was chosen in preference to the largest circumference because of more definite landmarks and because of more frequent mention in obstetrics.

A very slight uniform pressure was used in all of the measurements with the idea of entirely avoiding compression and yet not allowing any slack to be present in the measuring tape. The specimens were also removed from the solutions long enough previous to measuring to allow the external moisture to evaporate and yet not long enough to allow any "drying out." The length of time varied, according to size, from a few minutes for the smaller ones to nearly an hour for the larger ones. All measurements were recorded in millimeters, and will so appear in all succeeding tables and figures.

As soon as the series of readings were completed they were assembled and arranged as in Table I. The division into groups at intervals of 5 centimeters (C.H.) was retained as most conducive to the type of analysis desired. It is to be noted that

some heads are relatively small, others relatively large. In some only one or two measurements are smaller or larger than the average. This is probably due in most cases to permanent effects of birth moulding in the still-born child. However, the amount of deviation is, on the whole, very slight.

The crown rump (C.R.) was then plotted, as ordinate, on co-ordinate paper against the crown heel (C.H.), as abscissa. The resulting field graph is shown in Figure I. The males are represented by dots, the females by circles. Where the specimens were so small as to make the sex indeterminate the symbol ⊕ was used. The grouping of the several points was so close that similar graphs of the other measurements were made, Figs. II-XI. In each one the diameter, or circumference, under consideration was plotted as ordinate against the crown heel (C.H.) as abscissa and the same plan of distinguishing sex was employed.

It was not at once evident which method of drawing the curves thru these graphs would be the most satisfactory. Each of the three most common methods, not including inspection; namely, the weighted median, the weighted average, and the arithmetic average weighted by the median crown-heel height was tried and equally satisfactory curves resulted. All three methods were then employed in the case of the occipito-frontal diameter (O.F.) Fig. 12 and horizontal head circumference, Fig. 13. Similar results were obtained in the case of other diameters and circumferences. These figures (12 and 13) showed that as far as results were concerned it made very little difference what method was used. The method of averages was chosen as being the one more commonly used, and perhaps the more readily comprehen-

sible. The curves drawn thru the field graphs in Figs. I - XI incl. have then been drawn thru points derived by the method of arithmetic average. The data for the plotting of these curves appears in Table II.

DISCUSSION

The remarkable approach to a straight line of each of the curves if Figs. 6, and 11 is very striking. The remaining curves also approximate straight lines up to about 220-320 mm. C.H. length. Above this point there is a more or less marked deviation toward the horizontal, in all but Fig. I in which the deviation is toward the vertical. On closer examination of the larger specimens, which as stated above, had been primarily injected, a peculiar edematous swelling of the tissues of the ischio rectal fossa and adjoining tissues over the tuber ischii was noted. This swelling was found sufficient to account for the deviation noted, hence the straight line character of the curve may be restored. The divergence toward the horizontal in the other curves may be explained in one of four ways; -

1 - The fetal head approaches the newborn state before the rest of the body. The work of Stratz ('09) and Jackson ('09) might be construed to indicate that such is the case, but the fact that curves 6 and 11 retain their straight line form throws disfavor on this theory.

2 - The fetal head undergoes a change in shape during the latter part of fetal life due to a less rapid growth of the dimensions other than the occipito mental. This theory is more difficult to disprove than the preceding one.

3 - The effects of birth moulding are more permanent in the less elastic, mature, still-born head. Support is lent to this theory by the fact that in the series birth moudlings changes, with the exception of a caput succedanum, were rarely observed in the smaller specimens, whereas more or less marked changes were

of common occurrence in the larger ones. It is also noticeable that the greatest deviation in the curves occur for those diameters known to be the most affected by passing thru the birth canal; namely, the Suboccipito bregmatic, suboccipito frontal and the Bi-Parietal. The best work on the amount of birth moulding as it affects the different diameters of the head is that of Stumpf ('07). If we were to add the amounts of decrease of each diameter found by him to the present curves the straight line character for the whole of fetal life would be restored. Feeling that a series of measurements on unmoulded heads at birth might add a considerable amount of information on this subject, the writer has undertaken to make observations on a series of babies delivered by breech extraction and by Caesarean section without any previous labor having been allowed to occur. About a dozen such heads have been measured. Although the number is yet too small to warrant any definite conclusions, the results obtained do confirm this hypthesis, to a great extent. It is possible that this set of measurements, may disprove the second theory; namely, that the head undergoes a change in shape in late fetal life.

4 - The larger specimens of the series were injected with an embalming fluid before their preservation in a solution similar to that used for the smaller ones. In order to rule out any changes due to this difference in technique a series of measurements has also been undertaken with this point in view. The immediate effect of the injection of the fluid in an increase in the individual measurements of the head, which is proportional, in most cases, to the increase in body length, also resulting from this injection. The early and later effects of formalin

preservation is also being studied after somewhat the same plan followed by Schulz ('19). This series of measurements was undertaken in order to arrive at values for all of the head measurements (Schulz studied only O.F. + Bi P) and also to ascertain what effect primary embalming might have on the ultimate changes from formalin preservation.

This latter work is only well begun, but it would appear that the results obtained will not alter the straight line character of the curves. Two possible results may, however, occur. First, the whole curve may be shifted downward toward the "X" base, as Schulz has shown a decrease in C.H. with an increase in head diameters following preservation. Second, a change in "grade" or "inclination" in the curve might result.

This also is rather to be expected, as Schulz demonstrated that the size of the specimen seemed to have no effect on the percentage change resulting from the preservation.

If then, the upper ends of the curves should be altered by the amount observed by Stumpf as indicative of the average moulding, straight lines will be found to result. This would mean that each diameter, or circumference, must be at all times a first degree function of the standing ehight. Simple empirical formulae for arriving at any diameter, given the crown heel, should then be readily deducted. The formulae found are in general, $\frac{a\ (C.H.)\ \text{in mm.})}{100} + K = X\ (\text{in mm.})$, where a and k are certain definite constants peculiar to the dimension (X) desired.

In the separate cases we have:-

1 - C.H. (in mm.) $\frac{64}{100}$ + 8 = C.R. (in mm.)

2 - C.H. (in mm.) $\frac{23}{100} + 5 = O.F.$

3 - C.H. $\frac{19}{100} + 2.5 = Bi\ P.$

4 - C.H. $\frac{20}{100} + 6.5 = S.O.B.$

5 - C.H. $\frac{22}{100} + 6.5 = S.O.F.$

6 - C.H. $\frac{24}{100} + 2 = O.M.$

7 - C.H. $\frac{68}{100} + 13 = H.H.C.$

8 - C.H. $\frac{67}{100} + 14.5 = S.O.B.C.$

9 - C.H. $\frac{64}{100} + 14.5 = S.O.F.C.$

10 - C.H. $\frac{66}{100} + 5 = O.M.C.$

11 - C.H. $\frac{73}{100} + 9 = L.C.$

So far these formulae are only proven for the early part of foetal (not to include embryonic) life. As stated above, the early indications of present endeavor point in such a direction that they may be soon proved valid for the whole of fetal life.

The curves appearing in Figures I to XI (Incl.) were next assembled in Figures XIV and XV. From a study of these latter figures and the above formulae certain facts are evident.

1 - The inclination or grade of the curves representing diameters or circumferences in the occipito-mental plane is steeper than those of other planes, that is, the rate of growth of the base of the skull plus the lower jaw is more rapid throughout fetal life than is the growth in other planes.

2 - The large circumference, which throughout the greater part of fetal life greatly exceeds the other circumferences, is shown to be smaller than the others, except possibly the occipito mental circumference (O.M.C.), in very early fetal life. The same may be said of the occipito-mental diameter with reference to the other diameters.

3 - It may thus be seen that early in fetal life, the head is roughly spherical and later assumes an ovoid form. This substantiates in some degree the work of Sergi ('00), Tovo ('05), Frassetto ('09), and others on the form of the fetal skull.

4 - No two curves possess the same "grade" up to the point of divergence toward the horizontal, that is, each diameter or circumference has its own peculiar rate of growth. Above the point of divergence, however, a very marked tendency of the curves to run parallel with one another is noted. The exception to this fact is found in the case of the S.O.B. diameter after it has taken a second deflection toward the horizontal between 41 and 42 cm. crown heel length. This tendency to parallelism might be explained in either of two ways:

(a) The fetal head attains its newborn shape at some time between the fifth and seventh months, and its growth thereafter is in size only in contradistinction to its earlier changes in both form and size.

(b) That the fetal head is compressed into the shape that will most readily admit of its passage through the birth canal has been long taught and thoroughly believed. Just what changes that compression involves and to what degree has never yet been satisfactorily proven. It is fairly well agreed that the amount of moulding may vary to no small extent in the individual case.

The factors involved are the size of the head, the size of the birth canal and the driving forces. In the great mojority of cases no great disproportion between the head and the birth canal will be found. Ossified, non moulding heads are rare. With these two points in mind the character of the pains, or the driving forces, is of *a* value not so much in determining the amount of moulding as in fixing the time necessary for that moulding to be produced.

That there is a certain definite way in which the head will most readily pass thru the pelvis is indicated by the frequency of occipital presentation and the relative course of labor in this as compared to other presentations. That the size of the head makes little difference in determining presentation, is shown by the very marked predominance of occipital presentations in prematurely born infants as well as in those born at term. That a certain definite average shape of the head will result at the moment of birth, or during the birth process, may logically be deduced. In stillborn infants, to which class most of those in the present series belong, it also seems quite natural that many of those birth changes would persist, at least in some degree. The larger, harder, less elastic head is, because of its size, usually more markedly affected by birth moulding. It is therefore quite probable that much more marked permanent effects may be looked for in such heads in the present series. Final proof of these by hypotheses must be deferred until measurements on a larger series of unmoulded heads have been secured.

A histogram of the different measurements in percent of their value for the newborn, which is taken as 506 mm. C.H., the figure found by Taylor('19) for the University of Minnesota clinic, was made. The material studied was largely obtained locally and hence

probably possesses the same race characteristic as Taylor's live material. This histogram shows two things of interest.

(a) A high comparative percentage throughout for the measurement in the bi-parietal, the suboccipito bregmatic, and suboccipito frontal planes. This is probably due to the more marked deviation toward the horizontal observed in the corresponding curves.

(b) At the 50 mm. crown heel stage a much higher percentage of development of the head measurements than of the standing height. This may be, in whole or in part, due to the same "deviation" factor or it may mean that in early embryonic life the head develops much more rapidly, relatively, than the body as a whole.

REVIEW OF LITERATURE.

In order to compare this series of measurements with other studies of the growth of fetal head a brief review of the literature on this field is given here. Such related subjects as the measurements of the newborn, growth of other parts of the body and of the body as a whole, and the attempts to measure the size of the fetus in utero will not be included in this discussion.

To Dr. J. Clarke (1786) goes the credit of having made the first accurate study of either fetal or newborn heads. His incentive was to determine why more stillbirths occured in male than in female children. His procedure consisted in taking weights, horizontal head circumference, and an ear to ear measurement over the vertex in 120 new born children, 60 of each sex. He concluded that the larger head of the male accounted for the higher mortality in that sex.

Since that time many studies of fetal heads have been made using as a basis for the analysis either body-weight or length of gestation, or both. Of these the more important are Spondli ('57), Pfannkuch ('72), Fehling ('75), Jousset ('77), Arnovljevic ('84), Brandt ('86), Bouillet ('88), Shaeffer (92), LaTorre ('94), Dardel ('96), Faucon ('97), Weisz ('97), Corrado (99), Ballantyne ('01), Legou ('03), Retzius('04), Freidenthal('06), Michaelis ('06), Jackson ('09), Lutz ('12), Heuser ('12), Kjölseth ('13), and Beneke ('13).

Pfannkuch ('72) noted that the bi-parietal diameter was always 26.7 to 26.8 per cent of the sum of the bi-parietal, occipito-frontal and occipito-mental diameters of the newborn head. He offered the opinion that "Man auf diese Weise eine einfache Formel finden könnte, welche die eine grössere

Annäherung an den Terminus a quo der Reife gestattet, als die einseitige Verwerthung eines Maasses es ermöglicht."

Probably the two most intensive attempts along this line so far are those of Kjölseth ('13) and Corrado ('99). Unfortunately Kjölseth did not publish her individual measurements and hence her work is not as valuable for the present study as that of Corrado who published all of his individual measurements. Kjölseth made observations upon 250 children born in the Kristiania Klinik. She chose the fourth day of postnatal life as the time to make her measurements. Her analysis was based upon sex of the child and age and parity of the mother; and she, like all other observers recording series of measurements in the literature, did not use body length as a basis for study.

Corrado ('99) studied 250 dead fetuses. He used age and sex as a basis.

Jackson ('09) has made a study of head volume increase in fetal life. This subject will be considered in connection with increase in the volume of the body as a whole in a later article.

Others publishing their individual head measurements include Spondli('57), Spiegelberg ('68), Fehling ('75), Jousset ('77), Boudin and Ribemont('79), Faucon ('97), Weisz ('97), Legou('03), Retzius('04), Freidenthal ('06), Michaelis ('06), Heuser ('12), and Lutz ('12). These series of observations, including some others, will be treated graphically later in this paper and will therefore be briefly described here.

Spondli('57) studied 100 living newborn infants in Zürich.

Spiegelberg ('68) measured 53 premature infants in Breslau in connection with a study of newborn measurements.

Jousset ('77) published examples of the values of the different

diameters for each month of pregnancy. It is not evident that more than one specimen for each month was so studied.

Budin and Ribemont ('79), studied 225 living newborn infants in Paris.

Faucon ('97) made observations on 39 dead, apparently fresh fetuses, in Paris.

Weisz ('97) does not state the number of cases studied. His observations as well as those of Luts and Fehling were based on living newborn fetuses of the last trimester of pregnancy. Luts ('12) measured height, weight, and horizontal head circumference on over 1000 cases in Berlin. Fehling['75] studied horizontal head circumference in 300 newborn infants in Leipzig.

Legou['03] in Paris made observations on 106 fetuses of the third to the sixth month

Retzius ('04) studied 48 and Friedenthal, 10 preserved specimens. Formalin was employed as preservative in most of Retzius' and in all of Friedenthal's specimens.

Michaelis ('06) measured 100 dead, apparently fresh, fetuses.

Heuser ('18) in Marburg made a graphic analysis based on age of 61 fetuses measured. His graphs are very striking but a close examination of his data indicates such definite results are not justified. By his own statement he had too few cases from which to draw any definite conclusions.

Calderini ('75) made a very extensive study of the biparietal and bitemporal diameters of the fetal head in the last 3 months of pregnancy. They are, however, published in such a form as to make them impossible of analysis.

Shaeffer ('92) published only ranges for the values of the different dimensions for the different months of pregnancy. Neither individual measurements nor definite averages appear in

this paper. This makes its value doubtful for the present analysis.

Several attempts to correlate the size and body proportions of the offspring with one or the other parent have also appeared in the literature. Some of these are von Skalkowski ('90), Gönner ('95), Heckmann ('96), Weisz ('97) and Riggs ('04). These are very interesting but not convincing. Moreover they deal with the newborn and older infants and do not properly come within the scope of this paper.

Hecker ('77), and Jellinghaus ('96) thot that the fetal head varied considerably in shape and might therefore be very influential in determining the type of presentation. Sergi ('00), Tovo ('05) and Frassetto ('09) described changes in the shape of the dried fetal skull at different periods of pregnancy, likening these different shapes to mathematical figures as ellipsoidal, pentagonal, etc.

Ballantyne ('90) was able to collect measurements of three apparently unmoulded heads and deduced therefrom average measurements for full term fetal heads in utero. He also made a study of the effects of birth moulding on the different diameters of the head. Other students of the effects of labor on the shape of the fetal head include Swayne ('67), Runge ('90), Stumpf ('07), Mueller ('10), and Kaznelson ('14). Of these Stumpf has brought out the most comprehensive piece of work, a study of birth moudding in 200 cases. He took several measurements of the head at birth and repeated them several days later when the effects of birth moulding had passed off and yet before any considerable growth had occured. This work is important in determining the final condition in utero but needs to be verified by a study of unmoulded heads.

COMPARISON WITH OTHER SERIES OF MEASUREMENTS.

In order to compare the present series of measurements with the other series which have appeared in the literature composite tables were drawn up in a similar manner to that employed in Table II. The resulting tables are numbered III to XI inclusive. In each table it is to be noted that there is considerable variation in corresponding values. This is, in general, due to one or more of three different factors; namely, type of material, technique employed, and number of cases studied.

Differences of technique is particularly evident in the occipito-frontal (O.F.) and occipito-mental (O.M.) diameters. Most observers measured head length as the distance from the glabella to the tip of the occipital bone, whereas glabella to inion was taken in the present study. The occipito-mental measurement was usually taken from the menton to the small fontanelle, or even the maximum distance in this plane, as compared to the menton - to - inion dimension of the present series.

These factors make the occipito-frontal (O.F.) slightly larger and the occipito-mental (O.M.) readings slightly smaller than the corresponding diameters in other series. Many observers do not describe their technique and hence accurate deductions are not possible on this score.

Curves based on these tables and constructed as were the curves of the present series, show several points of interest.

1 - The close approach of each of the curves to that of the present study, represented by the heavy solid line, is perhaps most striking. Even those series embracing only a few cases possess this characteristic.

The approach is, however, much closer in those segments of the curves where they are based on a larger number of observations.

2 - The curves, based on preserved material, are in general higher than those based on unpreserved or living fetuses. This is in accord with the results obtained by Schulz. The necessity, therefore, of making the proper correction for formalin preservation, in order to make these curves applicable to living fetuses, is quite evident.

3 - The curves of Kjölseth and those of Budin and Ribemont are, in general, higher than those of the present study. In these two series birth moulding played a much less important role and hence they may be considered as more nearly representing the true conditions of the fetus in utero. The Norwegian nationality of the Kjölseth material may also be a factor. The large number of observations represented also tend to make these two curves much more dependable for the period they represent.

A final analysis of these curves can only be made when the above mentioned preservation and moulding studies have been completed.

SUMMARY AND CONCLUSIONS.

