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Fig. 1 (No. 346A).

Fig. 4 (No. 346B).

Fig. 5 (No. 164).

Fig. 2 (No. 346A).

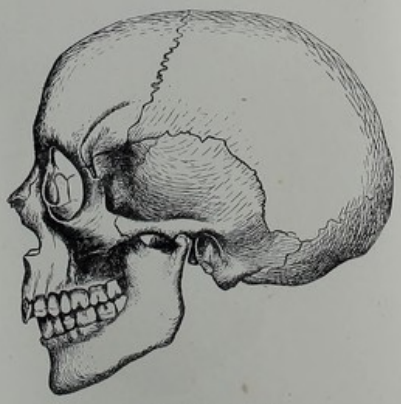

Fig. 3 (No. 346B).

Fig. 6 (No. 164).

Ancient Skulls from the Orkney Islands (*see* p. 54).

With the Authors Compts.

8

ON THE

OSTEOLOGY OF THE ANCIENT INHABITANTS OF THE ORKNEY ISLANDS.

BY

J. G. GARSON, M.D.,

Anat. Assist. Royal College of Surgeons of England; F.Z.S.; Memb. Anthrop. Inst.

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On the Osteology *of the* Ancient Inhabitants *of the* Orkney Islands.

By J. G. Garson, M.D., Anat. Assist., Royal College of Surgeons of England; F.Z.S.; Memb. Anthrop. Inst.

(With Plate I.)

In the following remarks I propose to direct the attention of the Institute to the osteological characters of those of our ancestors who formerly inhabited the Orkney Islands. Though much has been written on the prehistoric archæology of these islands, the physical anthropology of the early inhabitants is only known from short accounts, chiefly in the writings of Drs. Barnard Davis and Thurnam. The cause of this is, perhaps, not far to seek, since the osteological remains hitherto available for anthropological research have been very limited, though not so much on account of actual want of material as from its being scattered. Concentration of the osteological remains of all races in a few large museums, where such specimens are preserved and made available for scientific research and comparison, is very desirable. Single skulls, in the possession of private individuals or of small museums, are seldom of much use to any one, whereas collected together they are of the greatest use and scientific interest. The presentation of these to the larger anthropological museums is consequently much to be encouraged for the advancement of anthropology, and it is to be earnestly hoped, therefore, that every one who is able to assist us in this way will not lose an opportunity of doing so, especially those who possess well-authenticated skulls or skeletons of any of the ancient inhabitants of this country, or indeed of any race. Donors need not be afraid of their presentations being overlooked among the multitude of other skulls and skeletons in our larger museums, as I have often heard it expressed. It must be remembered that it is to these collections that anthropologists go when in search of information; consequently the specimens are more likely to be seen and used, while the catalogues, which usually not only record the history of the specimens, but also the munificence of the donor, are read and perused by many more who may not have the opportunity of examining the specimens.

The ancient inhabitants of the Orkneys are represented in the museum of the Royal College of Surgeons of England by one skeleton, more or less complete, and five skulls. In the museum of the University of Cambridge there are six skulls; in

the collection of the Society of Antiquaries of Scotland, at Edinburgh, there is one; and in the museum of the Philosophical Institute of Leeds there is another skull. To all of these there are well-recorded histories of the localities in which they were found, and of the objects which surrounded them. Through the kindness of Professor Humphry, I have had an opportunity of examining the Orkney skulls at Cambridge, as well as those in the College of Surgeons' museum. The single skulls at Edinburgh and Leeds I have not measured, but their chief dimensions are recorded in the "Crania Britannica."

As much information is to be derived from studying the osteological remains in conjunction with the archæology of the places in which they were found, I propose, before describing the specimens, to give a short history of these places, which were either places of abode or burial. Of the former there are the so-called Picts' houses, the most complete example of which is that of Skerrabrae, in Sandwick, which has been described and figured by the late Mr. George Petrie,[1] and was the subject of a second paper, containing the results of more recent excavations, by Dr. William Trail.[2] The buildings consist of a group of central chambers, arranged on both sides of a winding passage, into which they open. The most complete chamber is about 20 feet square. In the centre is the hearth, elevated a little above the floor; partitioned off by means of flagstones, set on edge, are small compartments arranged round the four walls; and on the floor are some stone cists, near one of which was found a very rude clay urn. The walls of the chamber are at present about 6 to 8 feet high. In each wall are openings which lead into small chambers, or cells; through one of these, which communicates by a doorway with the exterior, a drain passes outwards, and the opening seems to have been guarded. The openings into the central passage are two in number, one principal doorway and a second smaller one opening into one of the side chambers, which in turn opens into the central passage. The height of the main passage seems to have been 5 or 6 feet, judging from the portion where the roof is complete, and from 2 to 3 feet wide; at one part it widens out into a triangular corner; it also widens opposite some of the doorways of the chambers. From the fact that the jaw-bones of a large whale were found lying across the floor, one on each side of the hearth, it seems probable that the structure had been roofed. Four chambers, such as described, have been discovered and cleared out, but it seems probable that some others remain unexplored.

[1] "Proc. Soc. of Antiq. of Scot.," vol. vii, Part 1, p. 201 (1869).
[2] *Loc. cit.*, vol. viii, Part 2, p. 462 (1870).

There is some evidence of one of the chambers having been destroyed while the building was inhabited. In these dwelling-places great varieties of stone and bone relics, all of the rudest manufacture, have been found; amongst other things may be mentioned celts, which are rare in Orkney, and stone discs of various sizes; two circular stone balls, about the size of an apple, carved into a series of projecting conical points; bone chisels; pins; beads, at various stages of manufacture; bone cubes, or dice; various pieces of rude pottery, without any ornamentation; and lumps of unbaked clay. There were also found large stone mortars, which contained pounded bones and heaps, amounting to several bushels, lying near them. As indicative of the animals that existed, there were found the bones of sheep, pig, red deer, oxen, several large ox-bones, which Mr. Laing states[1] to be those of *Bos primigenius*, and the small straight bones of *Bos longifrons*; whales' teeth, and other bones, as well as those of dog and fish. Conspicuous by their absence were querns, whorls, the hand-comb, spears and arrows. No trace whatsoever has been found of any metals.

The human remains found in Skerrabrae consist of the skeleton 346A, a skull 346B, and a few other bones. The skeleton was found in the chamber described, near the fireplace, with the head to the north, the knees tucked up, and the arms folded; the head was the lowest part, and was about 3 feet above the floor. There were some other bones higher up in the sand than the body. As to the exact spot where the other skull and bones were found, I have not been able to ascertain; but Mr. Petrie states that "human bones were found in the triangular corner of the passage, along with bones of the ox, &c., and one of them, a femur, had been notched." Again, Mr. Laing mentions that "a fragment of a lower jaw and other human bones were found, with animals' teeth and bones, under the pavement in one of the chambers." The specimens were in the possession of the late Mr. Watt, who chiefly excavated the buildings, till his death, when they were thrown out of his valuable museum, and re-interred. "In the summer of 1879," says Dr. Charles Clouston, jun., by whom the specimens were presented to the College, "when in Orkney, I managed to find where they were, and got leave from the present Mr. Watt to have them dug up again. The place where both interments took place is dry and sandy, which, I suppose, accounts for their preservation." Such is the history of how these remains have been rescued and preserved for scientific investigation. The other skulls in the College of Surgeons' museum were found in stone cists in round barrows

[1] "Proc. Soc of Antiq. of Scot.," vol. vii, Part 1, p. 56.

at Newbigging, Rendall, and Townhill, the first two of which have been fully described by Mr. G. Petrie.[1] The Newbigging cist, which was of a complex nature, measured 4 feet 6 inches long, by 3 feet 1 inch broad, and 2 feet 3 inches deep, and lay east and west. It contained two skeletons. The one of which 162 is the skull lay at the east end, on the right side, with the right hand supporting the right cheek, the left arm and hand lying across the chest; the lower limbs were flexed and drawn up. The second skeleton lay at the other end of the cist on the left side, with the lower extremities flexed, and the femur and leg-bones across those of the first skeleton, which showed that the second had been the last to be placed in the cist. It was, moreover, so huddled together as to indicate its having been buried some time previous to being placed in the cist, or having been dismembered before being deposited. A heap of ashes, on which were some of the bones, was likewise found in the cist. The other bones and the skull fell to pieces on being removed; some fragments of the latter were preserved and sent to Dr. Barnard Davis, who considered it was probably that of a man. There are no remains of this skeleton in existence now. Near the barrow in which these skeletons were found, a clay urn and a skull were accidently discovered some years previously by some workmen, who at once re-interred the skull, but the urn was broken. No trace of the skull could be obtained by Mr. Petrie. The cist at Rendall measured about 5 feet long by 2 feet 3 inches broad and 2 feet 7 to 10 inches deep, and lay nearly north-west and south-east. It contained two skeletons, which Mr. Petrie tells us were remarkably like those he had previously found at Newbigging. At its north-west end was a skeleton which corresponded to No. 1 of the Newbigging cist, lying on the right side, with the right hand apparently placed under the right cheek, and the left arm and hand across the chest. The lower limbs were drawn up and flexed. The skull fell to pieces on being removed. At the other end lay a second skeleton, of which 164 is the skull, in a similar position on the left side; the arms, thigh, and leg-bones lay huddled together across and above the leg-bones of the first skeleton, and altogether it seemed as if it had been dismembered or crushed before interment. The bones were generally wasted, and crumbled down when exposed to the atmosphere; but Mr. Petrie says, "I was able to examine these sufficiently to ascertain that, while the upper part of the frame was broad and massive, the thigh and leg-bones were not of corresponding size." A second cist, measuring 3 feet long, 1 foot 10 inches wide, and 3 feet deep, was found a few feet distant

[1] *Loc. cit*

from the first, in which was a partially burnt skeleton, of which 165 is the cranium. The Townhill cist, in which skull 163 was found by Mr. Petrie in 1859, is described in the "Thesaurus Craniorum" as a short-flagged cist; but I have not been able to discover its dimensions, or further information regarding it.

