The results of an anthropological investigation of the external ear / by Arthur Keith.

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THE RESULTS OF AN ANTHROPOLOGICAL INVESTIGATION OF THE EXTERNAL EAR.

By Arthur Keith, M.D. (Aberd.), F.R.C.S., Lecturer on Anatomy at the London Hospital Medical College; Examiner in Anatomy, Royal College of Surgeons, England.

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This paper, if its full history may be told, really commenced in an early day of May some two and twenty years ago when, with some forty companions, I entered the dissecting-room of Marischal College to prepare myself for the practice of medicine. Yet the subject with which it deals is not, properly speaking, one which lies within the bounds of practical medicine, nor have the means by which I have earned a livelihood since we sat in the benches which you now occupy been those usually employed by medical men. It is strange that the circumstances which determine the main course of a man's life are those which appear at the time to be trivial and passing, for I now see, looking back over those years, that on the morning I entered the dissecting-room I had turned aside, unconsciously, into a side path of medicine.

The dissecting-room has been altered much since then; men and methods have changed with the times. Physical anthropology as a separate branch of study was confined then to France; had the instruction and the means which Professor Reid has made free to you been accessible to me, it would have saved me many a vain endeavour and made my work of higher value. It is strange that all details relating to dissecting and to reading in the dissecting-room have left no trace in my memory now, but there remains fresh as yesterday the impression of a man who, as he lectured, and as he

taught, took us up into the region of research, to the verge where men work from the known into the unknown, and infused into us something of his enthusiasm and independence of judgment.

That was the living influence which fascinated and turned me aside, but the words that directed my steps came through books; books by Owen, books by Huxley, books by Darwin. It seemed to me then, and the conviction has remained, that the course in life which was most worth striving for was the one most likely to help in answering the questions: When, where and how did man, and the races of men, arise? It was years later that I discovered that all inquiries and observations which are made, in order that these questions may be answered, constitute the subject known now as anthropology.

Like many others, I had become an anthropologist unconsciously, and this paper, which you have afforded me the pleasure of contributing to your Proceedings in a year when our University is entering another century of beneficence, contains the results of one of those inquiries, and it may have value to you because of its failures and of its negative rather than of its positive conclusions. In the matter of conduct we often learn more from failures than from success.

My observations on the ear were commenced in the summer of 1895, when I was studying in Leipzig. The methods which Dr. Beddoe was then employing to analyse and classify British races by observing and estimating their degree of pigmentation, a method which happily combined travel and observation, undoubtedly suggested to me that a complicated structure such as the external ear, which is admittedly characteristic of families, was suitable for such a method of observation, would be likely to give important clues to the relation of one race of mankind to another, and of one species of animal to another. It seemed well worth trying to see if an inquiry into the forms of ear found in the peoples along the western shores of the North Sea bore any direct relationship to those found in the people of our country, as one would expect if the history of invasions by Saxon, Jute, Angle and Dane are historically true.

The inquiry into the physical conformation of the unfit, which Lombrosa and his followers were then carrying out, and which they had applied to the ear, demanded extension and confirmation ; it was evident that, before such a method could be applied to the insane and the criminal, it must be widely applied first to the sane to give a sure foundation on which to build. Further, the relationship of man to other primates was a problem which was, and still is, far from being definitely settled, and the external ear being a complicated structure and one which, so far as we then, or even now, know serves no definite function, was, therefore, one which would not be directly subject to variation on account of use. It was a character which at least would remain unaltered by those conditions which do lead to alteration of structures which play an important part in the economy of the individual. So far at least my inquiry had that which every investigation must have, if it is to yield real knowledge—a definite aim —or to be more exact three definite aims :—

(1) To discover what relationship lay between the peoples on the shores of the North Sea ;
(2) To ascertain the degree of correlationship between a disordered mind and the form of the outer ear ;
(3) To see if the external ear of man indicated any definite relationship between man and any other primate.

Having definitely settled the object of my inquiry, there remained to be determined the features of the external ear to be observed, and the manner in which they were to be recorded. Papers on the ears of sane, insane, and of criminals, and also on the stigmata of degeneration, such as those which had been then published by Gradenigo, by Vali, by Féré and Leglas, and many other articles[1] of a similar nature which have been published since, appeared to me useless for my purpose, because they were records of anomalous forma-

[1] The best introduction to and summary of the literature on the external ear is given by Professor Schwalbe in *Bardeleben's Lehrbuch der Anatomie*, Theil ii., Bd. v., 1898.

tions, and did not deal with the various degrees of development of the ear as found in normal races.