The sitting height (C.R.) plotted as ordinate against the standing height (C.H.) plotted as abscissa of a group of formalin preserved fetuses results in a straight line curve. This curve presents a 64 per cent grade or inclination. Therefore the C.R. in mm. of any fetus, or fetuses, may be obtained from their C.H. in mm. by using the formula, $\frac{64}{100}$ C.H. + 8 = C.R. This simple relationship apparently exists throughout fetal, not to include embryonic, life. One of these measurements is therefore probably quite as valuable as the other in any study of human fetuses.

Similar results may be obtained by treating head diameters or circumferences in a like manner; straight lines or curves closely approaching straight lines, resulting in every instance. Simple formulae for arriving at these head measurements, given the standing height, may therefore be found. They are:-

$\frac{23}{100}$ C.H. + 5 = Ø.F.

$\frac{19}{100}$ C.H. + 2.5 = Bi.P.

$\frac{20}{100}$ C.H. + 6.5 = S.O.B.

$\frac{22}{100}$ C.H. + 6.5 = S.O.F.

$\frac{24}{100}$ C.H. + 2 = O.M.

$\frac{68}{100}$ C.H. + 13 = H.H.C.

$\frac{67}{100}$ C.H. + 14.5 = S.O.F.C.

$\frac{64}{100}$ C.H. + 14.5 = S.O.B.C.

$$\frac{66 \text{ C.H.}}{100} + 5 = \text{O.M.C.}$$

$$\frac{73 \text{ C.H.}}{100} + 9 = \text{L.C.}$$

Given any one of these measurements on a particular fetus, one may therefore readily arrive at any other by a simple mathematical deduction.

The rate of percentage growth of any one of these dimensions in fetal life is exactly proportional to the rate of growth of any other dimension. The bi-parietal diameter, in utero, is therefore as good a criterion of the age of the fetus as is the body length. After the plan of Haase ('75) one might arrive at the age of the fetus in months by dividing the bi-parietal diameter, in millimeters, by 10 when that diameter is 50 mm. or more. When less than 50 mm. the age is found by taking the square root of half the reading.

The possibility of determining the exact size of the fetus in utero is worthy of further study.

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Table 1.

Measurements of Individual Cases. (in mm.)

		Body Length		Head Diameters					Head Circumferences.				
Number	Sex	C.H.	C.R.	O.F.	Bi.P.	S.O.B.	S.O.F.	O.M.	H.H.C.	S.O.F.C.	S.O.B.C.	O.M.C.	L. C.
H-93	?	23	20.5	9.7	6.3	9.	10.5	8.2	26.	28.	28.	23	27.
H-390	?	26	24.	12.3	9.	10.3	12.3	9.8	29.	33.	29.	27.	29.
H-46	?	28	26.	13.6	7.6	12.2	14.	11.	35.	36.	35.	28.	32.
G-16-50	?	29	26.	11.	7.4	11.	12,	9.8	30.	34.	31.	29.5	30.
G-16-49	?	31	27	13.8	7.9	13.4	13.8	10.3	34.	35.	33.	28.5	31.
H-402	?	33	28.5	12.5	9.	13.5	14.	13.5	37.	36.	37.	30.	36.
X Y Z	?	35	31.	13.8	8.9	14.7	15.3	13.5	38.5	40.	38.	37.	38.
O.D.	?	36	30	14.	10.	13.	14.5	10.5	40.	41.	40.	33.	38.
G-13-80	?	36	31.	11.8	9.	13.	13.7	11.3	34.	35.	34.	32.	36.
G-13-20	?	40	32.5	14.	9.1	12.8	14.4	13.	38.	41.	36.	35.	39.
O.A.	?	41	35.	13.	10.	14.	15.	13.	38.	39.	42.	35.	41.
G-13-86	M.(H)	41	34	17.6	11.9	16.7	18.0	16.	49.	48.	48.	47.	44
O.X.	?	42	34.5	15.	10.	13.	14.5	13.	44.	44.	39.	34.	38.
M.T.	F(?)	46	38.	15.6	10.2	16.	16.4	13.	-	-	-	-	-
706	?	47	39	16	11	13	16	-	37	40	35	-	-
Foet.9.	?	49.	41.	14.	12.	15.	15.	13.5	42.	44.	45.	39.	45.
H-414	?	49	36.	16.	12.2	14.6	16.4	13.8	49.	50	48.	43.	46.
H-143	?	50	39.	15.5	11.6	14.	16.	14.3	47	47	45.5	40.	45.
O.F.	M(?)	53	41	14.	11.	12.	15.	15.	42	45	41.5	41.	44.5
H 388	?	53	42	16	11.4	16.7	16.6	14.	48.	49	49.	43.	46.
H 400	F(?)	54	41	17.	11.	18.	18.	16.5	48.	49.	46.	44.	47.
H 428	F(?)	57	45	18.3	13.0	18.4	19.1	15.	53.	54.	52.	44.	49.
H 353	?	60	49	19.	12.5	19.	19.	17.	51.	50.	51.	45.	53.
H 272	M(?)	65	50	19.	10.	16.	18.	16.	45.	51.	51.	43.	49.
G-13-32	F(?)	66	52.5	20.	14.	20.	20.5	17.	57.	57.	58.	46.	58.
H-429	?	68	54.	20.	14.8	19.	20.2	18.7	57.	58.	55.	50.5	56.
H-424	?	70	55.	18.	15.5	20.	20.	17.	54.	55.	54.	48.	55.
G-13-63	M	71.	55.	21.4	16.2	22.5	23.5	21.	60.	58.	59.5	47.	54.
G-16-47	F	71.	54.	20.8	15.7	21.3	21.7	17.7	59.5	59.	58.	46.	57.
709	M	73	57	23.4	17.5	22.6	23.6	22.3	66.	66.	64.	59.	67.
H-313	F(?)	77.	57.	19.	16.	18.	19.	19.	57.	54.	56.	52.	58.
N A	M	77.	59.	21.5	14.	20.5	23.5	21.	58.	63.	62.	56.	63.
H-427	M	78.	60.	23.7	17.7	24.	24.6	23.2	65.	71.	67.	58.	67.
G-16-51	F	82	62	23.	17.3	22.7	23.	21.4	67.	69.5	68	55.	69
G-14-29	F	82	61	23.7	18.	22.8	25.	21.7	68.5	71.	64.	62.	67.
H-264	F	83.	63.	25.2	19.2	23.	24.7	23.5	70,	70.	70.	65.	70.
M Y	F	86	65.	22.	16.3	22.6	23.8	22.	67.	70.	68.	59.	68.
H-343	F	87	63	25.4	18.6	22.8	24.	23.2	69	68	66.	57.	72
H-407	?	87	64.	25.	20.	25.	26.	25.5	70	71	76.	62.	75.
H-396	M	88	65.	25.	19.	21.4	25.	22.6	73	74.5	73	59.	69.

Number	Sex	C.H.	C.H.	O.F.	Bi.F.	S.O.B.	S.O.F.	C.W.	E.E.C.	S.O.F.C.	S.O.B.C.	O.M.C.	L.C.
S.O.	F	89.	65	26	20	25	25	22	75	78	75	63	73
H-76	F	90	64	24.5	20	24.5	25.7	22	70	70	65	64	70
H-342	F	90	67	26.9	19.8	24	26.8	23	76.5	76	76.5	68.5	72
G16-57	M	91	66	25	20	24	25.7	24	76	76	76	64	73
503	M	93	67	24.5	19.4	23.6	25	24.2	71	68	69	67.5	75.5
704	F	97	71	27	20.3	24.6	27.4	24.3	76	77	72	65	78
A-12-100	M	100	-	26	22	24	25.5	25	76	75	75	66	79
12	F	100	73	28.6	21.8	25.7	29	28	80	83	80	69	83.5
H 301	F	105	73	26.7	21	25.6	28.4	25.5	80	82	83	69	83
13	F	105	77	27.6	21.5	26.8	28	24.5	80	75	83	63	86
H 81	F	107	78	30	22	28	30.5	28.5	84	83	85	74	85
H-344(2)	M	109	77	32	23	29	32	30	92	92	86	82	91
H-101	M	110	78	29.9	24	28.6	30.9	27.4	90	89	84	72	88
G-16-11	M	111	83	27	21	25	27.5	28	79	82	85	79	85
8	F	112	82	33	25.7	31.4	32.8	28	96.5	98	96	77.5	97.5
H-299	F	113	81	30.7	25.2	29	31	30	93	92	91	79	93
G-16-52	M	114	80	31.5	25.4	29.6	31	29	92	93	89	88	92
7	F	114	79	32.8	26	30.4	31.4	29	92	96	94	78	89.5
H-306	M	117	86	33	24.8	30.6	32	30	91	87	90	77	87
H-345(2)	M	117	82	31.5	22	29	31.4	28.7	89	87	87	75	87
G-13-34	F	117	87	32.5	26	32	33	32	94	96	93	85	94
5	F	117	88	32	25.5	30.5	33	29.5	94	98	97	82	97
H-309	M	119	82	32	24.4	29.6	31.7	28.2	92	95	97	73	90
H-464	F	119	85	31	24	30.5	32.5	27.5	92	91	87	85	99
H-431	F	121	85	33	28	30.3	35	32	97	98	101	86	101
Sp.16	M	122	90	29.6	24.5	32.3	32.5	28.5	89	90	94	83	92
M.H.	F	123	89	28.3	23.2	29.7	31	27	86	88	80	75	93
H-263	M	124	86	34	27	32	34	30.4	96	97	95	83	95
H-331	F	124	91.5	31	26	30	31	31	97	95	93	92	-
712	F	125	88	32	26	31.5	33	28.7	91	96	94	74	95
M H	F	127	91	32	27	30	32	31.5	97	98	98	94	105
11	F	128	89	35	28	32.5	34.5	31	97	98	98	88	100
H-441	F	128	90	33.4	29	28.6	34.2	32	100	103	97	92	103
H-458	F	129	91	34.	25.7	32	36.8	30.4	98	97	94	80	91
M-161	F	129	93	33.8	29	35	34.5	30	98	102	-	-	-
X X(2)	F	130	94	37	28.7	34.3	38.7	31	102	106	102	95	107
H-76	M	130	92	31.6	26	31	33.6	29	90	92	96	77	90
H-310	M	130	92	37	27	32	36	31	103	105	103	94	105
H-340	F	131	90	36.6	30.5	31	35.3	28	106	106	102	92	106
6	M	132	98	36	26	35	37	31	95	96	94	80	99
H-338	F	135	97	38.5	29	34.7	38	34	107	108	108	96	109

Table I. - continued.

Number	Sex	C.H.	C.H.	C.F.	Bi.P.	S.C.H.	S.C.F.	C.M.	H.H.C.	S.C.F.C.	S.C.B.C.	C.M.C.	L.C.
S-346	M	136	94	37.5	32	35.3	38.4	36	118	114	109	101	118
B-261	M	137	96	36.4	30.5	35.8	35.4	35	104	105	106	95	112
X Y(2)	F	138	98	39.5	28.4	35	40.6	35.5	106	109	101	94	110
14	F	139	100	37	27	37	38	33	102	103	101	88	98
H-354	M	139	98	37	29	30	34.5	31.5	110	111	107	91	109
Sp.7	F	141	101	39	29	39	39	33	111	116	110	97	107
H-87	F	144	101	37	28.7	35	36.5	35.5	105	107	102	99	110
H-140	M	145	102	35.5	28	35	37	31.5	99	104	94	93	99
O.O.	F	148	101	39	32	40	40	35.5	108	110	106	96	111
H-144	F	149	104	37.5	32	36	38	33.5	108	110	108	-	-
C.R.	F	150	103	41	34	38	41	39	120	120	110	107	124
H-142	M	158	111	38	29.5	37	38	38	107	111	106	95	116
M.Y.	F	160	112	42	31.5	38	41	39	120	121	119	111	126
C-15-56	F	160	114	44.1	34.1	42.7	41.2	46.9	123	128	123	108	-
H-30	M	161	111	44.2	34	41	47.2	38	126	133	123	114	134
H-169	M	162	114	43.5	38	39.5	41.5	40.5	125	126	126	124	136
2	F	165	114	48.7	36	41	46	44.5	122	123	115	107	125
Sp. 3	F	166	117	42	32	39	42	41	118	119	112	113	132
H-39	M	166	116	44	36	38	43.6	41	129	129	128	116	133
H-241	F	166	113	44.4	36.5	39	43.6	42	136	134	126	122	138
701	M	167	118	41	33	38	41	40	117	116	115	113	126
N.J.	F	168	113	44	33	43	44.5	42.5	121	122	115	111	125
4	M	168	114	46	36.5	40.5	46.5	40	134	135	125	118	121
H-445	F	170	119	46	38.7	40	46	42	130	132	125	125	140
H-177	M	170	122	43	31	37	42	38.5	115	115	113	105	118
700	F	172	119	41	33	42	44	40	121	127	127	115	135
C-13-57	F	173	119	42.5	34	39	42	37	120	124	119	110	130
M.P.	M	179	125	47.5	35.5	47.5	50	43.6	140	139	132	123	142
H-442	M	183	121	47.5	38.5	41.5	47	45.5	140	139	133	126	147
3	M	183	128	47.5	40.8	46	48.5	46	138	141	137	124	145
H-166	M	183	123	44	37	43	45	44.5	130	137	125	117	132
C-16-1	F	185	125	48.4	39	46	50	45	139	139	133	129	146
S I	M	188	130	51	39.5	45	48.5	40	146	140	135	138	153
H-393	M	189	139	46.4	40.3	44.6	46	43.5	141	141	139	127	151
711	M	192	126	50	41	48	50	46	144	143	140	129	145
C-16-58	M	197	136	47	33	46.5	47.5	45	126	130	123	122	146
G17-55	F	199	138	47	37	44	47.5	47	132	134	127	129	144
Sp. 13	F	200	135	52.5	39	43.7	50.5	49.4	144	143	134	135	150
H-164	M	200	138	51	40.5	49	50	51	147	148	142	138	153
M S	F	203	139	53.7	43	51.6	55.8	54.4	162	164	160	152	166
L L	F	204	141	48	35	45	47	48	146	146	144	143	150
Cardam	F	206	141	52.5	43	47	51	50.5	157	162	147	145	166

Table I. - continued.

Number	Sex	C.H.	C.R.	O.F.	Bi.P.	S.O.B.	S.O.F.	O.M.	H.H.C.	S.O.F.C.	S.O.B.C.	O.M.C.	L. C.
G 15-21	M	206	142	49	40	47	48	47	143	143	137	136	157
H-153	F	207	137	50	38	43.4	47	49	142	141	130	130	149
H-204	F	210	140	53.5	46	47	52.5	51	159	157	154	140	168
O G	F	210	143	54	41	50	51	52	148	146	138	141	162
K K	F	210	143	53	41	47	50	55	158	156	153	151	168
G-14-27	M	211	140	52	39.8	48.5	51	50	148	148	143	141	157
H 333	M	213	143	54.4	42.3	47.4	52	52.6	154	150	144	142	160
90	F	213	144	54	44	48	51	53	156	158	150	152	161
50	M	214	145	59	46	54	59	-	172	173	168	-	-
H 186	M	214	147	56	42	48	57	57.5	164	165	152	161	171
714	F	214	149	53	41	51	55	49	152	157	155	150	163
H 223	M	214	151	61	50	57	60	65	175	174	167	171	187
H 155	F	215	145	57	44	51	56	53	164	165	159	157	169
H 147	F	215	148	60	47.5	58	59	56	175	177	175	163	189
H 276	F	215	150	56	45	52	57	56.5	169	171	162	160	177
Sp.14	F	217	143	53.2	38.7	50.7	54	47	147	149	144	128	156
H 262	F	220	150	54	42	51.5	55	49	159	157	152	142	162
N.C.	F	220	151	57.5	43	53.5	56	56	163	161	155	154	170
H-168	M	222	147	55.5	44.5	50.5	56	55	165	165	158	147	168
M Q	F	222	153	59.5	42.4	55.	58.5	54	164	163	155	152	171
H-149	F	228	152	58	46	47.5	57	55	170	168	163	160	177
H-184	F	228	157	55	44	51	54	52.5	156	155	151	148	168
N.B.	F	229	145	57	44	48	53.5	54	160	157	153	152	168
M.X.	F	229	160	56.5	45.6	52	57	56.5	168	173	166	168	180
M.O.	M	230	155	56	48	48.5	56	54	159	158	151	149	161
G-18-36	M	232	157	59.5	43	49	58	61.5	167	166	160	160	177
H-171	F	232	158	62	48.5	54	60	58.5	177	175	170	168	181
G-14-39	M	234	160	61	49	60.5	62.5	62.5	178	178	170	162	181
H-152	M	235	160	61.5	52	54	61	62.5	181	180	168	165	195
O.H.	M	236	157	61	47	55	59	57	170	168	164	157	176
G-13-61	M	236	158	61	45.8	54	60.5	53	173	172	167	154	173
N.D.	M	238	158	63	51.7	57	60	64	181	177	170	167	189
H-173	F	238	162	57	42	51.5	56	56	164	163	160	150	167
190	F	240	159	58.5	42.5	51	56.5	-	168	165	161	-	-
357	F	240	160	57.5	48	51	57.3	57	174	172	163	160	190
H-185	M	240	162	62	53.5	63	62	62	184	185	184	180	198
H-174	F	242	163	64	52	57	62	59	185	182	178	170	195
500	F	243	160	66	49	60.5	63.5	61	183	180	165	164	191
N.G.	F	243	167	67	51	62	65	66.5	190	188	175	171	195
H-148	M	245	166	66	54	59	64	66	190	187	178	175	190
H-182	F	246	162	63.5	51	58	63	60	184	181	172	175	188
H-294	M	246	166	62.5	53	55	61.5	62.6	187	186	179	169	197
H-302	M	247	163	64	50.5	57.3	63.4	60	186	186	184	178	192

Table I. - continued.