Of the other skulls to be described, one was obtained in a cist in the parish of Harray, which measured 2 feet 10 inches long, by 2 feet 6 inches wide, and the same in depth; one from the Burg of Quoyness, in Sanday, regarding which I have not been able to ascertain any further history than the inscription upon it by Dr. Thurnam already given; and six were unearthed from the Knowe of Saverough, of which it will be necessary to give a brief description. This tumulus was opened in 1861 or 1862 by the late Mr. Farrar, M.P., by whom an account of its exploration has been published.[1] It is situated only a few feet above the seashore, and measures roughly 168 feet in diameter, by 14 to 16 feet in height. Its shape is liable to vary, from the shifting of the sand of which it is entirely composed. All the bodies were found in stone cists, which in many instances were broken. These appear to have been constructed on the surface of the ground, and to have been covered over with sand. The heads of the skeletons faced the north-west, except two which were turned to the north. At that time the remains of twelve or thirteen persons were found, and in several instances the skeletons were more or less complete, and in good condition; of these all that I know of are four skulls in the museum at Cambridge, one at Edinburgh, and one at Leeds. What has become of the other parts of the skeletons I am unable to say. That these should not have been as carefully preserved as the skulls is exceedingly unfortunate, as they would have been invaluable, if only for determining the sex of some of the skulls. Beside the skull now in Edinburgh was found an urn of baked clay; except this no relic was found with any of the skeletons, but in a cist by itself was found a bell. I may mention that no trace of the custom ot burning the dead, so common in round-barrow cists, was found here. A little distance from the cists, within the tumulus, the remains of an old building were discovered in a very ruined state, which Mr. Farrar recognised to be a "Broch," or burg, another kind of ancient dwelling found in Orkney, which is thought by some authorities to have been contemporary with the "Picts' Houses," but which others consider to belong to a later period. In this burg were found an ancient "comb," some whales' bones, bone pins, querns, and "a deer's-horn handle of some instrument, which retained yet the marks of iron tacks or nails."[2] In 1866

[1] "Gentleman's Magazine" (1862), Part 2, New Series, vol. xiii, p. 601.
[2] *Loc. cit.*

Mr. Farrar further explored the mound, and discovered a well-built wall, enclosing what appeared to have been a flagged court, an oblong stone like a ship's block, a bone pin, fragments of deers' horn, and a portion of a human skull. Outside the wall was the burg midden.

In order to determine, if possible, a little more accurately the history of this burg and the skeletons, we must compare it with other buildings of a similar kind. At Oxtro, which is about a mile from Saverough, some cists, containing urns filled with ashes and burnt bones, were found by Mr. Leask in deep-ploughing and levelling what appeared to be a natural hillock. They were the ordinary cists of the bronze period, and in some instances contained bronze ornaments. Below the cists, which were about 3 feet from the surface of the soil, traces of masonry were found, and on clearing away the rubbish to the foundation a complete circular burg, about 60 feet in diameter, was disclosed. This has now been thoroughly explored, and consists of two massive concentric walls, which in their present condition are about 6 feet in height. The inner wall encloses a large circular central chamber, from which there are doorways leading into smaller chambers, the external sides of which are formed by the outer wall. The cists and bronze articles were confined entirely to the strata above the burg, in which were found only deers' horns, bone and stone relics, &c. At Monkerhouse, near Stromness, Messrs. Laing and Petrie discovered the remains of a burg, about half of which has been carried away by the wasting of the coast-line. On the mound formed by the ruins of the burg an ancient chapel and cemetery have been placed. In digging in the cemetery quantities of bones and teeth have been turned up from the midden of the burg, and a rude hand-comb. In the outskirts of the midden, at about 3 or 4 feet below the present surface, cists between 5 and 6 feet in length are found, containing extended skeletons, the bones of which have been noticed to be very old, and the skulls very thick. The level of these cists corresponds to the foundations of the burg and is distinctly below that of the old chapel and cemetery. From these two burgs we learn important facts bearing upon the history of Saverough. We learn that burgs evidently existed long before the bronze period, since at Oxtro sufficient time had elapsed for the ruins of the burg to become covered over with several feet of soil before the inhabitants of the bronze period buried there. We learn from Monkerhouse that it was the custom, apparently, of the inhabitants of the burg to bury their dead in cists near the burg. This, I think, was very likely practised at Saverough, a conjecture which is strengthened by the relation of the cists to the burg found by Mr. Laing to

exist at Keiss, in Caithness, though it would be very desirable to procure, if possible, some skulls from the burg cists at Monkerhouse, for comparison with those from Saverough. I therefore do not agree with Mr. Farrar in his conjecture that Saverough "may have been used as a place of burial by some of the tribes inhabiting the islands long after it became a ruin." Both the probable history of the burg and the character of some of the human remains appear to me to be against its being a burial-place only of the comparatively recent date Mr. Farrar would lead us to suppose. That the mound has been used as a burial-place at different periods there is clear evidence from some of the skulls obtained from it. I agree, however, with Mr. Farrar as to the bell found in it having been placed there at a comparatively very recent date.

We have now to consider the physical characters, as indicated by the osteological remains before us.

Stature.

The datum we possess is, unfortunately, quite insufficient for establishing any accurate ideas as to the height of the ancient Orcadians. The only indication which I have been able to obtain is from the measurement of the skeleton from Skerrabrae, that of a woman, which, when articulated, measures 1·590 m. in height. This appears, from the most trustworthy results I have been able to obtain, to be about the mean height of the present existing English race of females. Professor Bowditch found that the height of young women between eighteen and nineteen years of age in Boston, U.S.A., was 62 inches = 1·575 m. Quételet gives 1·580 m. as the mean height of 300 Belgian women; while Krause[1] states that he found the average height of well-developed North German women between the ages of twenty and forty years to be 1·620 m. General Pitt Rivers found the average height of seventeen women whom he measured at Flamborough to be 5 feet 4 inches = 1·625 m. Probably, then, if we take 1·600 m. as the mean height of European women, we will be very nearly correct, the variations above and below this figure being exactly equal. The height of the skeleton before us, estimated from the lengths of the lower limbs, agrees very nearly with that of the articulated skeleton. Professor Humphrey has shown that the length of the femur, in proportion to the height of the body, is as 275 to 1,000.[2] The length of the femur being in this skeleton 442 mm., by this proportion the height of the body

[1] Krause, "Handbuch der Anatomie," 3te Aufl. (1879), Bd. ii, S. 9.
[2] Humphrey, "Treatise on the Human Skeleton" (1858), p. 108.

would be 1·607 m. Calculated from the length of the femur and tibia, according to Rolleston's method,[1] the estimated height would be 1·602 m. It is unfortunate that although several skeletons have been found, as we have learned from the histories of the excavations, none of these, or even of the long bones (from which the height could have been fairly accurately ascertained), have been preserved in at least any of our well-known anthropological collections. I may here observe that it is of the utmost importance to secure all the bones that can be got of these ancient inhabitants of Great Britain, whether in the Orkney Islands or elsewhere. The time is soon coming when all their osteological remains will be unprocurable. The history of other races that have become extinct without our having secured an adequate number of their skulls and skeletons, from which to study their osteological characters, should be a lesson to us in respect of those who have once inhabited our own country. Broca has very aptly said, "Pour les races peu connues, à défaut d'un squelette complet, tout fragment de squelette est une acquisition précieuse."[2] All the bones are of importance, I repeat, and would specially impress this upon antiquarians and those who are engaged in carrying on excavations in old barrows and other places where human remains are found. Many valuable skeletons are lost by the bones being very fragile and falling to pieces on being handled. These may, in most instances, be preserved by taking the simple precaution of melting a piece of spermaceti, and painting them over with it while still *in situ*. Should spermaceti not be at hand, a piece of paraffin, or composite candle, melted down and painted over the bones, will answer as well.

The Skull.