In the *Festschrift* published to celebrate the attainment by Virchow of his seventieth year in 1892, Schwalbe codified the inquiries he had made into the morphology of the external ear, and provided a sure basis for others to build on. The features of the ear which Schwalbe laid most stress on were the auricular tip (Darwin's point) and the proportions of its measurements. Exact measurements have this one supreme advantage—that they are definite facts, which can be added to, verified and compared by workers all the world over; they are not expressions of opinion or indefinite expressions of fact, which are useless to other observers; measurements must ever constitute the firm basis on which every department of knowledge is to be reared. But the method I sought for was one that could be applied in the street and to large numbers, and yet would lead to the accumulation of facts which could be used by other observers, and for this purpose actual measurements were out of the question; further the relative diameters of any structure is one of the least essential of its features; the method desired was one which would record not only the form of the organ as a whole, but also the form and arrangement of the individual parts.

But what were the individual parts of the ear; how could they be determined? I accepted embryology as my chief guide and took each one of the six tubercles or elevations which His[1] had described as entering into the formation of the external ear, as a definite element to be studied and recorded. Fortunately I had studied the ears in many forms of primates, and, as will be seen presently, the experience so obtained also influenced my method. But were I now to begin again I do not think that embryology would be my chief guide; rather I would found the basis of my method on principles established by observations on the ears of the lower primates, especially on the lower forms of monkeys found in the New World.

[1] *Die Formentwickelung des äusseres Ohr: Anatomie Menschlicher Embryonen*, Theil iii., Leipzig, 1885.

There was, however, in all this one fatal omission, namely, a total neglect of the functional meaning of each part of the ear; in my opinion it is this neglect of function that renders so profitless much of the anthropological work of the present day. It is only now when I return to my accumulated records, which have been cast aside for some years, that I see that much of my labour has been in vain because I did not, nor do I yet, know the meaning of the structures which I had attempted to study. One of my reasons for bringing this paper before you is that it may save some from making the mistakes which I have made.

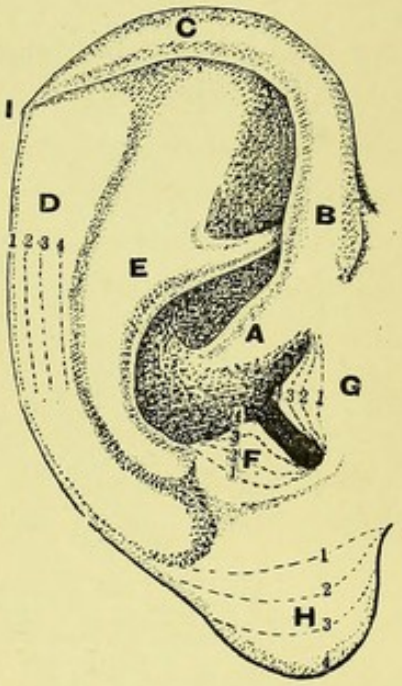

Fig. 1.—Diagram to explain the method used in making observations on the ear. A, root of helix; B, ascending helix; C, horizontal helix; D, descending helix; 1, 2, 3, 4, showing the four degrees into which the infolding of the helix was divided; E, anthelix; F, antitragus; 1, 2, 3, 4, the four degrees of classification; G, tragus; 1, 2, 3, 4, the four degrees of classification; H, lobule; 1, 2, 3, 4, the four degrees of classification; I, the auricular point (Darwin's point).

After some preliminary work in the streets of Leipzig the points on which I determined to make observations were the following—they are shown diagrammatically in Fig. 1: These were, first, the degree of infolding of the posterior border of the helix, from the situation of the auricular point above to the lobe of the ear below. The posterior border may show no trace of infolding, or it may be turned into an extreme degree of 10 mm. (see Figs. 1 and 2). The degree of infolding was divided into four stages, represented by 1, 2, 3, 4 (1 = no infolding, 2 = infolding to an extent of 3 mm. or less, 3 = infolding to an extent between 3-6 mm., and 4 = more than 6 mm.).

The condition of the auricular tip was noted, but only those cases in which there could be no doubt of its presence. Three conditions were noted: (1) where the tip formed a distinct triangular projection, whether it projected backwards or was inrolled with the posterior

border of the helix; (2) where it was distinct but not pointed; (3) where it formed a distinct tubercle.