Number	Sex	C.H.	C.H.	O.F.	Bi.F.	S.O.F.	S.O.F.	O.M.	H.H.C.	S.O.F.C.	S.O.B.C.	C.H.C.	L.C.
H-151	M	247	167	68	51	56	64	66	194	192	180	175	196
E.C.D.	M	249	-	66	48.7	57.5	64.6	64	187	185	193	181	199
H-231	M	251	167	64	49.5	58	63	61	184	183	180	170	188
197	F	254	167	63.5	49.5	56	62	62	179	178	168	167	185
Sp. 15	M	254	172	65	51.5	60.5	65.7	58	194	194	188	166	193
N.E.(2)	M	255	168	69	54	63	66	63.5	194	192	184	176	190
H-179	F	255	176	69.5	52.2	57.5	68.5	66.5	204	202	197	193	202
H-176	F	256	172	60	54	-	-	-	190	-	-	178	195
H-158	M	256	175	63	55	58	62	62	188	187	181	180	199
M.E.	M	257	172	66.5	48	59	65.5	65	180	178	170	172	187
M.M.	F	257	175	70	50	63	68.5	69.5	195	193	189	178	215
Sp. 5	F	258	170	61	45.5	51	58	58.5	173	170	161	163	184
J.	M	258	171	65	43	57	63	62	178	177	172	162	182
M.M.	F	259	172	69.6	50	58.7	66.6	67.7	198	193	185	181	205
H-161	F	259	173	67	50	61	64	59	187	188	185	175	192
H-150	M	260	180	66	50	60	65.5	66	188	190	183	187	207
M.M.	M	261	176	67	53.5	63	66	68	194	194	192	190	207
H-185	F	264	176	64	51	59	62	60	189	187	183	182	200
82	F	265	175	68.5	48	56	65	68.5	190	186	178	173	199
H-188	M	266	179	74	58	68	71	71	211	207	201	198	217
H.156	M	269	179	65	56	58	63	61	193	192	188	185	202
G-17-10	M	269	180	69.5	53	67.5	69	65	199	200	189	185	205
G-18-28	M	270	182	65	51.5	59	63	68	187	185	183	183	200
H 245	M	271	175	71	58	68	70	70	204	203	193	192	214
Foet.21	M	271	177	69	52	57	63	68	192	164	178	175	202
715	F	271	186	69	57	63	67	70	203	202	194	192	224
Br.I(2)	M	271	192	63	47	57	60	65	190	187	180	178	203
815	M	272	182	70	53	59	68	67	203	200	186	190	211
Br.II(2)	M	273	194	67	46	56	61	68	191	188	185	176	194
H-358	F	275	187	66	53	57.5	63.5	65	195	191	188	183	217
H-201	M	276	185	68	56	61	66	65	197	195	191	181	210
H-202	M	280	187	71	54	61	69	72	205	203	196	186	213
H-195	F	280	190	74	61	64	67	74	210	200	200	198	225
M.L.(2)	M	282	183	72	56.5	68	70	69.5	207	205	197	180	210
H-360	M	286	187	75	57	66	72	71	210	206	201	199	216
H-234	F	287	192	74	59	66	71	75	215	207	204	203	226
H-198	M	287	195	67.5	55	62.5	66.5	70	198	197	195	197	220
H-80	M	288	185	72.5	60	63	69.5	73	212	211	204	202	225
170	F	288	189	74	56	65	72	71	213	212	206	198	218
H-800	M	289	191	73	66	67	72	73	210	203	201	193	216
H-261	M	291	194	70	60	66	67	67	206	206	204	196	220
Sp. 12	M	292	195	77	54	70	74.5	74.4	223	[illegible]	[illegible]	190	-

Table I. - continued.

Number	Sex	C.H.	C.R.	O.F.	Bi.P.	S.O.B.	S.O.F.	O.M.	H.H.C.	S.O.F.C.	S.O.B.C.	O.H.C.	L.C.
10104	M	292	218	72	56	63	67	72	213	209	205	207	-
M-206	M	296	203	72	60	66	71	76	213	212	208	195	212
M.B.	M	297	199	78	66	66	77	74	225	224	206	203	232
U.	F.	299	195	75	57	67	72	76	223	215	205	210	233
H-172	F	299	206	78	57	68	74	73	218	216	205	200	221
2815	M	299	214	73	58	67	72	73	221	220	209	217	-
T.	M	300	205	75	61	65	77	76	230	222	220	218	243
H-218	F	300	206	82	61	73	79	82	228	225	218	223	250
501	M	305	198	77.5	58	64	72.5	72.5	218	208	195	190	228
H-205	M	305	205	77	60.5	65	73	73	224	216	212	210	235
H 76	F	306	204	77	63	68	74	75	224	221	214	212	227
H-217	F	309	209	80	60	70	77	82	230	225	215	221	240
F.B.	M	310	205	72	59	62	68	72	209	201	196	190	223
H-211	F	310	210	77	60	72	74	71	222	220	218	208	225
H-225	F	311	207	71	53	65	70	70	204	203	198	194	220
M	M	312	207	71	52	65	70	75	212	208	201	200	232
H-216	F	315	213	81	60	74	80	79	225	221	214	216	235
H-227	M	315	219	82.5	66.5	72	78.5	84	246	239	229	237	259
C-18-27	F	318	219	89	65	79	81	81.5	249	244	237	233	264
N.Z.	F	320	213	76	57	69	71	75	216	209	207	203	227
C.C.	M	320	215	76	64	66	71	80	234	230	228	220	250
Z-3045(3)	M	322	217	84	66	75	79	82	240	230	225	215	245
H-193	M	323	208	84	62	72	81	83	237	233	221	215	245
Sp.10	M	323	213	74	60	67	73	82	237	232	225	232	268
M.W.	F	323	220	78	64	69	74	80	226	221	214	213	245
H-214	F	326	223	83	62.5	72	77	84	235	224	218	228	243
2816	F	329	219	90	76	82	87	83	260	256	247	235	263
O.O.	F	331	230	79	54	64	69	78	223	221	217	216	245
H-238	M	337	219	86	67	76	80	84	248	237	234	254	260
D.D.	F	337	227	80	57	70	75	80	230	227	222	212	242
M.	F	337	228	77	54	70	71	80	222	220	215	220	230
11470	F	337	230	81	65	70	75	82	247	242	233	220	255
H-223	M	338	233	80	66	71	77	81	235	233	227	218	250
H-233	M	341	227	86	70	71	82	86.5	250	244	240	238	259
1-3045(3)	M	344	228	82	69	78	80	81	242	237	233	230	256
S.S.	M	344	232	78	59	74	75	81	227	229	226	219	237
H-232	F	345	252	87	77	77	82	88	261	255	244	257	282
2090	M	345	235	85	69	77	83	84	249	246	242	242	272
L.	F	347	237	82	65	74	80	84	241	239	239	240	267
H-226	M	348	234	89	75.5	77	86	87	259	257	246	244	277
F.	F.	350	237	79	62	67.5	73	90	236	227	220	226	258
3022	F	350	241	88	66	78	82	87	245	236	235	236	269
Sp.11	M	352	236	91.5	80	78	90	95	272	270	253	255	279

Number	Sex	C.H.	C.B.	C.F.	Bi.P.	S.O.B.	S.O.F.	O.M.	H.H.C.	S.O.F.C.	S.O.B.C.	O.M.C.	L.C.
S-3045(3)	M	353	237	85	70	77	80	87	248	242	236	230	257
X 291(2)	F	354	242	86	81	77	82	86	243	240	226	230	258
G-18-26	F	357	236	87	67	76	85	84.5	248	245	239	236	261
H	F	358	234	81	69.5	71	80	82	234	225	221	226	253
3048	M	358	244	92	73	88	91	89	263	259	255	251	276
C C	M	360	250	84	70	82	88	89	270	259	257	256	300
2550	F	362	248	88.5	68	81	85.5	86	238	247	244	246	275
H 210	M	363	248	89	71	81	85	88	262	255	250	230	269
W 291(2)	F	364	249	89	64	80	86	91	252	246	238	243	268
2849	F	365	252	83	64	77	85	91	252	250	238	247	281
H-213	M	367	241	86	76	83	85	85	260	257	255	249	279
H-220	M	367	243	92	71	85	89	89	262	263	259	250	268
B-	F	367	244	82	72	77	77	97	257	248	242	247	272
702	F	368	247	88	72	78	80	85	258	240	238	242	265
Khat	F	370	235	84	58	71	77	90	241	230	224	213	-
H-209	M	372	242	94	86	86	94	93	288	284	273	263	299
H-206	F	372	244	87	70	84	86	89	257	256	255	257	272
M.S.	M	374	246	85	70	77	84	84	246	242	237	241	270
3079	F	274	252	87	74	83	86	95	260	256	258	252	287
Q	M	375	257	81	69	76	78	91	258	249	243	253	287
B B	M	377	257	96	75	88	91	97	277	268	264	267	283
2892	F	380	-	101	70	87	97	104	285	280	265	256	-
16-13	M	382	256	97	76	89	92	101	289	282	281	279	299
G-18-45	M	382	258	97	73	85	88	94	284	271	268	257	295
G-17-87	F	384	255	100	78	88	92	93	293	278	272	258	300
Drips	F	395	250	90	64	75	85	86	-	-	-	-	-
3	M	395	269	92	65	79	87	89	268	265	252	262	288
14684	F	396	261	89	70	75	76	89	265	257	256	250	278
T-	F	401	267	87	66	79	82	90	255	248	247	246	278
2778	F	401	271	93	73	81	87	94	276	269	265	257	296
2837	F	402	282	101	74	89	94	103	293	282	274	270	310
B X	F	404	269	106	81	92	98	101	301	288	286	285	312
H-236	M	404	272	104	80	92	98	105	298	287	276	290	326
O B	M	405	284	95	80	82	90	95	286	273	270	262	300
2987	M	405	284	101	71	81	93	106	297	286	262	284	-
B B	F	407	275	87	72	78	82	89	256	256	251	249	279
705	M	407	280	94	72	86	89	96	289	263	260	273	302
Ba mun	F	408	285	102	77	88	94	99	299	289	279	268	-
H-247	M	411	282	96	73	86	92	98	272	270	264	260	287
A	F	415	283	89	72	79	82	95	279	250	246	-	291
3041	M	421	293	101	80	90	97	99	290	289	278	277	317
Singh	M	425	270	98	67	82	83	95	278	266	255	230	-
703	M	427	296	115	84	98	108	104	304	292	286	280	302

Table I. — continued.

Number	Sex	C.H.	C.R.	O.F.	Bi.P.	S.O.B.	S.O.F.	O.M.	H.H.C.	S.O.P.C.	S.O.B.C.	O.M.C.	L.C.
708	M	435	296	108	83	94	100	105	303	289	284	278	318
2558	F	435	300	97	76	92	96	99	291	290	286	275	318
2564	F	438	300	103	82	86	96	104	299	289	279	292	328
Minera	M	438	303	98	77	87	91	99	286	280	277	238	-
2620	F	446	319	97	84	92	95	103	303	300	291	297	-
2988	M	449	304	104	80	90	95	104	303	291	292	281	-
2980	F	453	295	103	79	87	93	106	301	285	278	282	-
M Y	F	454	308	107	94	102	107	113	319	321	315	323	350
2951	M	455	315	100	90	91	99	118	322	313	303	330	350
2902	M	465	302	99	70	83	94	104	288	280	262	269	-
M B	M	458	308	101	80	90	93	103	299	286	282	285	320
2848	M	460	315	103	82	86	89	108	311	298	294	290	-
3054	F	465	310	103	84	89	97	113	303	287	284	283	-
C	M	469	321	109	82	89	100	118	316	307	298	-	358
I I	M	470	322	115	88	102	111	116	340	333	322	326	354
6-13-43	M	473	303	111	97	98	107	111	332	326	319	308	344
2990	F	477	338	110	86	94	105	115	322	306	303	297	365
D	F	479	321	105	93	94	98	119	325	318	309	350	365
2911	M	486	337	120	98	109	112	124	364	354	352	340	399
2872	F	492	342	114	85	98	108	117	342	337	326	340	365
2923	M	494	331	100	81	88	95	110	306	302	293	299	340
707	F	497	335	122	91	99	109	115	344	323	309	307	377
3050	M	497	342	120	99	105	115	129	353	347	330	367	402
2883	F	505	350	105	85	95	106	120	320	321	308	-	358
E	F	506	337	113	92	102	110	130	341	331	316	331	364
62973(2)	F	507	347	120	94	105	112	125	361	347	337	-	389
2973(2)	F	513	354	119	96	102	111	126	360	347	337	340	-
N	F	513	352	115	85	99	108	123	332	323	310	-	363
3048	M	515	349	116	99	99	110	119	336	328	310	320	366
2268	M	516	354	119	100	103	113	124	353	348	330	342	387
2992	F	521	352	105	91	94	99	118	329	320	314	307	385
N V	F	524	366	127	96	106	116	126	359	348	332	350	398
M M	M	525	354	115	97	100	106	116	354	339	330	325	396
2617	F	525	368	124	88	95	115	136	358	346	323	-	392
2845	F	526	358	115	94	98	107	129	349	335	327	-	398
3004	F	527	367	120	101	110	115	118	350	339	335	319	372
N T	M	528	354	120	96	102	112	127	347	344	322	340	395
J J	M	529	360	112	88	97	106	113	336	325	312	332	375
A A	M	531	355	115	99	101	107	120	350	335	330	336	376
3014	F	532	362	129	102	109	121	128	360	358	335	345	408
H H	M	536	361	111	94	98	105	113	336	336	330	315	362
O	F	536	384	126	96	105	118	142	373	367	347	380	407
Vail	F	537	335	121	88	108	114	119	356	353	343	317	-
2821	F	537	361	117	97	108	109	121	352	346	344	345	374
[illegible]	F	544	383	117	93	101	114	126	366	348	354	340	376

Table III.

Head Measurements By Groups. (in m.m.)

Group	No. Cases	No. Males	No. Female		Body Length C.H.	Body Length C.R.	Head Diameters O.F.	Head Diameters Bi.P.	Head Diameters S.O.B.	Head Diameters S.O.F.	Head Diameters O.M.	Head Circumferences. H.H.C.	Head Circumferences. S.O.F.C	Head Circumferences. S.O.B.C	Head Circumferences. O.M.C	Head Circumferences. L. C
I	17	1	1	Ave	37.2	31.4	13.7	9.5	13.2	14.5	12.1	37.5	39.	37.4	33.4	36.7
23-49		?=15		Max	49	41	17.6	12.2	16.7	18	16	49	50	48	47	46
mm (C.H.)				Min	23	20.5	9.7	6.3	9	10.5	8.2	26	28	28	23	27
II				Ave	75.4	57	21.7	16.2	21	22.4	20.1	61.9	62.9	61.7	53.6	62
50-99	29	9	14	Max	97	71	27	20.3	25	28	25.5	76.5	78	76.5	73	78
mm (C.H.)		?=6		Min	50	39	14	10	12	15	14	42	45	41.5	40	44.5
III				Ave	124.2	88.9	33.2	26.3	31.4	33.6	30.5	95.6	96.8	94.6	83.5	96.8
100-149	45	17	28	Max	149.	104.	39.5	32.	40.	40.6	36.	113.	115.	110.	101.	112.
mm (C.H.)				Min	100.	73.	26.	21.	24.	25.5	24.5	76.	75.	75.	63	79.
IV.				Ave	173.2	119.6	44.9	35.6	41.7	44.9	42.2	128.2	129.2	124.	117.6	135.
150-199	27	15	12	Max	199.	138.	51.	41.	48.	50.	48.	146.	143.	140.	135.	153.
mm (C.H.)				Min	150	103	38.	29.5	37.	38.	37.	107.	111.	106.	95.	116.
V				Ave	225	151.8	57.9	45.3	52.3	56.8	56.1	167	166.2	159.9	155.8	174.7
200-249	50	21	29	Max	249.	167.	68.	54.	63.	65.	66.5	194.	192.	184.	181.	199.
mm (C.H.)				Min	200.	135	48	35.	43.4	47.	47.	142.	141.	130.	125.	149.
VI				Ave	275.	183.9	69.2	53.9	61.8	67.1	67.8	199.8	197.7	191.3	186.6	207.4
250-299	46	30	16	Max	299.	218.	78.	66.	70.	77.	76.	225.	224.	210.	217.	233.
mm (C.H.)				Min	251	167	60.	43.	51.	58.	58.5	173.	170.	161.	162.	182.
VII				Ave	324.5	218.4	80.3	62.9	71.	76.5	80.	233.5	228.7	222.6	220.7	247.3
300-349	34	17	17	Max	348.	237.	90.	77.	82.	87.	88.	261.	257.	247.	257.	282.
mm (C.H.)				Min	300.	198.	71.	52.	62.	68.	70.	204.	201.	195.	190.	220.
VIII				Ave	369.1	248.3	88.7	69.8	80.	85.	90.2	260.4	254.6	248.9	247.3	277.3
350-399	31	14	17	Max	396.	269.	101.	78.	88.	97.	104.	293.	284.	281.	279.	300.
mm (C.H.)				Min	350	234	79.	58.	67.5	73.	82.	234.	225.	221.	215.	253.
IX				Ave	418.3	285.4	98.8	76.4	86.6	92.7	99.2	287.9	278.4	270.9	268.8	305.6
400-449	21	11	10	Max	449.	319.	115.	84.	94.	108.	106.	304.	300.	291.	297.	328.
mm (C.H.)				Min	401.	264.	87.	66.	78.	82.	89.	255.	248.	246.	230.	278.
X				Ave	472.6	319.4	108.3	86.4	94.4	101.8	113.7	322.7	313.2	304.6	310.3	361
450-499	17	10	7	Max	497.	342.	122.	99.	109.	115.	129.	364.	354.	352.	367.	402.
mm (C.H.)				Min	453	295	99.	70.	83.	89.	103.	288.	280.	268.	269.	330.
XI				Ave	524.2	358.1	117.3	94.2	101.7	110.6	123.5	345.6	339.9	327.1	334.9	383.4
500-549	22	7	15	Max	544.	388.	129.	102.	110.	118.	142.	373.	367.	347.	380.	407.
mm (C.H.)				Min	505.	337.	105.	85.	94.	99.	112.	320.	320.	308.	307.	358.

Table III.

OCCIPITO FRONTAL DIAMETER.(O.F.)