When the six skulls which I exhibit are placed on the table side by side, they can readily be separated into two groups, Nos. 346A, 346B, 163, and 165 forming one group, and Nos. 162 and 164 the other. The skulls at Cambridge likewise are divisible into two groups, Nos. 325, 326, 327, and 329 correspond to the first, while Nos. 322 and 330 correspond to the latter group; 323 (which seems to have been lost from the Cambridge collection), the skull at Leeds, and that at Edinburgh, belong, likewise, to this second group. These two groups are distinguished from one another by the skulls belonging to the first being longer antero-posteriorly in proportion to their breadth than those of

[1] Rolleston, "British Barrows" (1877), p. 564.

[2] Broca, "Instructions Générales pour les Recherches Anthropologiques," p. 11 (1865).

the second set, which are rounder in form. The first set are, as we will presently see, dolichocephalic, while the latter are mesaticephalic, or brachycephalic.

Sex.—Of the long or dolichocephalic skulls before us No. 163 can readily be singled out as that of a man, while the other three are those of women, though at first sight some doubt might be entertained as to the sex of 346A; more careful examination of it, as well as of the other bones of the skeleton, show that it belongs undoubtedly to the sex to which I have referred it. The skull, and in some respects the pelvis also, illustrates an observation made by Professor Welcher,[1] and confirmed by Professor Rolleston,[2] that the cases where ambiguity as to sex arises are cases in which female skulls have assumed, or must be supposed to have assumed, male characters. Of the other two round skulls before us, No. 162 is that of a man, and No. 164 that of a woman. This latter, we have found, was considered by Mr. Petrie to be that of a man, and has also been tabulated as such in the "Crania Britannica";[3] but in the "Thesaurus Craniorum" it is described as that of a woman. Without knowing of the discrepancy in the descriptions I classed it as a female. After finding that there had been doubts as to its sex, I placed it before our President, Professor Flower, who independently, and without apparent hesitation, classed it as a female skull. This being the skull of a female, there is reason to believe that the second skeleton in the Newbigging cist was also probably that of a woman, since Mr. Petrie states that its skull and the one before us were exactly alike, and differed from the skulls of the males at the opposite end of each of the cists in being rounder, and the bones of the skeleton shorter and smaller; though against this Dr. Barnard Davis states, very guardedly, however, that the fragments of the second Newbigging skull sent to him showed that "it might probably be that of a man." Though Mr. Petrie was mistaken in regarding the second skeleton in the Rendall cist as that of a man, and, I think by inference, probably also the corresponding one from the Newbigging cist, there is no reason to doubt this very careful and accurate observer when he tells us that the skull of the chief skeleton in the Rendall cist, which fell to pieces, was like the corresponding Newbigging skull, No. 162, that of a man, of exactly the same type. The history of the skeletons found at Rendall and Newbigging is therefore very interesting and suggestive. In both instances we have a man of brachycephalic type interred in the same cist with a woman of the same type,

[1] "Arch. f. Anthropologie," vol. i, p. 127 (1866).
[2] Greenwell and Rolleston, "British Barrows," p. 565 (1877).
[3] Table II, pp. 242, 243, No. LXXXIII.

who had been laid there after him, and who presented an appearance as if her body had been previously dismembered or roughly handled, and in the Newbigging cist partially burnt. We have, also, interred in close proximity to the Rendall skeletons, the partially burnt body of a woman of dolichocephalic type, and the record of another skull having been found in proximity to the Newbigging skeletons also. Contrasting those indications with what actually obtained amongst savage nations till recently, we have sound grounds for supposing that not improbably it was the custom amongst these ancient inhabitants of Great Britain, on the death of a chief, which in the above instances the conditions of burial would indicate the skeletons of the males to be, his wife was killed, possibly dismembered, and buried along with him, as well as one of his or her retainers. Of the round skulls at Cambridge two are those of men (Nos. 322 and 323), and one that of a woman (No. 330). Of the dolichocephalic skulls, one (No. 329) is a female; the other three (Nos. 325, 326, and 327) I have been obliged to classify as of doubtful sex. Many of their characters are female, but in some important respects they differ very considerably from that sex. Their imperfect condition renders it, without the other bones of the skeleton, impossible to determine their sex accurately. In the "Crania Britannica" they have been tabulated as female skulls, but in Dr. Thurnam's original catalogue, now at Cambridge, I find the following note:—"Crania 153-155" (these being the numbers the skulls had in Dr. Thurnam's collection) "were considered female, and are so marked. This seems quite doubtful." The skull at Leeds and that at Edinburgh are male.

Capacity.—Reference to the accompanying table shows that the capacity of the dolichocephalic male skull No. 163 is amongst the smallest, while No. 322 in the Cambridge Museum is considerably larger than any of the others. The average capacity of the six males is 1534 cc., measured with mustard-seed, according to Professor Flower's method. In order to compare the different measurements of these ancient skulls with those of Scotchmen of the present time, I have given a table of the measurements of eight males, chiefly inhabitants of Caithness, in the College of Surgeons' museum. Unfortunately, want of material has prevented me from adding a similar table of measurements of the female skull, of which we only possess a solitary specimen. The average capacity of the recent skulls is 1,490 cc. The six ancient Orcadian skulls are, therefore, 44 cc. larger than the modern skulls. Compared to male Europeans generally, the average capacity of which, according to Topinard,[1] is 1,560 cc. (deduced from 347 skulls), the Orkney skulls are slightly smaller, though not so

[1] Topinard, "Revue d'Anthropologie," 2nd Series, vol. xv, p. 398, *et seq.*

much as might appear from a comparison of the figures, since those measured by Broca and Topinard were cubed with shot, which gives a somewhat greater result than if cubed with mustard-seed, according to Professor Flower's method.

The capacity of the female skulls presents a greater variety than the males. Here we have the two skulls from Skerrabrae, both of which are dolichocephalic, occupying the two extremes of the series, 346A measuring only 1,200 cc., while 346B measures 1,420 cc., showing a difference of no less than 220 cc. The average capacity of the four measured is 1,290 cc. Compared to the average capacity of European women given by Topinard,[1] these skulls are considerably smaller, the average capacity of 232 of the former being 1,375 cc. The difference between the average capacity of the ancient males and females is 244 cc., while that between male and female Europeans is 185 cc. The difference in capacity between males and females, however, does not seem, from the extensive researches of Broca and Topinard,[2] to have the same significance as was once attributed to it.

The three skulls of doubtful sex were so imperfect that the capacity of none of them could be taken. One, however, is complete enough to admit of the capacity being estimated from the length, breadth, and height, according to Broca's method.[3]

A glance at the table will show that it is impossible to obtain any information respecting the relative capacities of the dolichocephalic and brachycephalic crania.

In the table of measurements I have added a column of the capacities of the skulls, both ancient and modern, taken with shot, according to Broca's most recent system, as laid down in a paper by M. Topinard in the "Revue d'Anthropologie," 2nd Series, vol. v, p. 394, July, 1882.

Cephalic Index.—This is the relation of the breadth of the cranium to its length, the latter being taken as 100. Before we can discuss this subject we must first fix the points between which the measurements of breadth and length are to be taken. The breadth of the skull has been taken by different observers as the maximum width of the parietal region, or that between the upper parts of the squamosals, or simply the maximum diameter, whether it be a parietal or squamosal. This latter is now almost universally adopted, and is, I think, the most satisfactory method of estimating the cranial breadth. Unfortunately the same unanimity of opinion does not exist as to the measurement of length. In this country Professor Rolleston advocated strongly measuring the length between the ophryon and the most pro-

[1] Topinard, "Revue d'Anthropologie, 2nd Series, vol. xv, p. 398.
[2] *Loc. cit.*
[3] Broca, "Instructions Craniologiques," p. 112 (Paris, 1875).

minent part of the occipital bone, and this plan has been adopted by Drs. Barnard Davis[1] and Thurnam, and by Professor Flower. Broca and other continental anthropologists have adopted the maximum length between the glabella, or nasal eminence, and the most prominent part of the occipital bone. Professor Rolleston, advocating the first mode of measuring the length, seems to have based his preferencefor the ophryo-occipital length chiefly because at the ophryon, to use his own words, "the applied arm of the compasses comes there into nearer relations with the cavity containing the cerebrum,"[2] his object evidently being to ascertain the length of the brain cavity; and much might be said in favour of measuring in this way. Against it I think we may adduce the facts that the point on the occipital bone upon which the one arm of the calipers rests, if the other is resting on the ophryon, is lower down than when the glabella is taken as the starting-point. The result of this is that we do not get the true length of the head, as it is seen on the living subject. Again, the length of the head in the living is usually estimated as the distance between the glabella and the most posterior part of the occiput: this corresponds to the glabello-occipital length. These points also being maximums, can be more easily and accurately measured than by taking a point on the brow, which varies more or less according to the measurer. The glabello-occipital length is, upon the whole, perhaps, the measurement most commonly adopted by anthropologists. It is also most nearly represented in drawings of the *norma verticalis* of the skull. That an understanding be arrived at as to which of the two methods is to be

[1] I may point out that M. Topinard has made a slight mistake in his work on "Anthropologie" (1876), where he states that Drs. Barnard Davis and Thurnam agree with Broca and others in measuring the length of the skull. Dr. Davis defines his measure of length as being "from the glabella to the most prominent point of the occiput, *the glabella being regarded as an inch above the naso-frontal suture*" (the italics are mine).

The following comparison of the lengths of the Caithness skulls given in Table II, will be, I think, convincing proof of Dr. Barnard Davis's measurement being the ophryo-occipital length; the first column is the number of the skull; the second is the measurement of length as given in the "Thesaurus Craniorum," converted from the English to the metric scale; in the third column is the ophryo-occipital length, as measured by myself; while the fourth is the glabello-occipital length, as defined by Broca:—

	Measurement of length in "Thesaurus Craniorum."	Ophryo-occipital length.	Glabello-occipital length of Broca.
No. 176	188 mm.	188 mm.	195 mm.
„ 177	185 „	185 „	186 „
„ 178	178 „	179 „	184 „
„ 179	183 „	182 „	184 „
„ 180	188 „	187 „	187 „
„ 184	181 „	181 „	185 „
„ 185	171 „	172 „	177 „

[2] Greenwell and Rolleston, "British Barrows."

adopted is very necessary, as the difference in the cephalic index is often very considerable, according as the one or the other method is used, and the results cannot be compared. In the present uncertain state of matters I have thought it advisable to give both the glabello- and the ophryo-occipital lengths, and the cephalic index formed by each.

The glabello-occipital length ranges from 186 mm. to 193 mm. in the three males, and from 178 mm. to 187 mm. in the six females. In the three skulls of doubtful sex the variation is between 190 mm. and 198 mm. The ophryo-occipital length in the six males varies from 176 mm. to 193 mm., and in the females from 165 mm. to 185 mm., the two most brachycephalic skulls being the shortest and also the broadest. The variations in maximum breadth of the skulls are less than those of the length. Of the male skulls, the narrowest has a maximum breadth of 144 mm., while the broadest measures 149 mm., the average being 146·5 mm. Of the females, the narrowest is 132 mm., while the broadest is 146 mm., the average being 137 mm. The three uncertain skulls vary from 133 mm. to 137 mm. in breadth, the average being 134·5 mm. The cephalic index presents considerable variations, indicating thereby considerable variation in the form of the cranium, the lowest index being 69·4, and the highest 82·0. Classifying the skulls according to their cephalic index, calculated from the maximum breadth as compared to the maximum or glabello-occipital length (the latter being taken as 100), we find that the male skull 163, and the female skulls 346A, 346B, and 165 of the College collection, and 325, 326, 327, and 329 (one female, and three of doubtful sex) of the Cambridge collection, or eight out of fifteen skulls, belong to the true dolichocephalic class of Broca; 323 (a male) of the latter collection is sub-dolichocephalic; the male skull 162 of the College collection, and 324 (a male) and 330 (a female) of the Cambridge collection, as well as the male skull at Edinburgh, and that at Leeds, or five out of the fifteen, are mesaticephalic, while 164 of the College collection is sub-brachycephalic.[1]

Calculating from the ophryo-occipital length and maximum breadth, and grouping the skulls according to their cephalic

[1] Broca's table of classification of crania, according to the cephalic index, as given in the "Revue d'Anthropologie," vol. i, p. 385 (1872), and in the "Instructions Craniologiques," p. 179, (1875), is as follows:—

Dolichocephalic	True dolichocephalic,	below and up to	75·0		
	Sub-dolichocephalic,	from	75·0	to	77·8
Mesaticephalic		„	77·8	to	80·0
Brachycephalic	Sub-brachycephalic,	„	80·0	to	83·3
	True brachycephalic,	above	83·0		

index, as Professor Flower has done,[1] a plan which has been followed in most of the recent monographs read before this Institute, we have results somewhat different. 325, 326, 327, 329, and 346B, or five out of fifteen, are dolichocephalic; 346A 165, 163, 323, 324, and the Leeds skull, or six of the fifteen, are mesaticephalic; while 162, 164, 330, and the Edinburgh skull, or four of the fifteen, are brachycephalic. Comparison with the table of measurements of the eight modern Scottish male skulls shows that while by Broca's classification the ancient skulls are either truly dolichocephalic or mesaticephalic, one half of the modern skulls are sub-dolichocephalic, and two are mesaticephalic; or by Professor Flower's method, while the ancient skulls are almost equally divided amongst the three classes, the modern skulls are all mesaticephalic except two, which are brachycephalic.

An interesting and instructive table may be compiled by placing the indices obtained by each method side by side, arranging the series of skulls according to their cephalic index, and indicating the locality from which each was obtained, and its sex. This I have attempted to do below.

A.—ANCIENT ORCADIAN SKULLS.

Cephalic Index calculated from Maximum Length (Glabello-Occipital) and Breadth.

True dolichocephalic.

No. of skull.	Sex.	Index.	Locality.	
327	doubtful	69·2	Burg	Saverough.
325	„	69·4	„	„
326	„	70·0	„	„
346A	♀	70·6	Picts' House	Skerrabrae.
346B	♀	72·3	„	„
329	♀	74·6	Cist	Harray.
165	♀	75·0	„	Rendall.
163	♂	75·0	„	Townhill.

[1] Professor Flower has proposed the following classification, according to the ephalic index, Osteol. Cat. Roy. Coll. Surg. Mus., Part I, p. 251 (1879):—

Dolichocephalic	below 75·0
Mesaticephalic	75·0 to 80·0
Brachycephalic	above 80·0

Sub-dolichocephalic.

323	♂	77·2	Burg	Saverough.

Mesaticephalic.

Leeds[1]	♂	77·9	Burg	Saverough.
324[1]	♂	78·0	,,	,,
162	♂	79·6	Cist	Newbigging.
330	♀	80·2	Burg	Sanday.
Soc. Ant. Scot.[1]	♂	81·0	,,	Saverough.

Sub-brachycephalic.

164	♀	82·0	Cist	Rendall.

Cephalic Index calculated from Ophryo-Occipital Length and Maximum Breadth.

Dolichocephalic.

No. of skull.	Sex.	Index.	Locality.	
325	doubtful	70·5	Burg	Saverough.
327	,,	72·1	,,	,,
346B	♀	72·3	Picts' House	Skerrabrae.
326	doubtful	72·7	Burg	Saverough.
329	♀	74·6	Cist	Harray.

Mesaticephalic.

346A	♀	75·0	Picts' House	Skerrabrae.
165	♀	75·0	Cist	Rendall.
163	♂	76·2	,,	Townhill.
323	♂	77·2	Burg	Saverough.
Leeds	♂	78·7	,,	,,
324	♂	79·2	,,	,,

Brachycephalic.

162	♂	81·8	Cist	Newbigging.
164	♀	82·0	,,	Rendall.
Scot. Ant. Scot.	♂	82·4	Burg	Saverough.
330	♀	83·6	,,	Sanday.

[1] These indices are approximate only.

B.—MODERN SCOTTISH SKULLS.

Cephalic Index calculated from Maximum Length and Breadth.

True dolichocephalic.

No. of skull.	Sex.	Index.	Locality.
176	♂	72·3	Caithness.

Sub-dolichocephalic.

180	♂	75·9	Caithness.
178	♂	76·6	Lewis.
184	♂	77·3	Caithness.
346	♂	77·7	Highlands.

Mesaticephalic.

177		78·5	
185		79·1	Highlands.

Sub-brachycephalic.

179	♂	81·5	Caithness.

Cephalic Index calculated from Ophryo-Occipital Length and Maximum Breadth.

Mesaticephalic.

176	♂	75·0	Caithness.
180	♂	75·9	„
178	♂	78·8	Lewis.
177	♂	78·9	Caithness.
176	♂	79·0	„
184	♂	79·0	„

Brachycephalic.

185	♂	82·0	Highlands.
179	♂	82·4	Caithness.

Index of Height.—Calculated from the glabello-occipital length and basi-bregmatic height, this averages in the six male skulls 75·2, and in the six females 71·9; calculated from the ophryo-occipital length it is 76·3 in the males, and 72·0 in the females. The height index of the eight modern male skulls is 72·7 by the first method, and 74·1 by the second. The basi-bregmatic height varies little in the individual skulls of either sex, except in the female 165, in which it is exceptionally low, measuring 10 mm. less than in the brachycephalic skull 164, which was found only a few feet from it. The frequent lowness of the vault of the cranium in the dolichocephalic race observed by Professor Rolleston[1] is further illustrated by skull 326, which is only 124 mm. in height. The average height of the six male skulls is 141 mm., and of four females 129·2 mm., a sexual difference of 11 mm. Compared with the maximum breadth, which averages in the male skulls 146·5 mm., in the females 137·0 mm., we find the height is less in all cases; the difference between these measurements averaging in the males 5·5 mm., and in the females 7·8 mm.; or the average height to the average breadth is in the males as 97·3 to 100, and in the females as 94·2 to 100.