Body Length (C.H.) in mm.		Heuser 1912	Kjölseth 1913	Faucon 1897	Michaelis 1906	Retzius 1904	Legou 1903	Jousset 1877	Corrado 1899	Weisz 1897	Spondli 1857	Friedenthal 1914	Ribemont 1879
0-49	No.Spec.			1	5	5							
	Ave.C.H.			46	35	26							
	Ave.O.F.			13	14	11.4							
50-99	No.Spec.				5	9	1					2	
	Ave.C.H.				79	61.4	85					75.3	
	Ave.O.F.				25	21.1	25					21.2	
100-149	No.Spec.	1		4	13	4	6		1			1	
	Ave.C.H.	120		122	149	115	125.2		119			134.1	
	Ave.O.F.	38		28.5	40	32.3	31.2		33			37.3	
150-199	No.Spec.			3		8	12	?					
	Ave.C.H.			185		175	176.2	185					
	Ave. O.F.			41.7		48.8	41.8	47.5					
200-249	No.Spec.	4		11	21	6	30	?	1			1	
	Ave.C.H.	223		217	223	222	224.2	230	240			219.5	
	Ave.O.F.	57.5		46.2	55	58.5	52.5	55	58			54.2	
250-299	No.Spec.	1		9	22	7	28	?	7	?			
	Ave.C.H.	281		272	295	270	270.2	260	286.7	293			
	Ave.O.F.	65		62	69	69.9	61.6	67	65	74			
300-349	No.Spec.			6	14		22	?	14			1	
	Ave.C.H.			316	331		332.2	312	325			302.1	
	Ave.O.F.			69.5	79		73.1	70.8	72			80.5	
350-399	No.Spec.			4	12	2	6	?	31	?	1	2	
	Ave.C.H.			362.5	397	355	354.7	378	379.4	364.2	392	365.8	
	Ave.O.F.			80	89	91.5	81.7	92.5	82	78	91.5	95.6	
400-449	No.Spec.	6	?	1	8				43	?	19		20
	Ave.C.H.	417.3	425.1	430	443				425.6	445.6	442.6		430.3
	Ave.O.F.	98	108	65(?)	106				93.3	105.6	11[illegible]		107.8
450-499	No.Spec.	8	?						53	?	74	1	104
	Ave.C.H.	482.3	481.6						473.7	470	478.2	470	471.9
	Ave.O.F.	110.5	114.7						103.4	108.5	118.2	120	114.4
500-549	No.Spec.	41	?						80	?	6	1	81
	Ave.C.H.	504.8	511.1						518.4	500	523	500.5	517
	Ave.O.F.	120.6	120.3						118.8	114	122	115.8	119

Table IV.

BIPARIETAL DIAMETER. (Bi.P.)

Body Length (C.H.) in mm.		Retzius 1904	Legou 1903	Kjölseth 1913	Faucon 1897	Michaelis 1906	Jousset 1877	Corrado 1899	Weisz 1897	Spondli 1857	Friedenthal 1914	Ribemont 1879
0-49	No.Spec.	3			1	5						
	Ave.C.H.	33			46	36						
	Ave.BiP.	10			6	11						
50-99	No.Spec.	9	1			5					2	
	Ave.C.H.	61.4	85			79					75.3	
	Ave.BiP.	17.7	20			25					17.2	
100-149	No.Spec.	4	6		4	13		1			1	
	Ave.C.H.	115	125.2		122	149		119			134.1	
	Ave.BiP.	26	25.7		17.5	30		27			30.7	
150-199	No.Spec.	9	12		3		?					
	Ave.C.H.	172	176.2		185		178					
	Ave.BiP.	39.6	34.6		35.3		40					
200-249	No.Spec.	6	30		11	21	?	1			1	
	Ave.C.H.	222	224.2		217	223	230	240			219.5	
	Ave.BiP.	48.2	40.8		38.6	43	45	44			41.8	
250-299	No.Spec.	7	28		9	22	?	7	?			
	Ave.C.H.	270	270.2		272	295	260	286.7	293			
	Ave.BiP.	57	49.4		49.7	53	60	50	61.5			
300-349	No.Spec.		22		6	14	?	14			1	
	Ave.C.H.		332.2		316	331	312	325			302.1	
	Ave.BiP.		59.4		54.8	61	62	56.5			54.7	
350-399	No.Spec.	2	6		4	12	?	31	?	1	2	
	Ave.C.H.	355	354.7		362.5	397	378	379.4	364.2	392	365.8	
	Ave.BiP.	75.5	65.8		66.3	65	74	67.3	68	78.5	64.9	
400-449	No.Spec.			?	1	8		43	?	19		20
	Ave.C.H.			425.1	430	443		425.6	445.6	442.6		430.3
	Ave.BiP.			78.3	70	79		76	83.7	87.4		87
450-499	No.Spec.			?				52	?	74	1	104
	Ave.C.H.			481.6				473.3	470	478.2	470	471.9
	Ave.BiP.			88.6				84.7	87	91.3	84	92.5
500-549	No.Spec.			?				80	?	6	1	81
	Ave.C.H.			511.1				518.4	500	523	500.5	517
	Ave.BiP.			92.1				91.1	91.5	91	90.5	95.6

Table V.

SUBOCCIPITO BREGMATIC DIAMETER.(S.O.B.)

Body Length (C.H.) in mm.		Legou 1903	Michaelis 1906	Kjælseth 1913	Weisz 1897	Riebmont 1879
0-49	No.Spec.					
	Ave.C.H.					
	Ave.SOB.					
50-99	No.Spec.	1				
	Ave.C.H.	85				
	Ave.SOB	25				
100-149	No.Spec.	6	13			
	Ave.C.H.	125.2	149			
	Ave.SOB.	30.5	34			
150-199	No.Spec.	12				
	Ave.C.H.	176.2				
	Ave.SOB	40				
200-249	No.Spec.	30	21			
	Ave.C.H.	224.2	223			
	Ave.SOB.	48.6	50			
250-299	No.Spec.	28	22		?	
	Ave.C.H.	270.2	295		293	
	Ave.SOB	57.6	62		64	
300-349	No.Spec.	22	14			
	Ave.C.H.	332.2	331			
	Ave.SOB.	65.8	67			
350-399	No.Spec.	6	12		?	
	Ave.C.H.	354.7	397		364.2	
	Ave.SOB.	76.2	81		70.4	
400-449	No.Spec.		8	?	?	20
	Ave.C.H.		443	425	445.6	430.3
	Ave.SOB.		86	86.7	87.5	93.1
450-499	No.Spec.			?	?	104
	Ave.C.H.			481.6	470	471.9
	Ave.SOB.			98.4	91	97.4
500-549	No.Spec.			?	?	81
	Ave.C.H.			511.1	500	517
	Ave.SOB.			100	95	101.5

Table VI.

SUBOCCIPITO FRONTAL DIAMETER (S.O.F.)

Body Length (C.H.) in mm.		Faucon 1897	Legou 1903
0-49	No.Spec.	1	
	Ave.C.H.	46	
	Ave.SOF.	12	
50-99	No.Spec.		1
	Ave.C.H.		85
	Ave.SOF		24
100-149	No.Spec.	4	6
	Ave.C.H.	122	125.2
	Ave.SOF.	22.5	32.7
150-199	No.Spec.	3	12
	Ave.C.H.	185	176.2
	Ave.SOF	42	42
200-249	No.Spec.	11	30
	Ave.C.H.	217.3	224.2
	Ave.SOF.	45	52
250-299	No.Spec.	9	28
	Ave.C.H.	271.7	270.2
	Ave.SOF.	59.5	61
300-349	No.Spec.	6	22
	Ave.C.H.	316	332.2
	Ave.SOF.	65	71
350-399	No.Spec.	4	6
	Ave.C.H.	362.5	354.7
	Ave.SOF.	73	78
400-449	No.Spec.	1	
	Ave.C.H.	430	
	Ave.SOF.	60(?)	
450-499	No.Spec.		
	Ave.C.H.		
	Ave.SOF.		
500-549	No.Spec.		
	Ave.C.H.		
	Ave.SOF.		

OCCIPITO MENTAL DIAMETER.(O.M.)

Body Length C.H.) in mm.		Kjölseth 1913	Faucon 1897	Michaelis 1906	Legou 1903	Corrado 1899	Weisz 1897	Spondli 1857	Ribemont 1879
0-49	No.Spec.		1	5					
	Ave.C.H.		46	37					
	Ave.O.M.		15	14					
50-99	No.Spec.			5	1				
	Ave.C.H.			79	85				
	Ave.O.M.			25	28				
100-149	No.Spec.		4	13	6	1			
	Ave.C.H.		122	149	125.2	119			
	Ave.O.M.		27	38	34	36			
150-199	No.Spec.		3		12				
	Ave.C.H.		185		176.2				
	Ave.O.M.		48		46				
200-249	No.Spec.		11	21	30	1			
	Ave.C.H.		217.3	223	224.2	240			
	Ave.O.M.		54	58	61	69			
250-299	No.Spec.		9	22	28	7	?		
	Ave.C.H.		271.7	295	270.2	286.7	293		
	Ave.O.M.		70	67	71	75	85.5		
300-349	No.Spec.		6	14	22	14			
	Ave.C.H.		316	331	332.2	325			
	Ave.O.M.		77	80	83	85.4			
350-399	No.Spec.		4	12	6	31	?	1	
	Ave.C.H.		362.5	397	354.7	379.4	364.2	392	
	Ave.O.M.		90	90	95	97	90	104.6	
400-449	No.Spec.	?	1	8		43	?	19	20
	Ave.C.H.	425	430	443		425.6	445.6	442.6	430.3
	Ave.O.M.	116.5	115	100		107.3	124.4	126.6	118.8
450-499	No.Spec.	?				53	?	74	104
	Ave.C.H.	481.6				473.7	470	478.2	471.9
	Ave.O.M.	129				119.6	129	132.9	126
500-549	No.Spec.	?				80	?	6	81
	Ave.C.H.	511.1				518.4	500	523	517
	Ave.O.M	134.5				131	133.5	140.6	131.4

Table VIII.

HORIZONTAL HEAD CIRCUMFERENCE (H.H.C.)

Body Length (C.H.) in mm.		Corrado 1899	Legeu 1903	Retzius 1904	Heuser 1912	Faucon 1897	Michaelis 1906	Weisz 1897	Spiegelberg 1868	Lutz 1913	Kjelseth 1913	Fehling 1875
0-49	No.Spec.			2		1						
	Ave.C.H.			29		46						
	Ave. H.H.C.			55.5		54						
50	No.Spec.			8			5					
50-99	Ave.C.H.			67.1			79					
	Ave.HHC			63			60					
100-149	No.Spec.	1	6	3	1		13					
	Ave.C.H.	119	125.2	117	120		149					
	Ave.HHC	108	98	96	80		109					
150-199	No.Spec.	2	12	8		3						
	Ave.C.H.	163	176.2	174.9		185						
	Ave.HHC.	107	121	143		125						
200-249	No.Spec.	2	29	6	4	7	21					
	Ave.C.H.	225	224.7	222.3	223	220.7	223					
	Ave.HHC	157	152	177	148	139	152					
250-299	No.Spec.	9	26	7	1	7	22	?				
	Ave.C.H.	285	269.9	270.2	280	277	295	293				
	Ave.HHC.	194	182.5	207	195	184	191	217.5				
300-349	No.Spec.	21	22			4	14		8			
	Ave.C.H.	325	332.2			324	331		303			
	Ave.HHC.	221	221			215	221		235			
350-399	No.Spec.	35	5	2		4	12	?	7	?		
	Ave.C.H.	378	353.6	355		362.5	397	364.2	378	380		
	Ave.HHC.	257	247	271		234	252	232.8	262	280		
400-449	No.Spec.	46			6	1	8	?	32	?	?	?
	Ave.C.H.	425			417.3	430	443	445.6	435	425	421.7	425
	Ave.HHC	286.5			289	260	277	308.6	295	[illegible]		297
450-499	No.Spec.	53			8			?	6	?	?	?
	Ave.C.H.	474			482.3			470	453	476.7	481.6	470
	Ave.HHC	318			331			324.9	295	337	338	324
500-549	No.Spec.	81			41			?		?	?	?
	Ave C.H.	518			504.8			500		524.3	511.1	520
	Ave.HHC.	342			351			338		357	356	349

Table IX.

SUBOCCIPITO BREGMATIC CIRCUMFERENCE. (S.O.B.C.)

Body Length C.H.) in mm.		Legou 1903	Faucon 1897	Weisz 1897	Ribemont 1879
0-49	No.Spec.		1		
	Ave. C.H.		46		
	Ave.SOBC.		34		
50-99	No.Spec.				
	Ave.C.H.				
	Ave.SOBC.				
100-149	No.Spec.	6			
	Ave.C.H.	125.2			
	Ave.SOBC.	96			
150-199	No.Spec.	12	3		
	Ave.C.H.	176.2	185		
	Ave.SOBC.	130	132		
200-249	No.Spec.	30	6		
	Ave.C.H.	224.2	223		
	Ave.SOBC.	145.5	140		
250-299	No.Spec.	26	7	?	
	Ave.C.H.	270.2	277	293	
	Ave.SOBC.	182.5	184	202.5	
300-349	No.Spec.	22	4		
	Ave.C.H.	332.2	324		
	Ave.SOBC.	212	215		
350-399	No.Spec.	5	4	?	
	Ave.C.H.	354.7	362.5	364.2	
	Ave.SOBC.	233	224	211.8	
400-449	No.Spec.		1	?	20
	Ave.C.H.		430	445.6	430.3
	Ave.SOBC.		250	286.5	292
450-499	No.Spec.			?	104
	Ave.C.H.			470	471.9
	Ave.SOBC.			295	313.3
500-549	No.Spec.				81
	Ave.C.H.				517
	Ave.SOBC.				323.4

Table X.

SUBOCCIPITO FRONTAL CIRCUMFERENCE.(S.O.F.C.)

Body Length (C.H.) in mm.		Faucon 1897	Legou 1903
0-49	No.Spec.	1	
	Ave.C.H.	46	
	Ave.SOFC.	34	
50-99	No.Spec.		
	Ave.C.H.		
	Ave.SOFC.		
100-149	No.Spec.		6
	Ave.C.H.		125.2
	Ave.SOFC.		96
150-199	No.Spec.	3	12
	Ave.C.H.	185	176.2
	Ave.SOFC.	138	121
200-249	No.Spec.	6	30
	Ave.C.H.	223	224.2
	Ave.SOFC.	142	152
250-299	No.Spec.	7	26
	Ave.C.H.	277	270.2
	Ave.SOFC.	183	182
300-349	No.Spec.	4	22
	Ave.C.H.	324	332.2
	Ave.SOFC.	216	216
350-399	No.Spec.	4	5
	Ave.C.H.	362.5	354.7
	Ave.SOFC.	227.5	241
400-449	No.Spec.	1	
	Ave.C.H.	430	
	Ave.SOFC.	260	
450-499	No.Spec.		
	Ave.C.H.		
	Ave.SOFC.		
500-549	No.Spec.		
	Ave.C.H.		
	Ave.SOFC.		

Table XI.

OCCITITO MENTAL CIRCUMFERENCE. (L.C.)

Body Length (C.H.) in mm.		Weisz 1897	Ribemont. 1879
0-49	No.Spec.		
	Ave.C.H.		
	Ave.L.C.		
50-99	No.Spec.		
	Ave.C.H.		
	Ave.L.C.		
100-149	No.Spec.		
	Ave.C.H.		
	Ave.L.C.		
150-199	No.Spec.		
	Ave.C.H.		
	Ave.L.C.		
200-249	No.Spec.		
	Ave.C.H.		
	Ave.L.C.		
250-299	No.Spec.	?	
	Ave.C.H.	293	
	Ave.L.C.	255	
300-349	No.Spec.		
	Ave.C.H.		
	Ave.L.C.		
350-399	No.Spec.	?	
	Ave.C.H.	364.2	
	Ave.L.C.	267.1	
400-449	No.Spec.	?	20
	Ave.C.H.	445.6	430.3
	Ave.L.C.	346.4	344.5
450-499	No.Spec.	?	104
	Ave.C.H.	470	471.9
	Ave.L.C.	360.5	369.9
500-549	No.Spec.	?	81
	Ave.C.H.	500	517
	Ave.L.C.	374.5	384.2

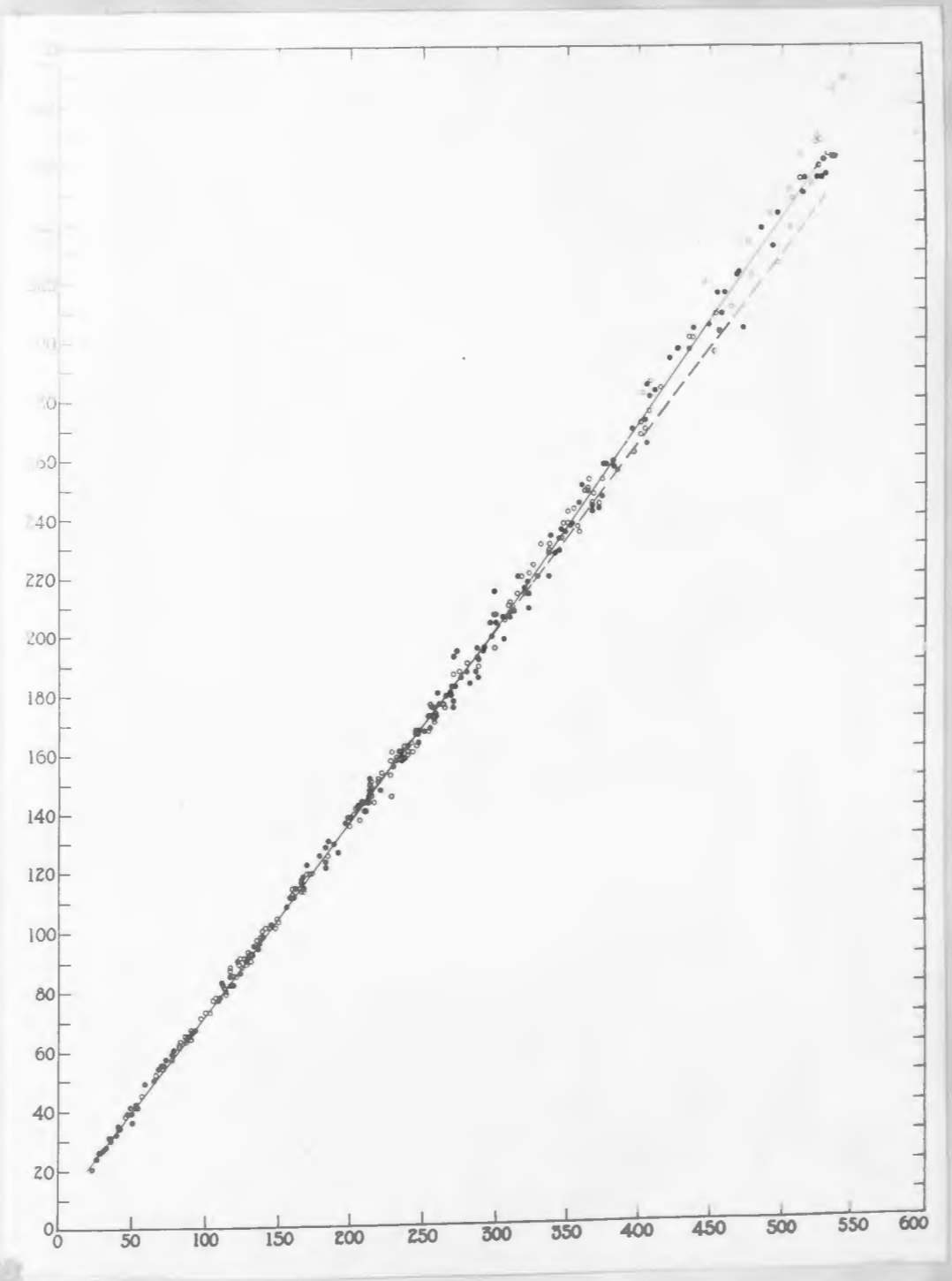

Fig. 1- Crown Rump.