The Circumference.—The horizontal circumference of the male skulls averages 531 mm., while that of the females is 508 mm., or 23 mm. less than the males; that of two of the skulls of doubtful sex perfect enough to be measured is 518 mm. Compared with the eight male modern skulls the ancient ones are somewhat larger in circumference, the former averaging 524 mm. The moieties of the circumference anterior and posterior to the auriculo-bregmatic line, or the pre-auricular and post-auricular circumferences of the ancient skulls, of both sexes, are so variable that from the small number examined no deductions can be drawn as to the relative sizes of each in the dolichocephalic and brachycephalic races. In skull 326, one of doubtful sex, the pre-auricular circumference is less than that of any of the female skulls, a fact which seems to point to deficient frontal development, in this instance at least.

The transverse vertical circumference is exactly the same in the three ancient male skulls, measuring 490 mm. in each. In the modern skulls it averages 452 mm., or 38 mm. less than in the ancient. In the ancient brachycephalic female this measurement is considerably greater than in the dolichocephalic skulls of the same sex, being in the former 443 mm., and averaging in the latter 418 mm., or 25 mm. less. In No. 326, of doubtful sex, it is 415 mm., or 2 mm. more than that of the lowest female skull. The antero-posterior vertical circumference, obtained by adding the longitudinal arcs, the length of the foramen magnum, and the

[1] "British Barrows," by Greenwell and Rolleston, p. 640 (1877).

basi-nasal length together, averages in the ancient males 523 mm., in the females 496 mm., and in the modern males 513 mm.

Projections.—In whichever way these are measured, whether, as Broca has done, with the skull placed so that the condylo-alveolar line is horizontal, or, as Professor Flower has recommended, with the axis of vision horizontal, it is almost impossible to obtain accurate measurements. Certainly Professor Flower's method is the more accurate, but even when taken in this way, with the most improved instrument, such as I exhibit to-night, in which the skull is adjusted to the proper position by means of a screw, a variation of 2 to 3 mm. occurs in the same skull when measured at different times. Though this may not matter so much in the anterior and posterior projections, yet 2 mm. is a considerable variation in the facial projection.

The figures given in Tables I and II are the average results of several independent measurements at different times. The average total projection of the two males is 199 mm., and of eight modern males 196 mm. The average of four females is 185 mm. The total projections of the brachycephalic female is shorter than that of the three dolichocephalic females, being 181 mm. in the former, and averaging in the latter 186 mm.

As I think it instructive to show the individual measurements from which those of the projections of the ancient Orcadian skulls given in Table I were arrived at, I append them in the following table :—

PROJECTIONS.

	Ant. Proj.	Post. Proj.	Facial Proj.
No. 162			
1st Meast.	100 mm.	101 mm.	25 mm.
2nd „	100 „	100 „	26 „
3rd „	99 „	100 „	27 „
4th „	100 „	100 „	26 „
5th „	100 „	101 „	28 „
No. 163			
1st Meast.	99 mm.	98 mm.	25 mm.
2nd „	97 „	100 „	15 „
3rd „	98 „	101 „	20 „
4th „	100 „	102 „	23 „
5th „	98 „	100 „	14 „
No. 346A.			
1st Meast.	97 mm.	90 mm.	22 mm.
2nd „	95 „	92 „	20 „
3rd „	95 „	94 „	23 „
4th „	94 „	91 „	18 „
5th „	96 „	94 „	22 „
6th „	95 „	93 „	20 „
7th „	96 „	93 „	21 „
No. 346B.			
1st Meast.	91 mm.	92 mm.	9 mm.
2nd „	88 „	96 „	8 „
3rd „	88 „	99 „	11 „
4th „	86 „	98 „	8 „
5th „	89 „	99 „	10 „
6th „	88 „	98 „	11 „
7th „	88 „	99 „	8 „

The auriculo-orbital width varies considerably in the female skulls: in the two from Skerrabrae it is 61 mm., while in the Rendall skulls it is 66; in three male skulls it averages 71 mm., and in the modern males 65·2.

Gnathic Index.—This ranges from 91·8 to 102·1, giving an average in males and females, between which there does not seem to be any difference, of 97·0. In all instances, except in the female skull 330, the basi-nasal length is greater than the basi-alveolar. The same condition obtains in the modern Scottish skulls. Both the ancient and the modern skulls belong to the mesognathous group of Professor Flower.[1]

The Facial Index, or the relation of the bi-zygomatic width to the ophryo-alveolar length, the former being taken as 100, is 75·8 in the females, and 73·9 in the males. In the females the indices of the dolichocephalic skulls are all higher than that of the brachycephalic skull. The facial index of the eight modern male skulls averages 74·4.

The inter-orbital width averages exactly the same in both the ancient and modern skulls, viz., 23·4.

The portion of the maxillary bones between the floor of the nose and the alveolar margin is well developed, averaging 23·3 mm. in the males, and 23·6 mm. in the females; in the modern skulls it averages 21 mm.

The form of the orbits vary; in some of the skulls they are round, as, for instance, in 346B, whereas in the majority they are of a square shape. The orbital index, or the relation of the height to the breadth, indicates this very well in the skull referred to, it being considerably higher than in the others. The only other skull of those exhibited which approaches this form is 165, in which the orbit is more or less round, though not so markedly as in the previous instance.

The indices show considerable variety, both in the individual skulls and in the sexes. The two male skulls on the table, 162 and 163, are microseme, and 323 at Cambridge is mesoseme, but the average index of the three (82·8) places them in the microseme group. Of the females 346A and 164 are microseme, the others are mesoseme, though 346B is within two decimal places of being in the megaseme group. The average of this index in the females is 85·0; they are therefore mesoseme. The average index of the eight modern skulls is 84·5; they are consequently

[1] Professor Flower divides crania, according to their alveolar indices, into the following categories (see Osteolog. Cat. Mus. Roy. Coll. Surg., Part I, p. 252, 1879):—

Orthognathous	below 98·0
Mesognathous	98·0 to 103·0
Prognathous	above 103·0

mesoseme, though half of them are microseme, as an examination of the table will show.

Nasi-malar Angle.—This angle could only be measured in a few of the skulls on account of the imperfect state of some of them. In the male skull 162 the angle approaches the size it obtains in the Mongolian skulls, which are distinguished by their flatness in this region, and consequently high nasi-malar angle. The slope of the nasi-orbital plane in the modern skulls corresponds to that of skull No. 163, averaging in them 135°. In the females the backward and outward slope of this plane is still greater than in the males, the nasi-malar angle being in them 128°—132°, except in No. 330 of the Cambridge collection, where it is 143°. It is worthy of observation that this angle is highest in the brachycephalic skulls.

The Nasal Index varies from 40·2 to 58·1, being rather greater in the females than in the males; consequently the form of the nasal aperture is broader in them than in the males. From the small number of male skulls not much importance can be attached to this comparison however, and the indices of both sexes may be included in one average; no perceptible difference seems to exist between the indices of the brachycephalic and the dolichocephalic skulls. The average index of all the skulls is 48·7; they are therefore mesorhine. The average index of the modern male skulls is 48·2, so that they correspond very closely with the ancient. Regarding the form of the nasal bones, and other nasal characters, I shall have something further to say.

The Palatal Index is higher in the male skulls than in the females, the average index of the former being 121·3, and 113·4 in the latter. The skull of uncertain sex shows a considerable variation from the others in that this index is much higher, being 128·0. The palatal index of the eight modern male skulls is 112·1; lower, therefore, considerably, than in the ancient males, and corresponding to that of the females. The measurements of the palate, from which these indices are derived, differ from Broca's in that the length is measured from the aveolar point to the centre of a line drawn across the maxillary tuberosities, and the breadth is the maximum between the outer borders of the alveolar arch, as described by Professor Flower.[1]

The Mandible.—The bigoniac width shows a marked sexual difference, the average for the males being 104·5 mm., while that of the females is 89 mm., or 15·5 mm. less than the males. A corresponding difference in width is shown by the bicondylar width. The height of the symphysial ~~posterior~~ portion is also smaller in the females by 6 mm. on the average; but the

[1] See "Memoir on Fijian Crania" ("Journ. Anthrop. Inst.," Nov., 1880, p. 161).

molar height does not maintain the same relation, the difference between the two sexes being only 3·3 mm. less in the females than in the males. The sexual difference is still more marked in the height of the coronoid, which in the males averages 70·7, and in the females 57·3 mm, or 13·4 mm. less. The difference in length of the portion of the ramus between the gonion and the symphysis averages 16·8 mm. in the two sexes, the females being the shorter by that amount. The height of the ascending ramus and its antero-posterior breadth shows also considerable difference in the two sexes, being considerably smaller in the female.

The form of the mandible in the skulls of uncertain sex approaches more nearly to the male type, as indicated by those before us, than to the females.

The mandibular angle in the males averages 116·3°, and the symphysial 77·5°; in the modern skulls the average of the former angle is 121·6°, and of the latter 72·2°; the chin in the modern is therefore more pointed than in the ancient skulls. In the females the mandibular angle averages 122°, and the symphysial 83·2°.

Having now directed attention to the principal characters indicated by our table of measurements, there remain yet to be described certain morphological details which cannot be expressed by ordinary measurements; these are indicated in the various *normæ*, viz.: *norma lateralis*, *norma verticalis*, *norma frontalis*, *norma occipitalis*, and *norma basilaris*, which I will not treat *seriatim* in each skull, but give the general results. All the skulls are those of adults, varying, probably, from between thirty to seventy years of age.

The Condition of the Teeth.—In skull 162 several of the teeth have been lost after death, but the first right lower molar during life. Those that remain are considerably worn down, and have tartar deposited upon them. In No. 163 the last right upper molar is absent, and there is no trace of its ever having been developed. The teeth are somewhat worn, but not more so than usual in a man of middle age; traces of the cusps still remaining, and a fifth tubercle is present on the last lower left molar. The skull 323, at Cambridge, has almost all the teeth present except the wisdom teeth, which appear never to have been developed; but they are very much worn, and the surfaces are "oblique and jagged, as if from gnawing roots or tearing flesh from bones," as Dr. Thurnam has very aptly expressed their condition.[1] In the skull at Leeds one of the wisdom teeth is absent, and the others are considerably corroded, but not quite so advanced in wear as in the previous skull, the skeleton having

[1] "Gentleman's Magazine," *loc. cit.*

been that of a young man about thirty years, while No. 323 is that of an older man. The skull in Edinburgh presents a condition of the teeth, as regards wear, similar to that in the Leeds skull. Of the female skulls the teeth of No. 346A are very much worn, but in excellent preservation; the cusps have been worn away. In No. 346B they are normal and very little worn; a small fifth tubercle is developed on the last left lower molar. In No. 165 the teeth are all lost; several have been lost during life, and the alveolar margin is shrunk. Those of No. 164 are very much ground down, and have tartar deposited upon them. Dental prognathism is indicated in No. 346A. In none are the teeth abnormal in size. In those of doubtful sex the teeth are worn down, but in good condition in No. 325.

The Sutures.—In No. 162 they are much obliterated and difficult to trace, owing to the skull having been painted over with preservative material. Generally speaking, their condition as to closure seems to be indicated by No. 3 of Broca's standard tables,[1] while their complication is represented by No. 3 of the same author. Those of skull 163 correspond to 2 and 3, both in their complication and closure. In No. 346A the complication of the chief sutures is represented by 2 to 4, and the degree of closure by 3. The wormian bones are medium sized, Nos. 2 and 3 ("*moyens*" of Broca). In 346A the sutures correspond to 3 and 4 in complication, and 3 as to their state of occlusion; there are few wormian bones, and those are small ("*petit*" of Broca, No. 1). In skull 164 the sutures can hardly be traced, their occlusion corresponding to No. 0. In skull 165 they vary in complication from 2 to 4, and 2 to 3 as to their state of closure; the wormian bones are small, being represented by No. 1.

The other skulls at Cambridge which I have examined show similar conditions as to complications and closure of the sutures. It may be generally stated that the sutures of these skulls are, could the term applied by Broca to indices be used, "mesoseme." In none of the skulls, either in the College of Surgeons' museum or in the museum at Cambridge, is there metopism, or persistence of the frontal suture, present. The basilar suture is closed in all the skulls.

The development of the inion is feeble, never more than is represented by Broca's figure[2] No. 1, and in 346B and 164G No. 0.

In skull 163 an epipteric bone is developed; this is of triangular shape, and does not stretch across the whole width of the *ali-sphenoid*, which accordingly articulates antero-superiorly with

[1] "Instructions Générales pour l'Anthropologie," Pl. VI (1865).
[2] *Ibid.*

the frontal, postero-superiorly with the parietal and epipteric, and postero-inferiorly with the temporal.

Some of the skulls are what Mr. Busk calls *phænozygous*, or partially so: that is to say, in the *norma verticalis*, when held at arm's length and looked at with one eye, the other being shut, both zygomatic arches are to be seen at the same time. The condition depends upon the comparative development of the fronto-parietal region, and the zygomatic arches. It is complete in skulls 162 and 346A, and partial in 346B. The zygomatic arches being broken in several of the series, it is impossible to tell the condition which obtains as a rule. In No. 164, however, nothing can be seen of the arches.

The *tubera* of the parietal bones are well marked in 364A, a condition which does not obtain in the other skulls I have examined. The prominence of the tubera is associated, in this instance, with a narrowness of the base of the skull, conditions found by Weisbach[1] usually to co-exist, and considered by him to be a child-like character retained most commonly in female skulls which have failed to attain the rounding out of the parietes which occurs from the latest expansion of the brain.[2] This skull shows, to some extent, the "ill-filled" condition of Cleland[3] which does not obtain in the other skulls, and which is in keeping with the prominent tubera.

Asymmetry of the posterior part of the cranium occurs in some of the skulls. In No. 162 it exists on the left side, and in Nos. 346A and 346B on the right side. The distortion in the first-mentioned specimen has been commented on by Dr. Barnard Davis, who thinks it open to question as to whether or not the early Britons were in the habit of distorting the skulls of their children, a custom which has been traced to exist in many parts of Europe in early times, as well as amongst the savage races of America and Polynesia, &c. The distortion, such as is seen in the skulls before us, is often found to be on the right side, as in two of these three skulls in which it occurs, and has been attributed by some to the skull having lain for a number of years on the same side, and having been subject to superincumbent weight. Others have attributed it to the subject of it having been carried when an infant with the head pressed against the person of the mother, and have accounted for the deformity being most frequently found on the right side by the fact that mothers are usually right-handed, and in order to have this hand free they would naturally carry their children on the left arm; the right side of the child's body would there-

[1] "Arch. f. Anthropologie," vol. iii, p. 68.
[2] Cleland, "Phil. Trans.," 1870, p. 149.
[3] *Loc. cit.*

fore be next to the left of the mother's. The question as to whether or not the distortion, such as is present in these skulls, and in those figured by Professor Huxley in the "Prehistoric Remains of Caithness," is not due to simple asymmetrical development of the skull, has not, I think, received the importance that is due to it. It is a fact well-known to all who have made investigations on the form of bones that asymmetry is one of the most common occurrences in the skeleton and for which no cause can be assigned. It is also clear that bones are not developed with any mathematical accuracy. Deformity from pressure is always accompanied, as far as I have seen, by a distinct *flattening* of the part where the pressure has been applied or acted upon. Now in the skulls before us, and in the others I have examined, there is no trace of any flattening: the outline presents an unbroken curve, only it is not symmetrical, on each side of the mesial line.

The form of the forehead varies considerably. The glabella is prominent in some and very flat in others, as is seen by comparing the ophryo- and glabello-occipital lengths. Again, the forehead in some of the skulls is almost perpendicular, while in others it recedes more rapidly. The accuracy of Professor Rolleston's assertion, that the forehead of brachycephalic skulls "is sometimes vertical, and especially in cases where the whole skull and skeleton are marked by great strength, or even ruggedness, it is markedly sloping," is well illustrated by skulls 164 and 162. The sloping of the forehead cannot, however, be considered to be a sign of deficient development of the anterior lobes of the brain, or a vertical forehead of the reverse without reference to the rest of the head, and in neither of these skulls is there any deficiency in the total circumference, or in the pre-auricular portion of it. The deficiency occasioned in No. 162 by the backward sloping of the frontal bone is made up by the extra width of that bone, as indicated by its maximum breadth. The different cranial measurements of No. 164, likewise, show that it is in all respects well balanced, the shortness being compensated for by greater breadth, while the circumference remains the same as in the other skulls. The sloping backwards of the cranium is always more marked in males than in females, a fact that is illustrated very clearly in this series of skulls. Prominent supra-orbital ridges coupled with a prominent overhanging glabella, as in skull 162, causes the forehead to have the appearance of receding much more than it does in reality.

The supra-orbital ridges are well developed for a female in the skull 346A, and also in the skulls of doubtful sex at Cambridge, while they are very flat in the others I have examined. The form of the forehead, as to breadth, is well indicated by the minimum frontal diameter. It is narrowest in the dolicho-

cephalic skulls. 346B exhibits a peculiar roundness and well-filled appearance of the frontal region, together with a degree of sharpness of the forehead which is not observable in the other skulls, except it be in No. 163. A front view of No. 346A, fig. 2, Pl. I, exhibits, besides the narrowness of the frontal region, a marked asymmetry of the tempоro-parietal portion of the cranium, which is twisted round to the left side: this is especially well seen in a stereoscopic tracing of the *norma frontalis*. The profile of the region of the glabella is represented by the following numbers of Broca's table[1]:—162, by outlines No. 3; 163, by No. 2; 346A, by No. 1; 346B, 164, and 165, by No. 0.