In all figures the diameter or circumference in question is plotted as ordinate against the crown-heel, as abscissa.
In figures 1 to 11, incl., sex is indicated as follows;-

Males--------- ●
Females------- ○
Indeterminate- ⊕

"H" indicates a possible hydrocephalus.

7.19.4m

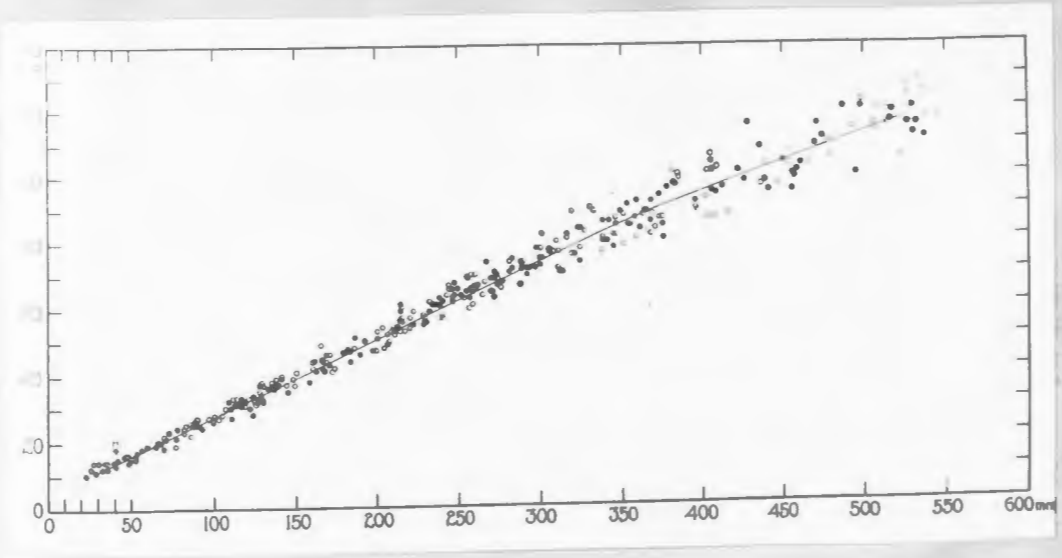

Figure 2- Occipito-Frontal Diameter.

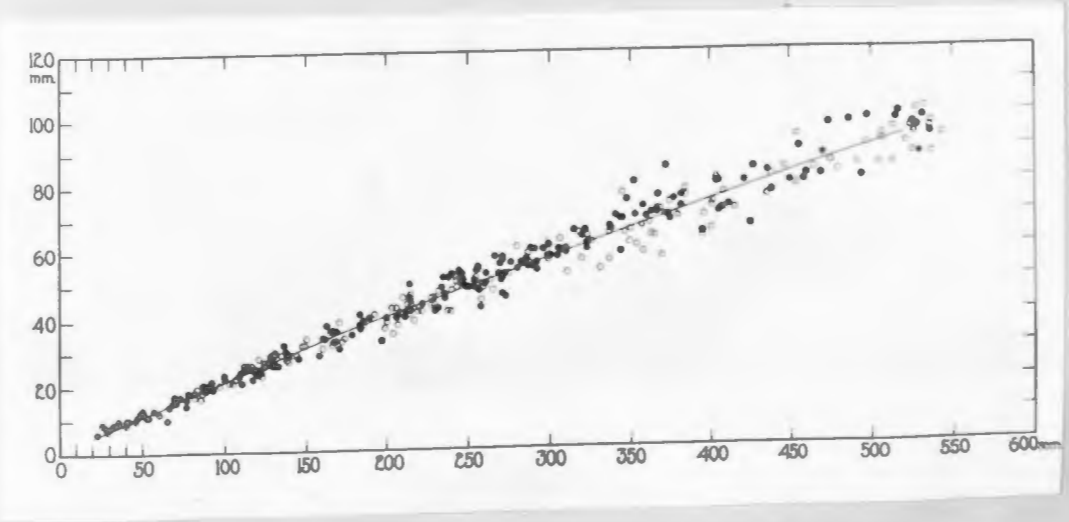

Figure 3- Bi-Parietal Diameter.

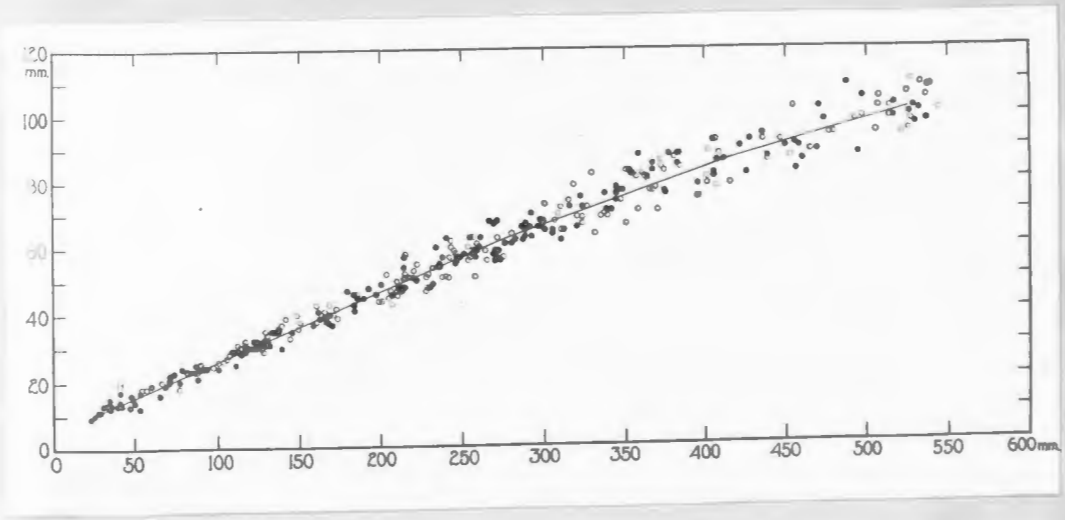

Figure 4- Suboccipito-Bregmatic Diameter.

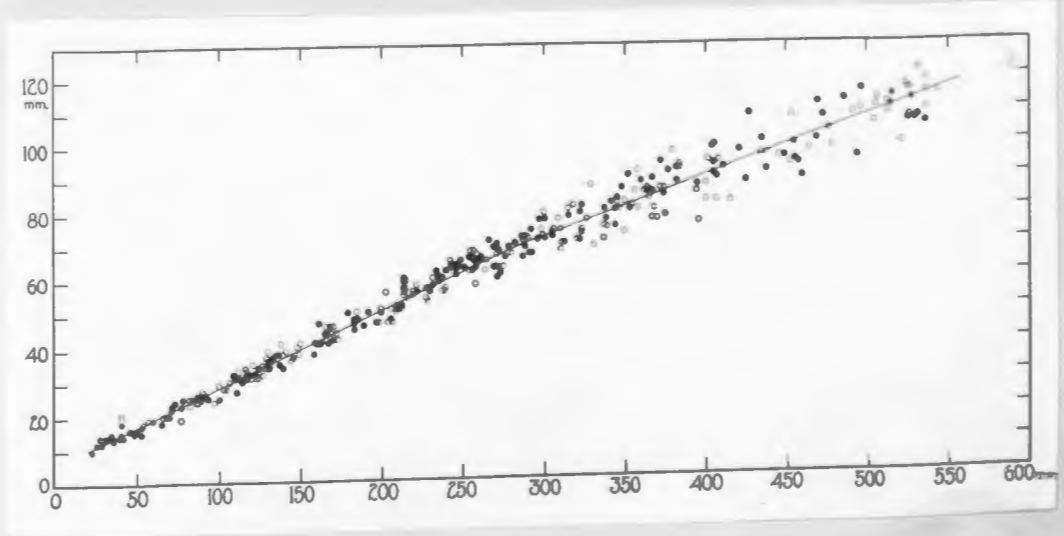

Figure 5- Suboccipito-Frontal Diameter.

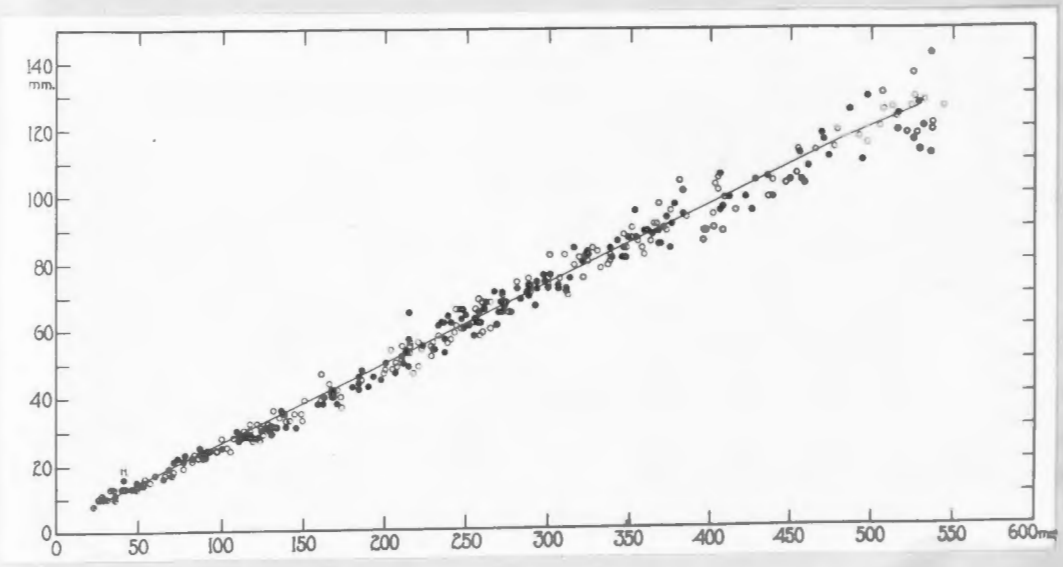

Figure 6

Occipito-Mental Diameter.

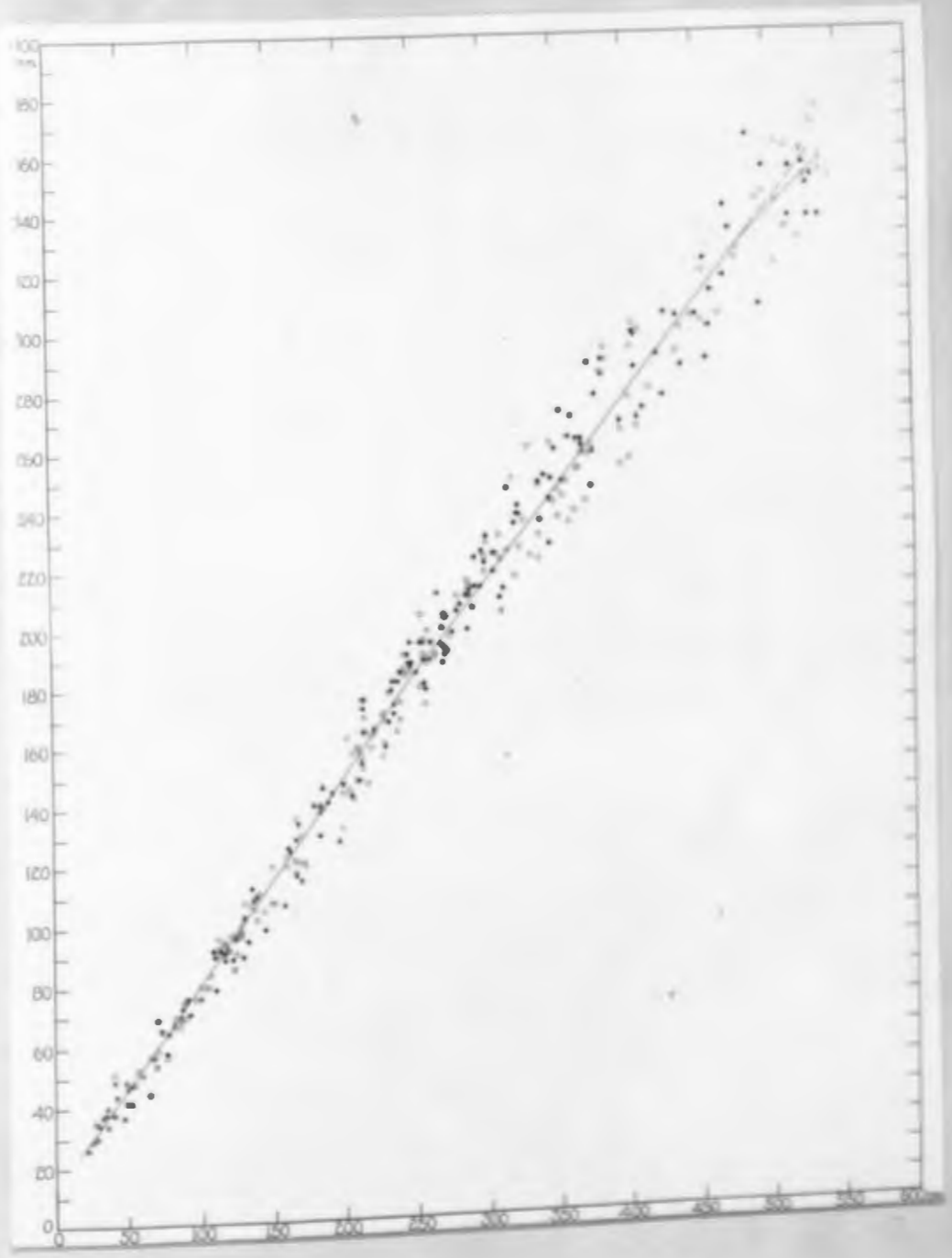

Figure 7

Horizontal Head Circumference.

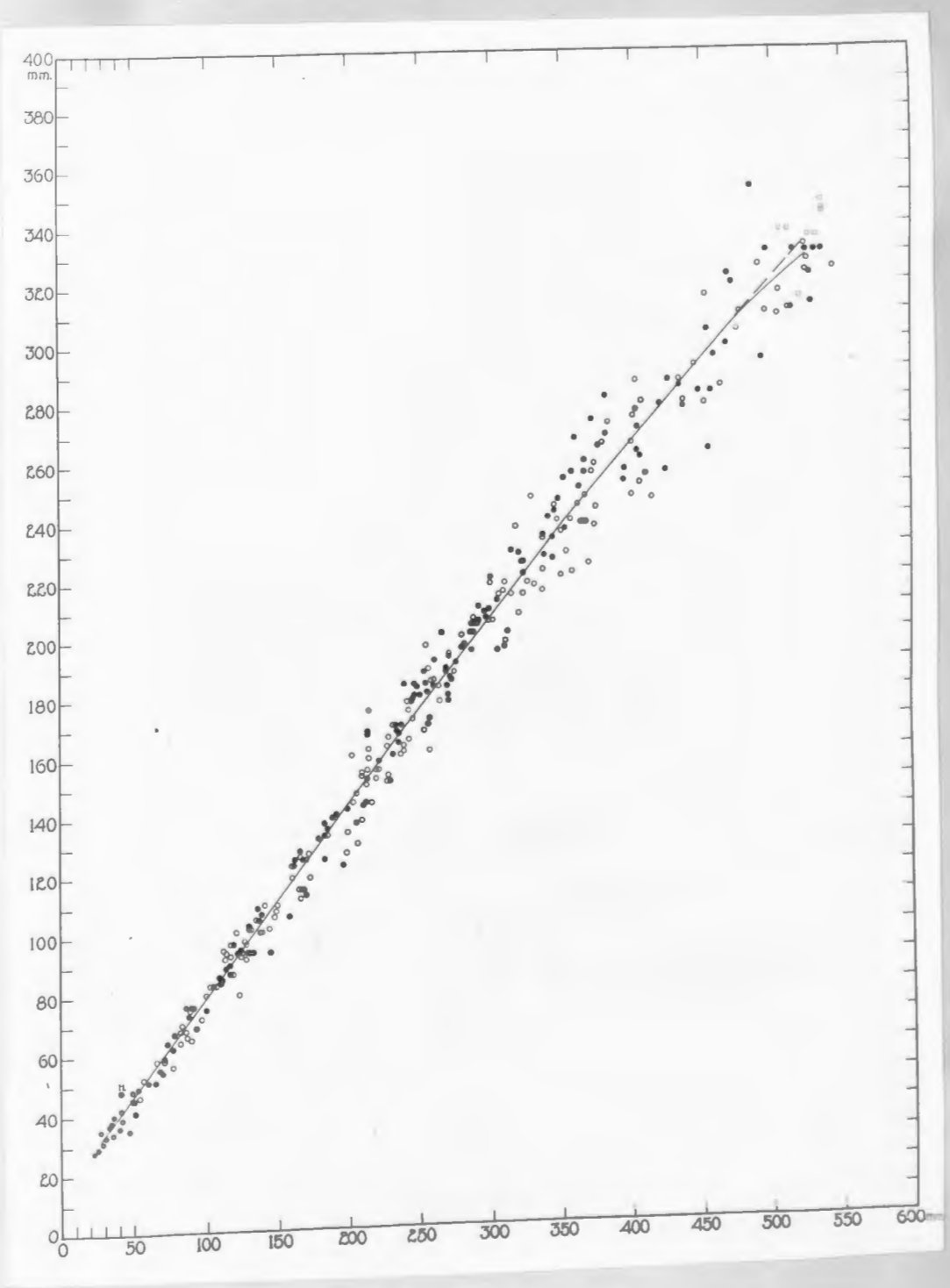

Figure 8

Suboccipito-Bregmatic Circumference.