The auriculo-bregmatic line.—When the cranium is placed with the axis of vision horizontal, this line is in all the skulls, and in both sexes, inclined forward at the upper end, a condition which Professor Flower found to obtain in the Andamanese skulls, while in European skulls this line, he says, is usually vertical, or may incline backwards.[2] In the eight modern Scottish skulls I find that in four the line is inclined more or less forwards, and in four more or less backwards.

The characters presented by the form of the nose can, unfortunately, only be imperfectly studied in this series, because in several of the skulls the nasal bones are broken, as is also the nasal spine. In No. 162 the outline of the curve of the nasal bones is represented by No. 4 of Broca's table,[3] and the nasal spine by No. 2; in skull 163 the nasal bones by No. 3, and the spine by No. 1; in 346A the nasals by No. 4, and the spine by No. 2; in 346B the nasals by No. 3, and the spine by No. 2; in No. 165 the nasals by No. 4, and the spine by No. 2 or 3. The base of the nose is narrow, and the nasal bones are usually laterally compressed at their basal suture, except in skull 165, in which the root of the nose is flat. The nasal bones are narrow superiorly, and broaden as they descend and project forwards. The lower margin of the nose is well formed, a well-marked ridge existing between the floor of the nasal cavity and the anterior or facial surface of the maxilla.

The malar bones are heavy in No. 162, being deep from above downwards. In this respect considerable difference is manifested in the various skulls, as, for example, between 346A and 346B, in the latter the malars are heavier than in the former.

The Pelvis.—Next in importance to the form of the skull in determining rare characters is the pelvis. Unfortunately we have only a single specimen of this part of the skeleton, that

[1] "Instructions Générales pour l'Anthropologie," Pl. VI.
[2] "Journ. Anthrop. Inst.," Nov., 1879, p. 42.
[3] *Loc. cit.*

belonging to the female skeleton 346A. In the general appearance the bones are somewhat rugged, and in this respect resemble those of a male. This is probably due to the subject having possessed a strongly developed muscular system. The measurements which I have found to be of chief importance are given in the following table, and have been taken in the manner recommended by me in a previous paper:—[1]

	Measurements of ancient Orcadian pelvis.	Average of these measurements in Europeans.
Sacral length	110 mm.	101 mm.
Sacral breadth	125 „	118 „
Ant. sup. iliac spine width ..	245 „	231 „
Inter-iliac crest width	270 „	271 „
Pelvic height	207 „	201 „
Iliac breadth	154 „	157 „
Posterior superior iliac spine width	79 „	84 „
Acetabulo-symphysial width ..	124 „	117 „
Pubo-ischeal depth	94 „	91 „
Antero-posterior diameter of brim	101 „	106 „
Transverse diameter of brim ..	132 „	133 „
Antero-posterior diameter of outlet	115 „	116 „
Transverse diameter of outlet..	102 „	116 „
Sub-pubic angle	76° „	76° „

The chief points of difference in the ancient Orcadian pelvis from the average modern European pelvis consist in the large size of the sacrum, it being both longer and broader than usual. The anterior superior iliac spines are farther apart, consequently the outline of the iliac crest is not so much curved as usual; the distance from the posterior border of the acetabulum to the symphysis is longer, and the pubo-ischeal depth is somewhat greater than the average; the antero-posterior diameter of the brim is shorter, and the transverse diameter of the outlet is somewhat narrower than usual. The transverse diameter of the brim, the crest width, breadth of the sub-pubic angle, and most of the other measurements correspond to the average of European females. The pelvic index, or the relation of the antero-posterior to the transverse diameter (the latter being taken as 100), which indicates the fundamental form of the pelvis, is 76·5, while that of 35 Europeans, given in Table II of my paper, already cited, is 82·2. The transverse diameter of the pelvic inlet is therefore greater in proportion than the antero-posterior. The opposite condition obtains at the outlet, where the antero-posterior diameter is greater in proportion to transverse. The pelvic outlet presents decided male characters, as regards its transverse diameter, but those are compensated for by the sub-pubic angle

[1] "Pelvemetry," by J. G. Garson, M.D. ("Journ. of Anat. and Phys.," vol. xvi, p. 106, 1881).

being decidedly female in character; indeed I have only measured one male pelvis which had so large an angle as 76°, the average sub-pubic angle in the male being 64°. The form of the pelvis, taking all the measurements into consideration, does not exhibit any signs of being that of a low type, and, but for the shortness of the antero-posterior diameter of the brim, and the narrowness of the outlet, would be perfectly normal.

The Limb Bones.

The following are the measurements of skeleton 346A, the only long bones of the ancient Orcadians I have been able to measure :—

	Right.	Left.	Mean.
Clavicle ..	136 mm. ..	140 mm. ..	138 mm.
Humerus ..	325 „ ..	318 „ ..	321·5 „
Radius ..	241 „ ..	238 „ ..	239·5 „
Femur ..	445 „ ..	442 „ ..	443·5 „
Tibia ..	367 „ ..	367 „ ..	367 „

The mean length of the clavicle being 138 mm., and that of the femur 443·5 mm., the length of the former as compared with the latter (this being taken as 103) is 31·1. In the average European male skeleton the clavicle is to the femur as 32·7 to 100, as was pointed out by Professor Flower, who also found in the Andamanese[1] that the clavicle in the males is to the femur as 29·1 to 100, and in the females as 28·3 to 100. On the assumption, then, that the same proportion exists between the clavicle and femur of the two sexes, in Europeans as in Andamanese, the length of the clavicle to that of the femur of this ancient Orcadian would be exactly normal. In the skeleton of a French woman in the College museum the proportion of the clavicle to the femur is 30·6 to 100.

The combined length of the humerus and radius shows the right limb to measure 566 mm., and the left 557; the right arm is therefore 10 mm. longer than the left. This condition is one which I have found to occur in two out of every three skeletons in a series of fifty which I examined. The combined lengths of the femur and tibia give a length to the right lower limb of 812 mm., and to the left of 809 mm.; the right extremity is therefore also the longer by 3 mm. This is somewhat contrary to what is generally the case, as I have pointed out,[2] that in 79 skeletons I found 41 instances where the left limb was the longer, and in these its average preponderance was 3·8 mm.;

[1] *Loc. cit.*

[2] "Journ. of Anat. and Phys.," vol. xiii, p. 502 (1879).

TABLE I.—MEASUREMENTS OF ANCIENT SKULLS FROM THE ORKNEY ISLANDS.

TABLE II.—MEASUREMENTS OF EIGHT MODERN SCOTTISH MALE SKULLS.

in 20 instances the left was the longer, in these the preponderance was 2·9 mm.; while in 9 cases of the 70, the limbs were equal. Comparing the upper with the lower limb, and taking the mean length of each (that of the upper being 561 mm., the lower 810·5 mm.), we find that the *inter-membral index*, or the relation of the upper to the lower limb, the latter being taken as 100, is 69·3, which is identical with what Professor Flower found it to be in the European (69·2),[1] and little different from what Broca found it to be in nine skeletons of the same race (69·73).

The femero-humeral index, or the ratio of the humerus to the femur, the latter taken as 100, is (calculated from the mean lengths of each bone) 72·9, precisely the same as Professor Flower found it to be in eleven Europeans, Broca making it 72·2 in nine Europeans.

The femero-tibial index, or the ratio of the length of the tibia to the femur, the latter being 100, is 82·7, while in fourteen Europeans Professor Flower found it to be 82·1.

The humero-radial index, or the length of the radius compared to that of the humerus, the latter being 100, which is perhaps the most important as a race character, is 74·1. Professors Broca and Flower independently ascertained this to be in twenty-three European skeletons 73·9. The length of the feet is, as nearly as can be estimated, about 24 c.m.

Only a portion of the left scapula accompanies the skeleton. This shows an united fracture of the acromion and part of the spine.

The humerus has no olecronon foramen, or supra-condyloid tubercle; its angle of torsion varies in the right and left bones; in the former it is 35°, and in the latter 26°.

The long bones are quite normal in all respects. The tibia measures, about the centre of its shaft, antero-posteriorly 31 mm., and transversly 20 mm., giving an index of 64·5.

General Conclusions.

It is evident that in this series of skulls we have not a single pure race to deal with, but two distinct races, which have existed at probably three different periods. The first, and apparently the oldest race, seems to be the long-headed people represented by the skulls from Skerrabrae, and those of doubtful sex from Saverough. We have next the round-headed race, which probably occupied the country for a considerable time. The earliest of these are probably represented by the skulls of

[1] "Journ. Anthrop. Inst.," November, 1879.

rounder form from Saverough, and the later by the skulls from Newbigging, Rendall, and Harray.