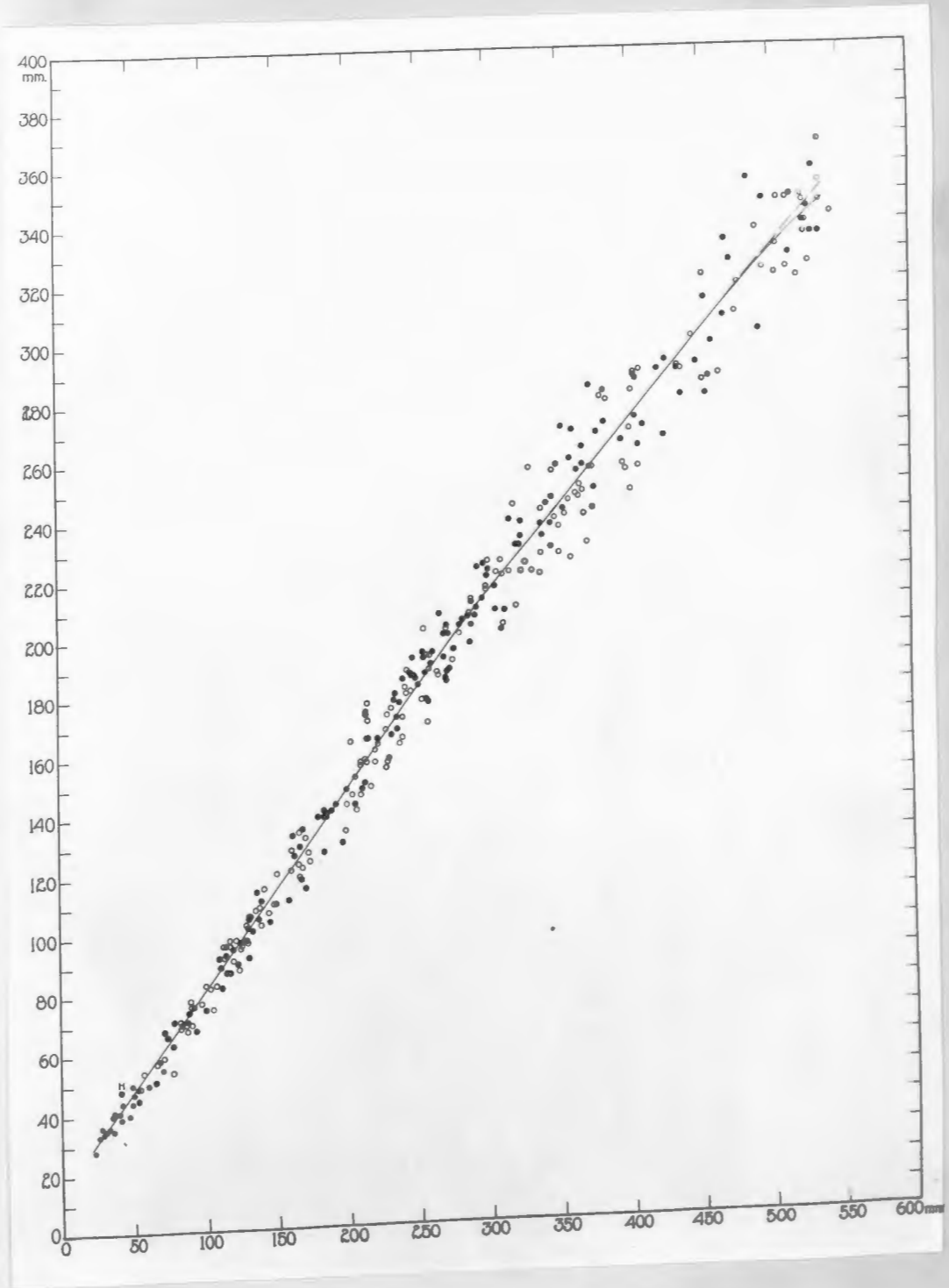

Figure 9

Suboccipito-Frontal Circumference.

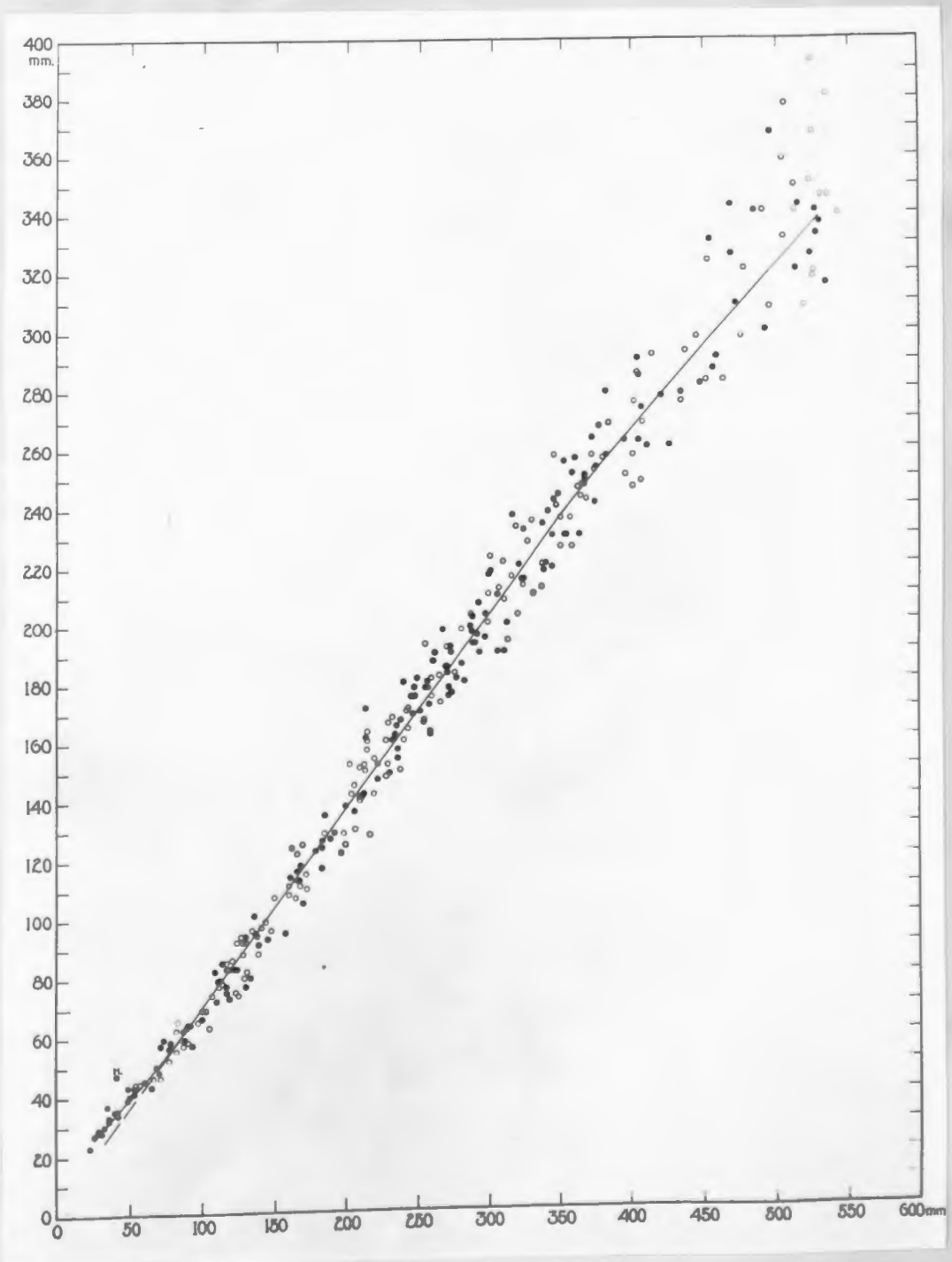

Figure 10

Occipito-Mental Circumference.

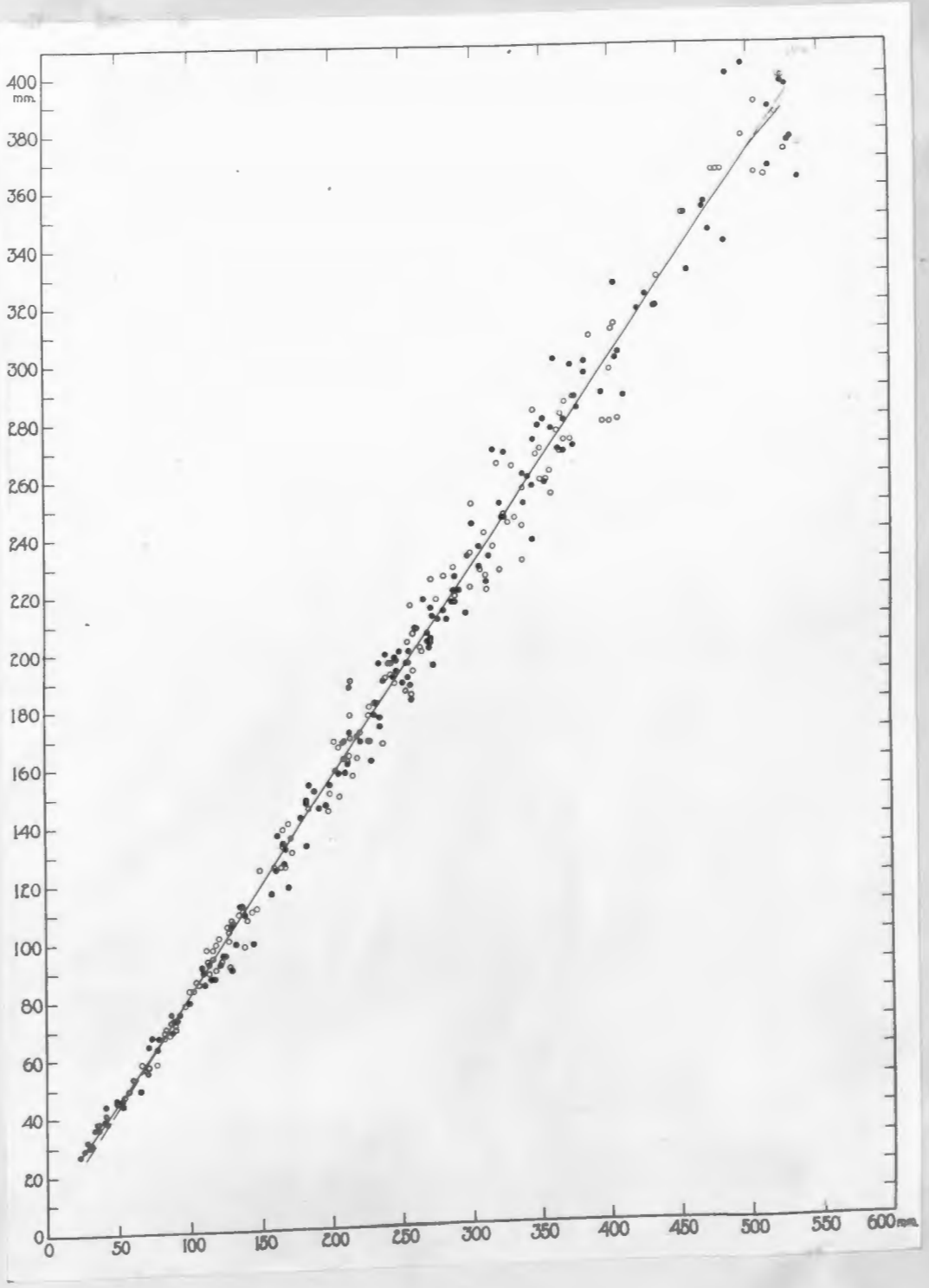

Figure 11

Large Circumference.

7.19.4m

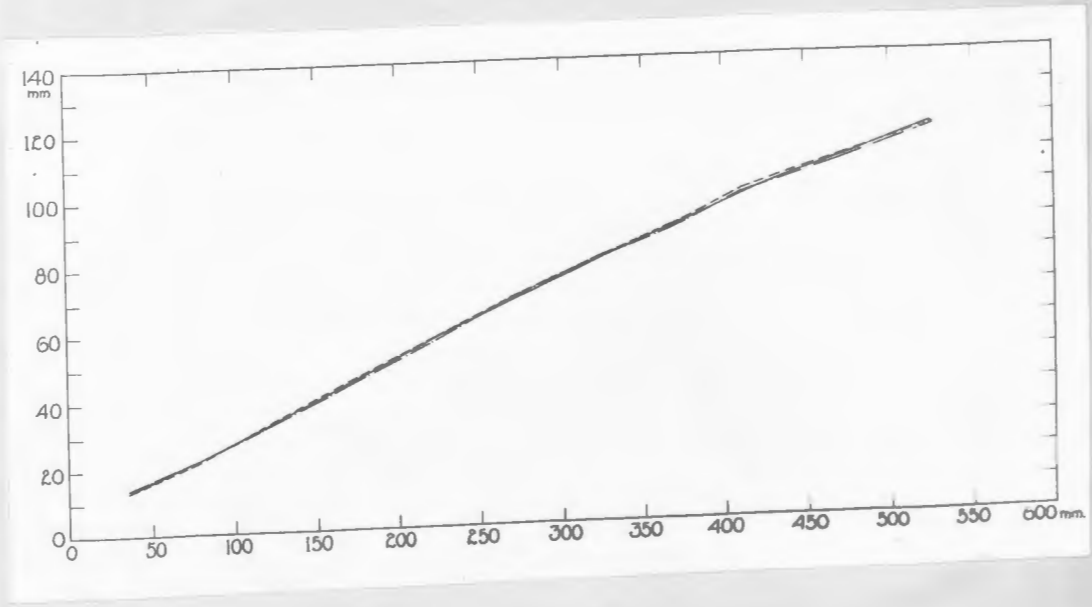

Figure 12

Occipito-Frontal Diameter as plotted by method of;-

Averages---------- ———

Weighted Medians---------- ——·——

Averages weighted by median crown heel-------

Note- The same system of symbols is employed in Figure 13.

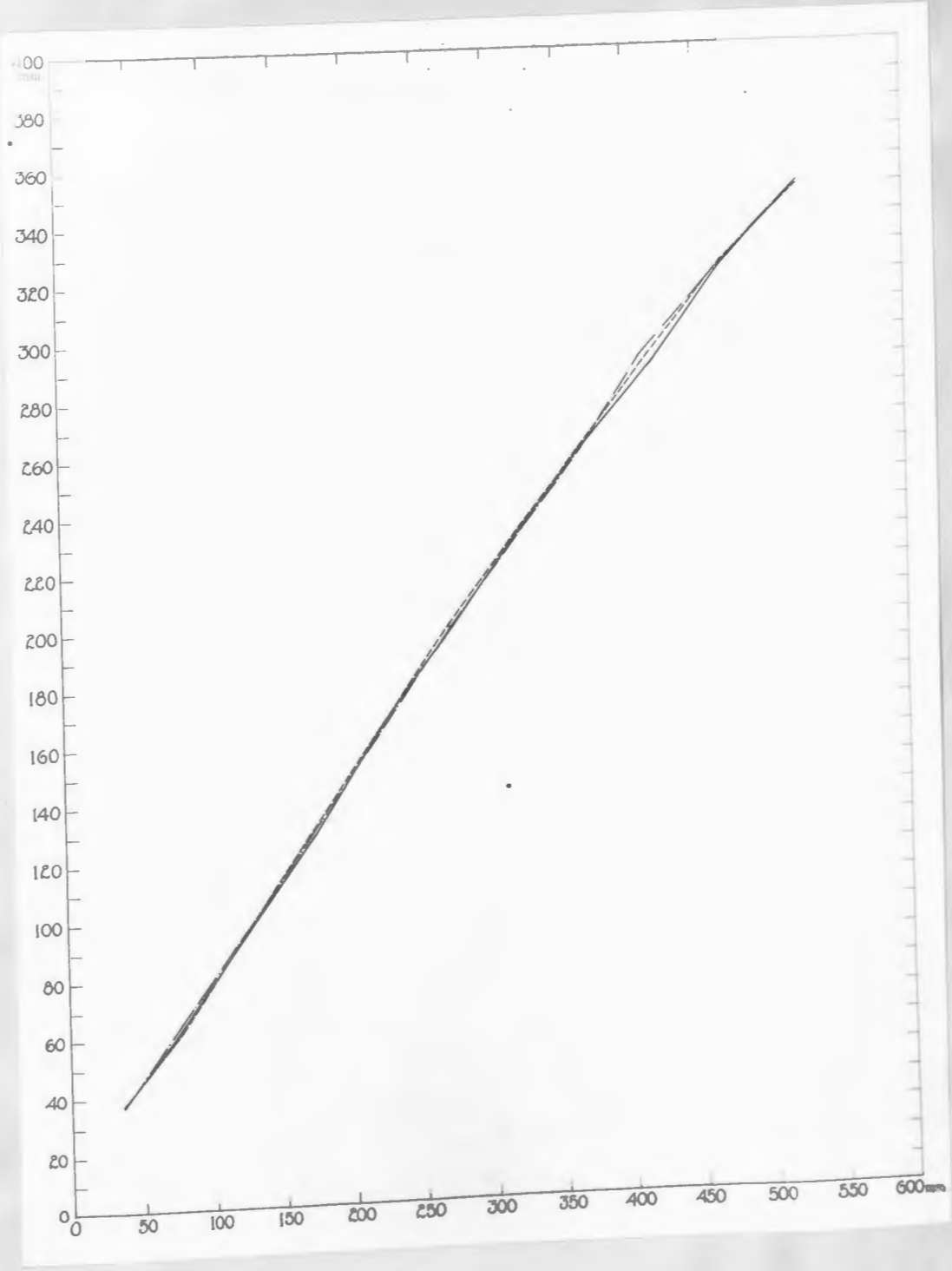

Figure 13

Horizontal-Head Circumference.
(Construction same as Figure 12)