That the skulls from Skerrabrae and the dolichocephalic skulls from Saverough are more ancient than the more brachycephalic skulls is, I think, clear. First, as regards the Saverough skulls, their small size, if we consider them as those of males, which I am inclined to do, would indicate that they are those of an early race, since there is decided proof of the size of the head having increased as time has rolled on. The maxillary portion of the face is developed more fully in these dolichocephalic skulls than in any of the more brachycephalic skulls found with them—a condition which occurs to a marked degree in low races as in Tasmanians and Australians. The condition of the bones also indicates that they are of ancient date, though too much dependence cannot be placed upon this; still, skulls subjected to the same decaying influence would, if they belonged to the same period, most probably exhibit a corresponding condition as to preservation; but in the Saverough skulls we have those of uncertain sex much more decayed than the brachycephalic skulls, which are comparatively fresh: therefore I think there can be little doubt that the one set is much older than the other. The rate of decay of bone in this tumulus would probably in any case be very slow, as the soil is composed of dry sand. That the Skerrabrae skulls are of ancient date, also, the history of the dwelling seems clearly to indicate; the only contra-indication of this being that the complete skeleton was found 3 feet above the level of the floor. The condition of one of the chambers renders it possible that the dwelling may have been attacked and partly destroyed by an enemy. Supposing this enemy to have been the round-headed race who evidently invaded the islands, the latest date we could assign to these skulls would be tha t of their arrival; but in the turbulent condition of society pointed out to have existed at that time by Dr. Trail, from the arrangement, as if for sentries, at the entrance to the chambers, it is quite as likely that the inhabitants of this dwelling were attacked and the building wrecked by their own race as by later comers, and probably more so. I may here remark that it would be very desirable to have this ancient dwelling of Skerrabrae more fully explored; possibly several chambers remain yet unexplored, and if the supposition is correct as to the dwelling having been attacked and destroyed by an enemy, human remains would most probably be found in the most interior chambers which have not yet been explored. Whether these Saverough skulls are older, or of about the same age as the Skerrabrae skulls, it is impossible to say. The only indication we have of the Saverough skulls being older than the Skerrabrae

ones is the fresher condition of the bones from the latter place. Both sets were buried in soil of much the same nature, but the mode of burial being different may account for the different conditions in which they are, the Saverough skulls being buried in stone cists, while the Skerrabrae ones were found in the sand, another indication, perhaps, that the owners of the latter perished in a hostile attack. In estimating the age of the two places some authorities have attached importance to the fact that no querns or hand-combs were found in Skerrabrae, while both were found in Saverough, as indicative that the former is older than the latter, and the burgs generally.

Next, regarding the skulls of rounder form from Saverough, I have placed them as earlier than the skulls from the single cists of the round barrows. My reasons for doing so are because in Saverough we have no traces of cremation having been practised, and from the total absence of more modern implements of domestic use and defence. It is true we have the history of the deer's-horn handle of some instrument with the trace of iron in it, and this is certainly difficult to account for. To throw doubt as to its being iron is an argument of a very weak character, and one which should not be resorted to; nor do we need to do so, as we have distinct proof that this tumulus was not undisturbed. I therefore am inclined to think that this handle has got into the mound at a later date, an occurrence which we find not unfrequently happens. An argument which has had some weight with me in regarding these skulls, or at least some of them, as being those of the early round-headed people, is that the burgs were evidently the strongholds in the country, an invading race would naturally seek to take possession of these in the first instance, and having done so would most likely bury their dead in close proximity to them, where the remains would be, as it were, under their eye at all times, and consequently not so liable to be disturbed by the hostile tribes as when buried in tumuli at some distance from their habitation.

At a later period, when the round-headed people were in full possession of the country, and when interment and burning the dead were practised, we have the people to whom the brachycephalic and dolichocephalic skulls found in tumuli containing single or compound cists, such as those of Newbigging, Rendall, and Harray, were found, though at this time we have both long and round skulls buried side by side. Thus we find skulls Nos. 162 and 164, those of persons of well-marked brachycephalic type, presenting characters of comparatively unmixed race, and, as far as I am able to judge by comparison of other skulls, agreeing with the type of brachycephalic people found in round

barrows throughout Britain. Quite different from these are the skulls Nos. 163 and 165, which belonged to persons of the same period, and which seem to me to exhibit traces of admixture. This is possibly what might be expected from the history of the three skulls Nos. 162, 164, and 165. The mode of burial of the first showed that he was of importance in his tribe. The second, buried along with another, a skull similar to No. 162, probably indicates that she was of the better class. These would more likely be of purer type than the lower classes, to which not unlikely No. 165 belonged. The conquered race would be more likely to intermingle with the lower classes than the upper classes of the conquerors; consequently we might expect to find mixed features amongst them—precisely what we find in No. 165, and also in No. 163. This latter, it will be remembered, was found in a short cist, which I think may have some indirect evidence, at least, as to his station in life. We find that the chiefs, both in Orkney and in the cists at Keiss, in Caithness,[1] were buried in cists measuring about 5 to 6 feet long; No. 165 was found in one only 3 feet long. No. 329, which, unfortunately, is in a very imperfect condition, closely resembles No. 165 in its physical characters, was also found in a short cist measuring 3 feet 10 inches long.

Have we any clue as to the time when these races inhabited the country? No direct answer can be given to this question, but there are certain indications of a negative character which give us some information on the point. The abundance of deer-horn found at Skerrabrae indicates that at the time when it was inhabited those animals were plentiful in the country. The presence of deer most probably would be associated with the existence of forests, of which there are many remains to be found in different parts of the island to the present day. When the Romans sailed round Scotland and visited the Orkney Islands, their historians tell us there were no forests at that time, and probably the deer had ceased to exist also. The fact that no metals of any kind whatever were found, and that all the implements were of the most primitive manufacture, points to the people belonging to the unpolished stone period. An important piece of evidence as to the antiquity of the burgs has been pointed out by Mr. Laing. At Breckness, near Stromness, there remains in the face of the cliff a part of a burg, the rest of it having been carried away by the sea. The curvature of the remaining wall shows the burg to have been 68 feet in external diameter; of this only 15 feet remain, upwards of 50 feet having been carried away. We must give the builders of this burg credit for placing it at least 50 feet or more from the edge of

[1] Laing and Huxley's "Prehistoric Remains of Caithness."

the cliff; consequently here we have a wasting of the coast-line of about 100 feet, at least, since the building of the burg. The coast-line at the place where the burg is situated is shelving, so that we have to deal with absolute wearing away by slow degrees, and not with any sudden collapse of the coast. "Those who know," as Mr. Laing remarks, "the slow rate at which a solid rocky coast is washed away, must feel that such facts as are exhibited by the section of the burg and cliff at Breckness are altogether incompatible with any theory that assigns the origin of burgs to recent date. The rock on which the burg stands is not exposed to the full force of the Atlantic, being mostly sheltered from the west by a point of rock" extending farther out. "The substance of the rock is very hard and homogeneous sandstone of the Devonian formation."[1] Unfortunately we have no data by which to estimate the wasting of rock of this kind. We know, however, of castles which have stood on the brink of precipitous rocks for centuries without there being any appreciable wasting of their foundations. We have seen that the burg of Oxtro must have existed for so long a period as to admit of its ruins being covered over to a depth of some feet with soil before the people of the bronze period deposited the ashes of their dead over its ruins. It appears to me, then, that the antiquity of the Skerrabrae skulls and those from Saverough, or at least some of them, may probably be very great; but we have no means of estimating in years how old they may be.

Next, then, as regards the age of the skulls found at Rendall, Newbigging, and Harray—those found in cists in single tumuli. Here we have somewhat better data, and are able to fix their age more nearly than that of the other skulls. Those seem to have existed probably somewhat before the bronze period of this part of Britain, as I can obtain no trace of any metals having been found buried with them; but we have, according to Mr. Petrie, stone implements sometimes found in cists similar to those in which they were interred. The custom of cremating the dead is usually assigned to the bronze period, and we have clear proof that this was the common method of disposing of the dead at that period in Orkney; but we have also abundant proof that cremation was practised at a time when metals were apparently unknown, or very scarce. The round barrows found in Orkney seem to correspond exactly to those of various other parts of Britain, except that in the latter we have bronze articles found. Allowing for the isolation of these islands, and for the longer time it probably took before the metals were as common as in England, I do not think we ante-date, but probably post-date, the existence of the people

[1] Laing, "On the Age of Burgs," *loc. cit.*

who buried in the round barrows of Orkney, if we attribute them with the same antiquity as those of the round barrows of England. The date of the introduction of bronze into England has been estimated by Canon Greenwell as being somewhere about the year B.C. 1000,[1] and the same authority considers the round barrows of England to belong to a period which centres more or less in B.C. 500.

Description of Plate I.[2]

Figs. 1 and 2, *Normæ frontalis et lateralis* of skull No. 346A, from Skerrabrae. Scale, one-third linear.
„ 3 and 4, *Normæ frontalis et lateralis* of skull No. 346B, from Skerrabrae. Scale, one-third.
„ 5 and 6, *Normæ lateralis et verticalis* of skull No. 164, from Rendall. Scale, one-third.

[1] "British Barrows," p. 131 (1877).
[2] These photozincographs were reduced from drawings by Mr. J. G. Goodchild, the projections having been taken by the author with Broca's stereograph.

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