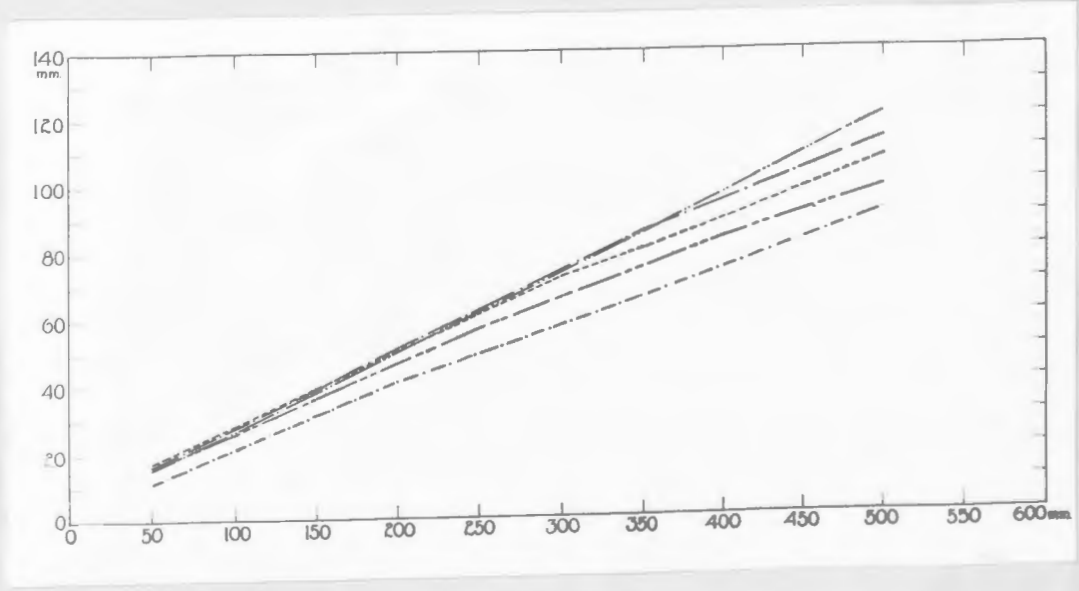

Figure 14

Head Diameters, represented as follows;-

Occipito-Frontal------ —·—·—·

Bi-Parietal---------- —·—·—·—·—·

Suboccipito-Bregmatic- —— -- —— -- ——

Suboccipito-Frontal--- ----------

Occipito-Mental------- ——·· ——·· ——··

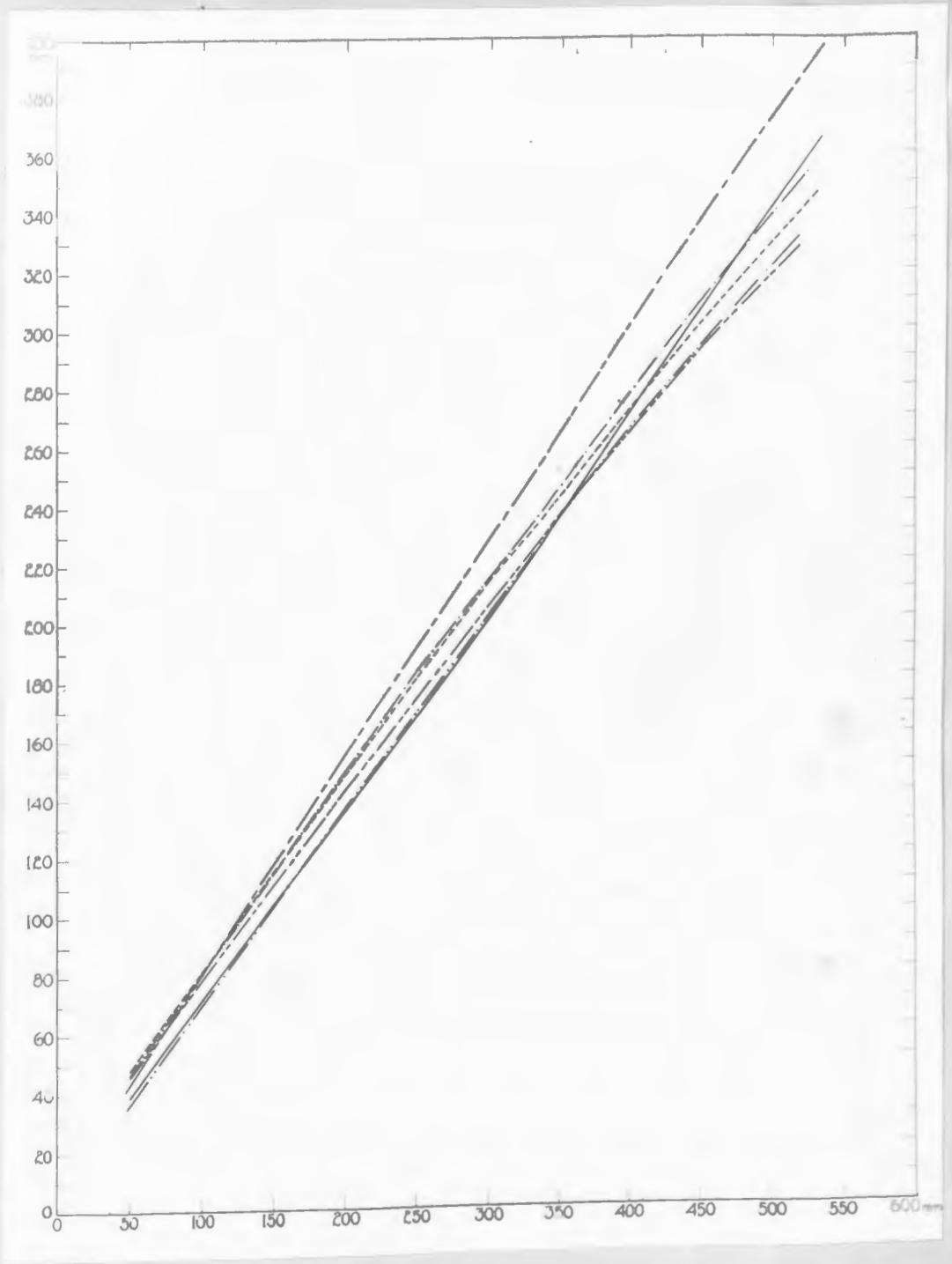

Figure15

Crown-Rump and Head Circumferences.

Crown-Rump----------
Horizontal Head Circumference-------
Suboccipito-Bregmatic Circumference-
Suboccipito-Frontal Circumference---
Occipito-Mental Circumference-------
Large Circumference----------

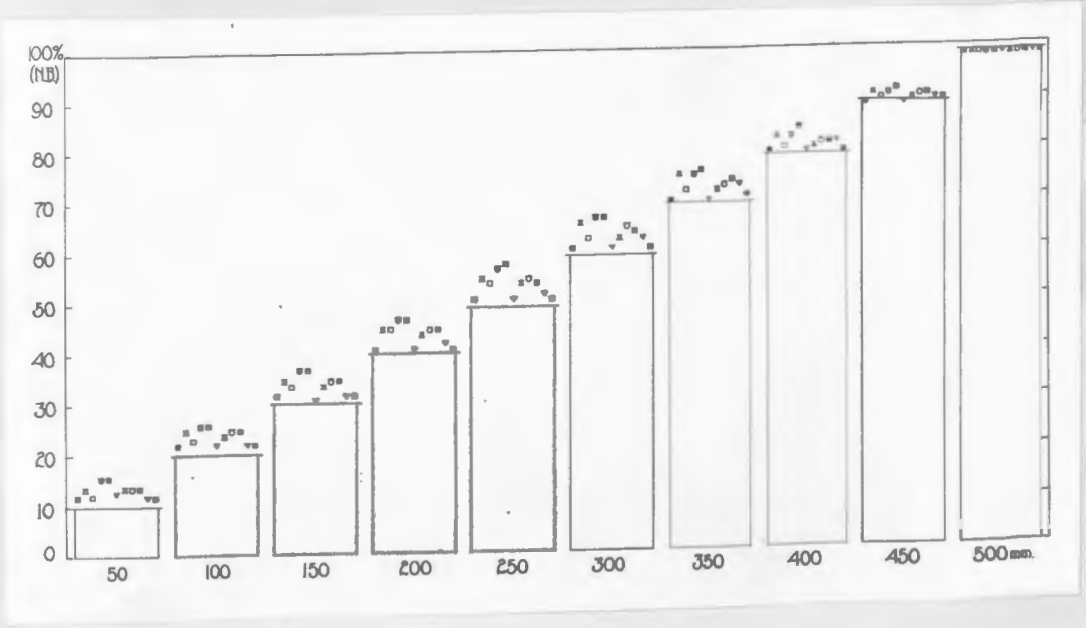

Figure 16

Histogram, showing per cent of new-born measurements as follows;-

Standing Height----------

Sitting Height----------

Occipito-Frontal Diameter----------

Bi-Parietal Diameter----------

Suboccipito-Bregmatic Diameter------

Suboccipito-Frontal Diameter--------

Occipito-Mental Diameter----------

Horizontal Head Circumference-------

Suboccipita-Bregmatic Circumference-

Suboccipito-Frontal Circumference---

Occipito-Mental Circumference-------

Large Circumference----------

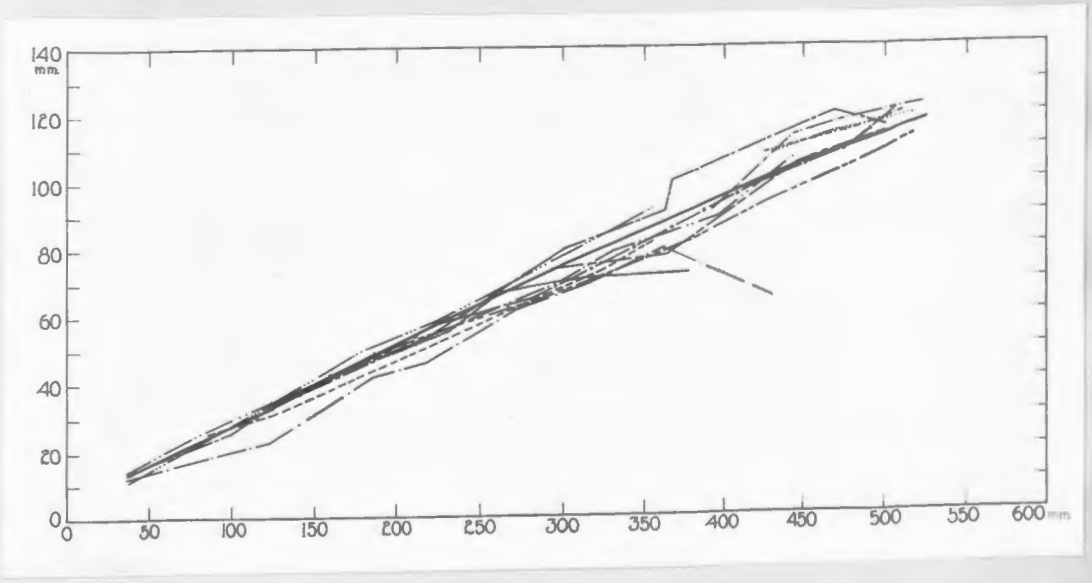

Figure 17
Occipito-Frontal Diameter.

Note- Figures 17 to 25 contain curves based on other series of measurements. The legend-

Budin and Ribemont- .....
Corrado---------- — - - —
Faucon---------- . ——— .
Fehling---------- .... —....
Friedenthal------- —— ~ —
Heuser---------- —— x —
Jousset---------- ~~~~~~~~
Kjölseth---------- .—.—.—.
Legou---------- --------
Lutz---------- — ~ — ~
Michaelis---------- .. ——— ..
Retzius---------- — ... —
Spiegelberg------- —— ~~ —
Spondli---------- .-. —— .-.
Weisz---------- - ——— -

The curve of the present study is always represented by the heavy solid line.

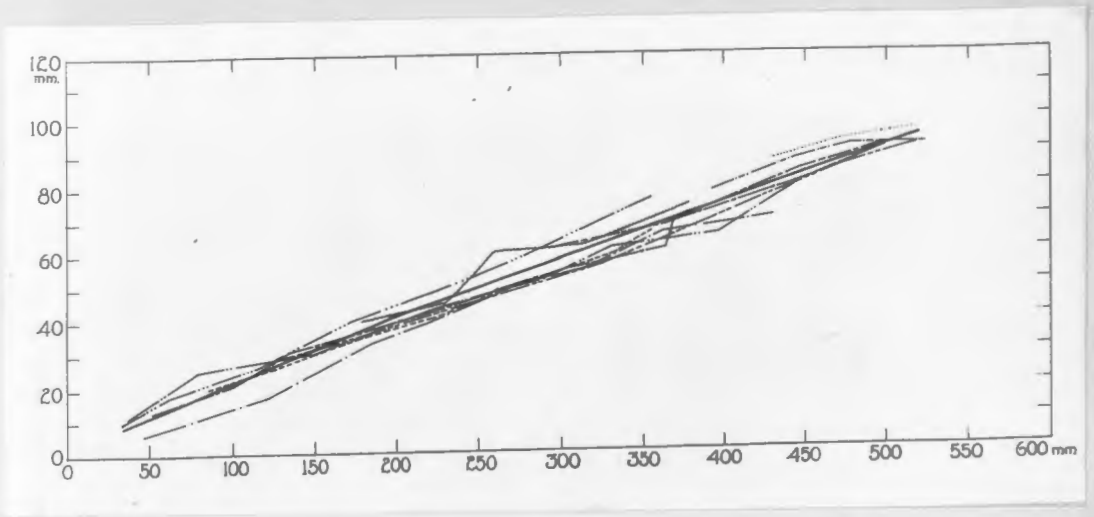

Figure 18
Bi-Parietal Diameter.

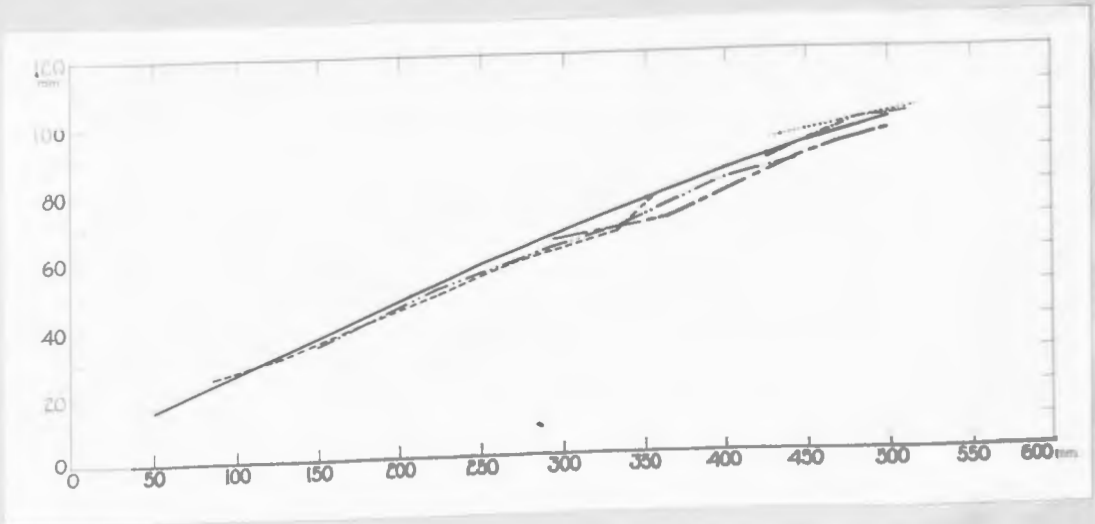

Figure 19

Suboccipito-Bregmatic Diameter.

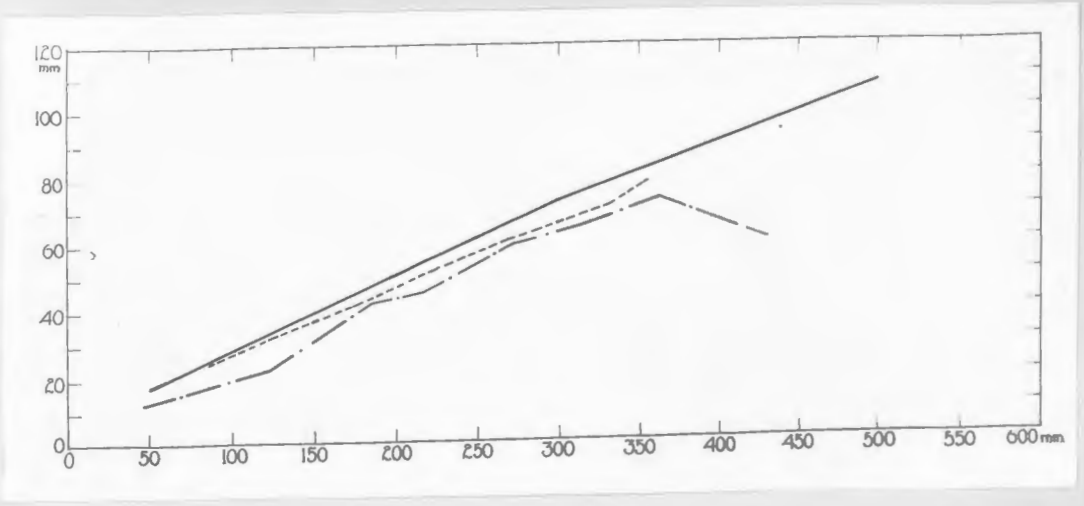

Figure 20
Suboccipito-Frontal Diameter.

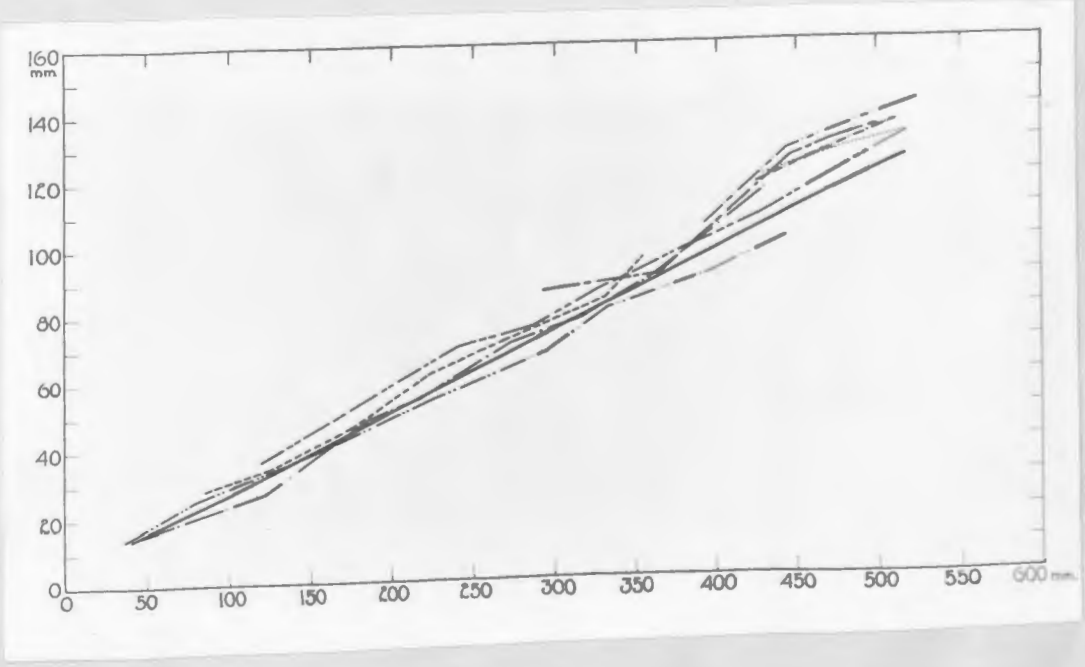

Figure 21.
Occipito-Mental Diameter.

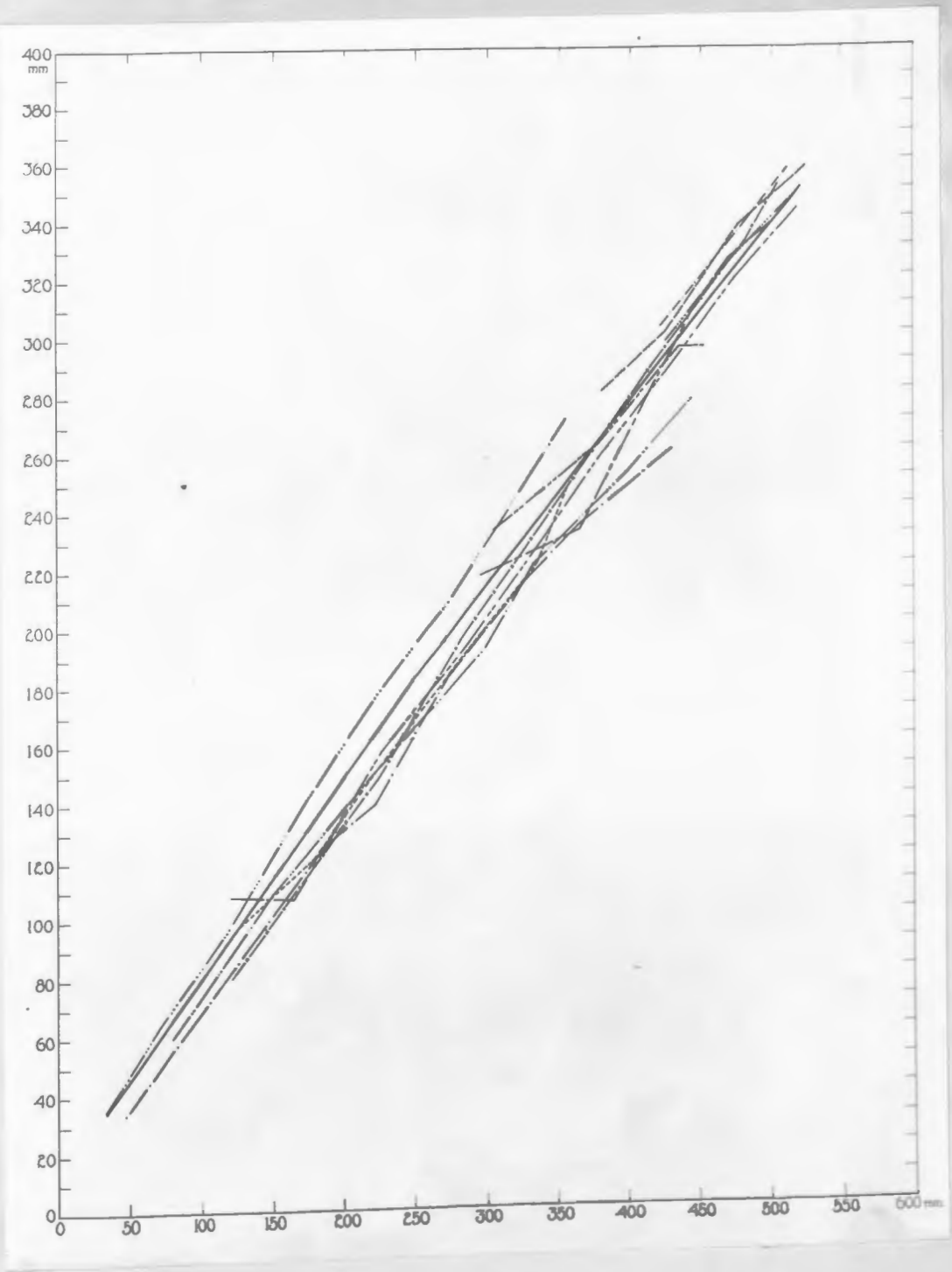

Figure 22

Horizontal Head Circumference.

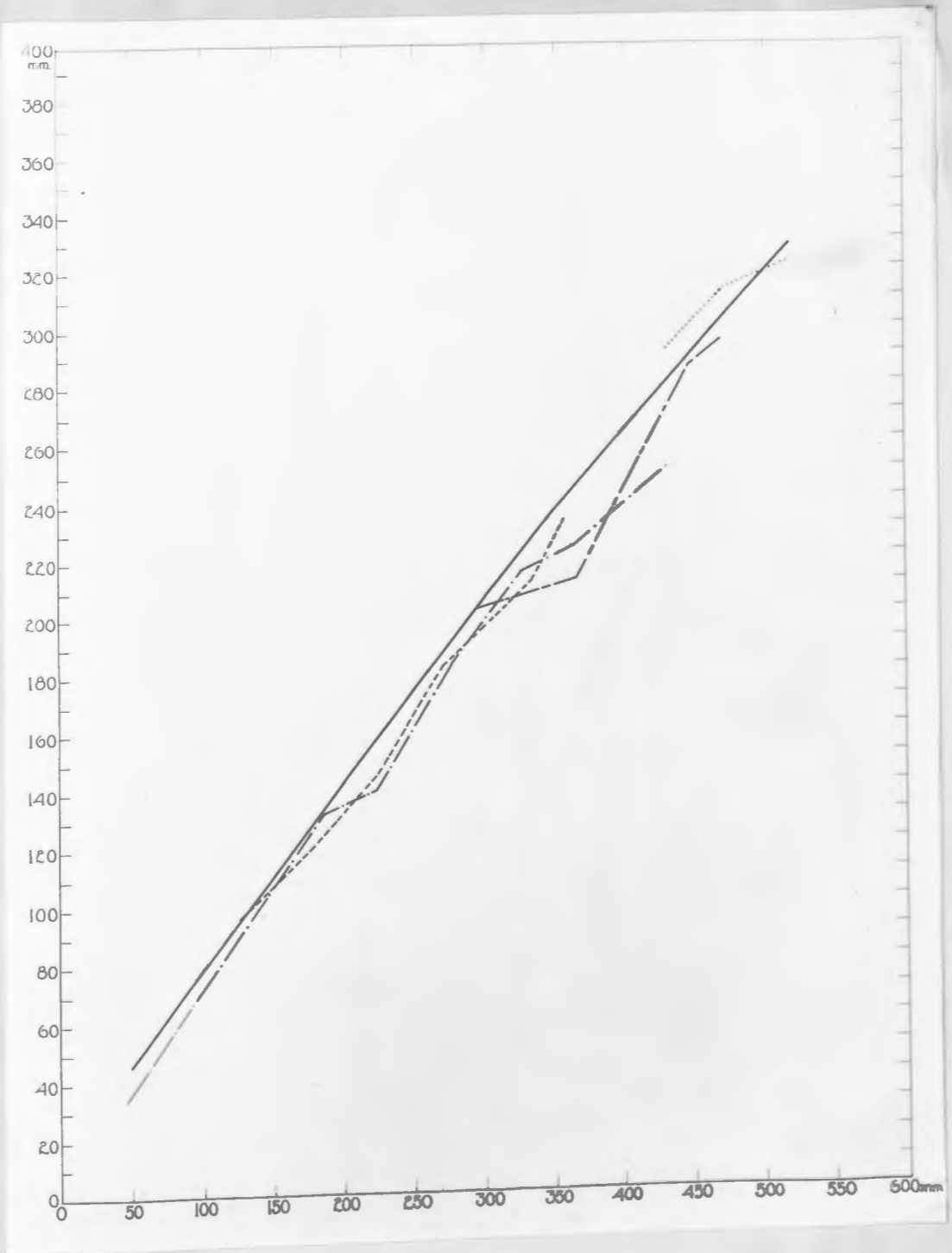

Figure 23

Suboccipito-Bregmatic Circumference.

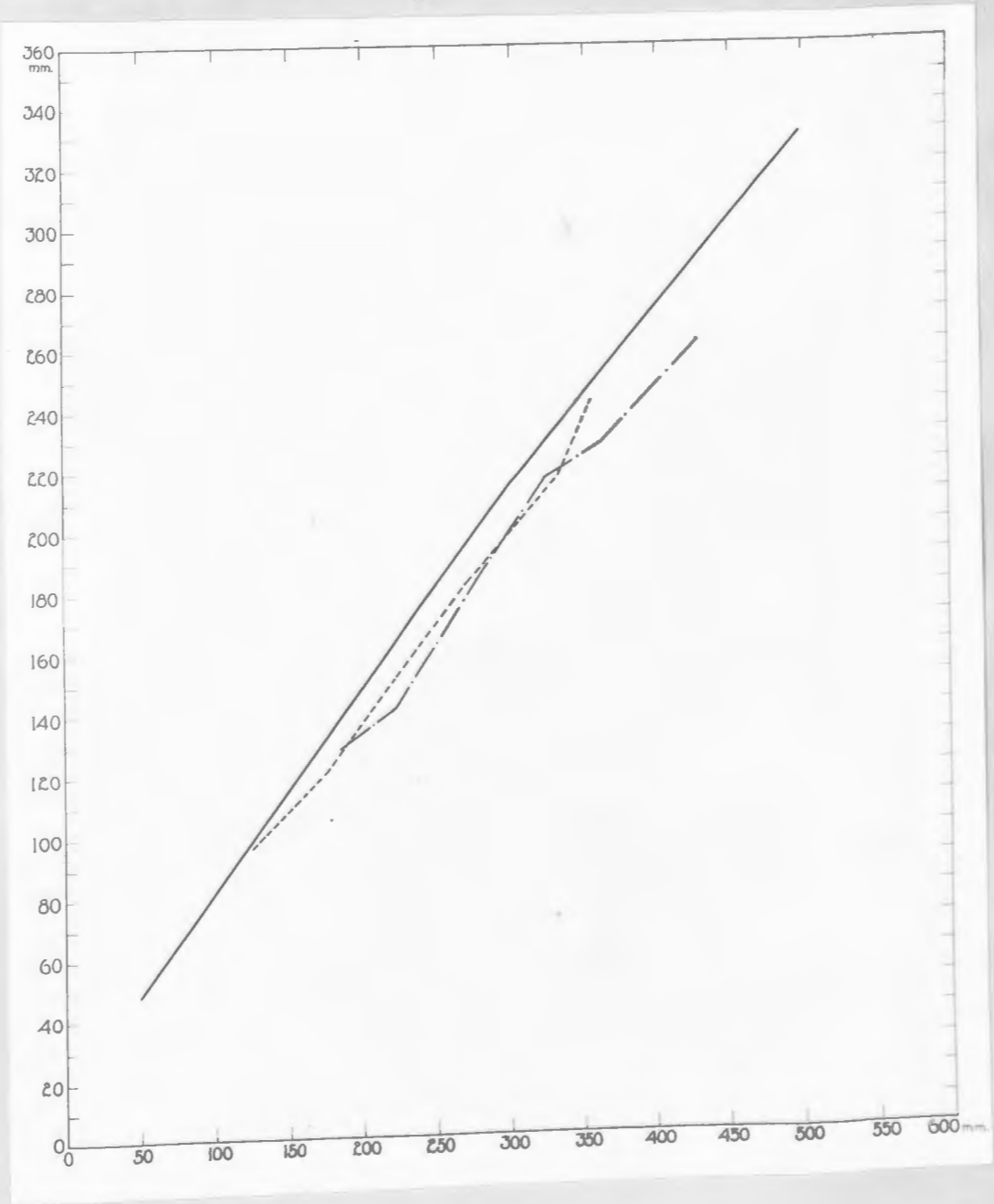

Figure 24

Suboccipito-Frontal Circumference.

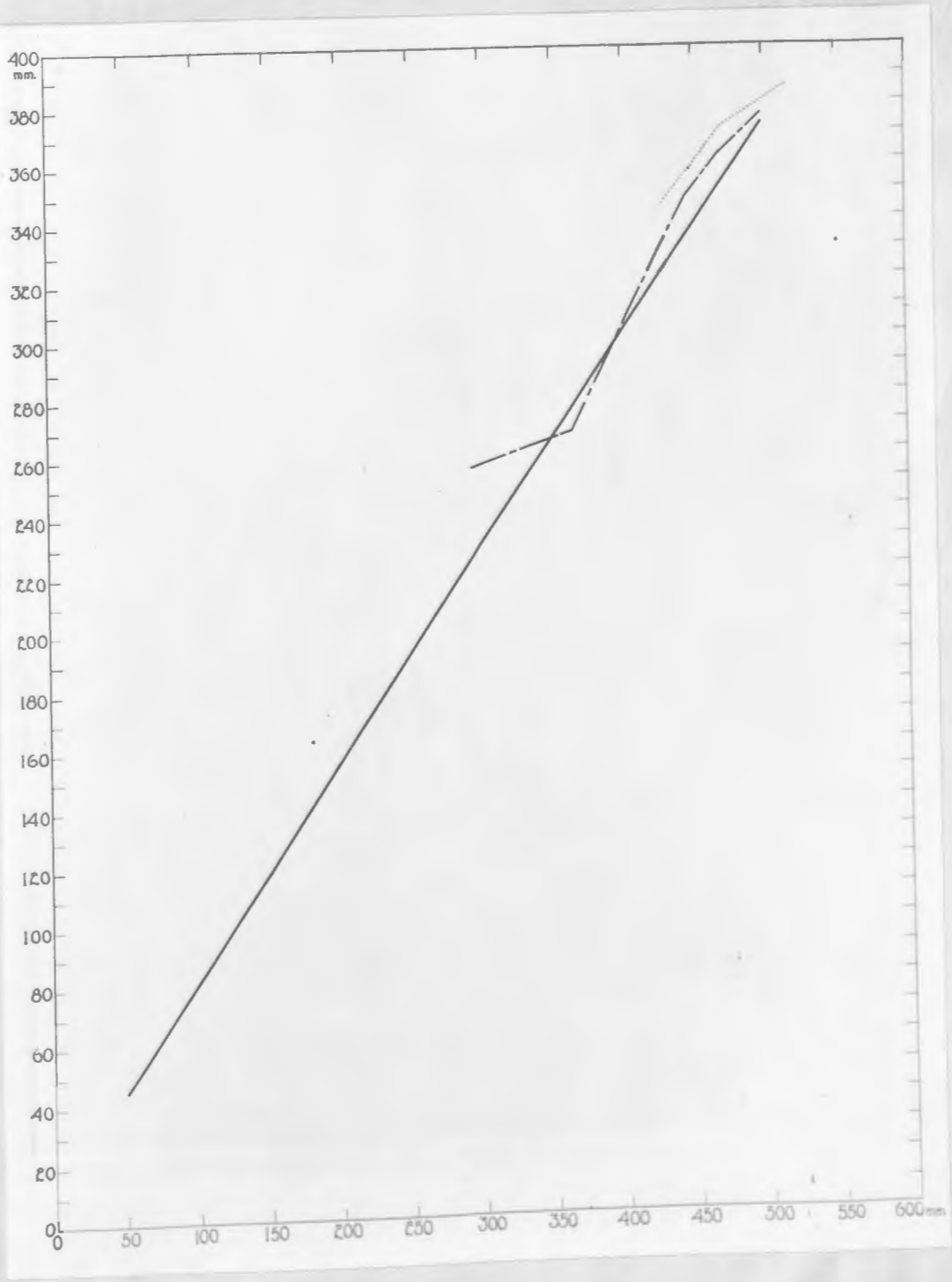

Figure 25

Large Circumference (Occipito-Mental).