The lobe of the ear, which I then knew was not a structure peculiar to man, but which, in the degree and form of its development,

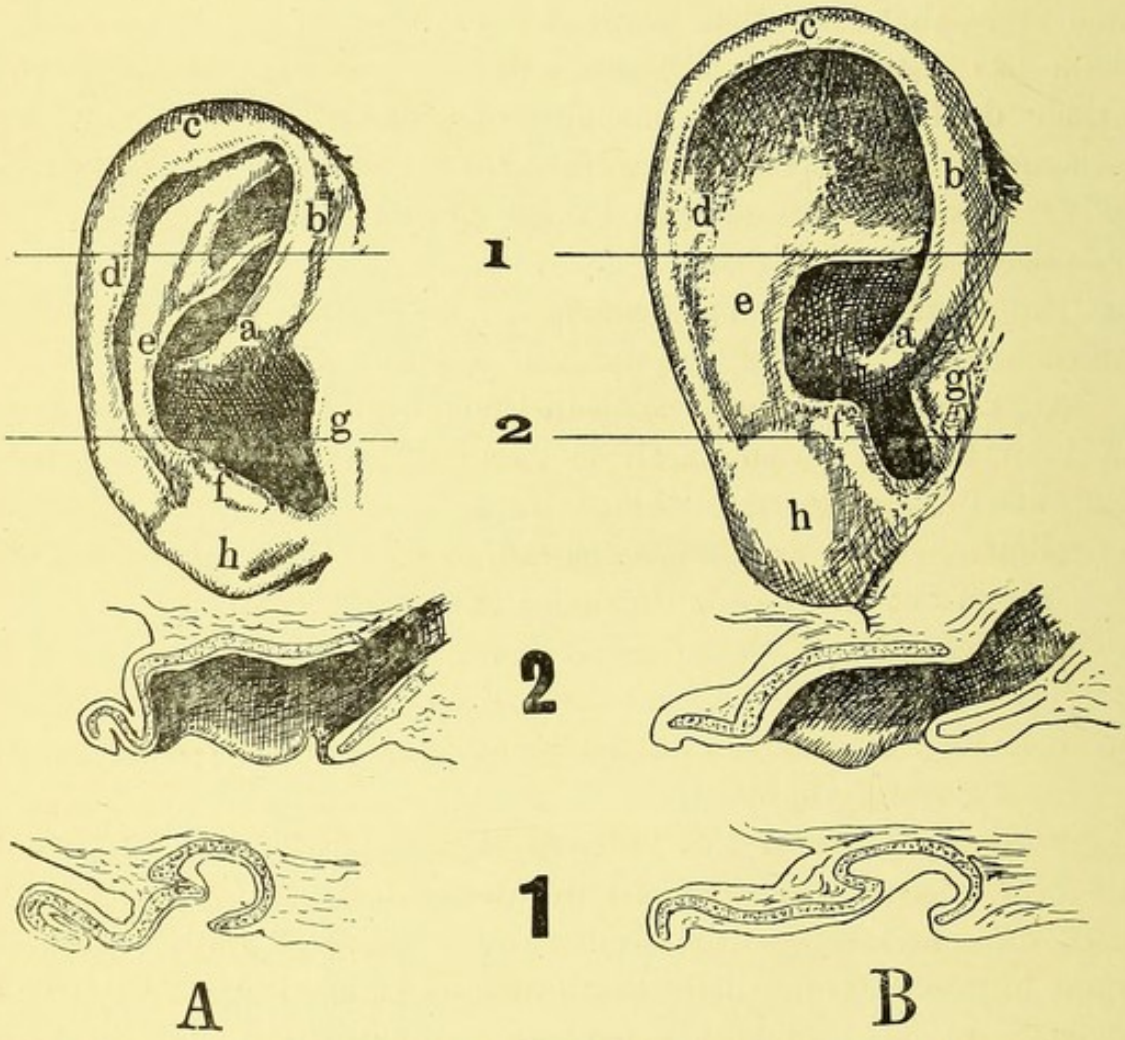

Fig. 2.—The types of ear distinguished as orang (A) and chimpanzee (B). 1, 2, sections across the ears at the positions marked 1, 2. The cartilage is stippled. a, root of helix; b, ascending helix; c, horizontal helix; d, descending helix; e, anthelix; f, antitragus; g, tragus; h, lobule.

is a human character, was peculiarly worth observation. In it, too, I recognised four degrees, 1, 2, 3, 4 (see Fig. 1). I have never seen an ear in which the lobe was completely absent. In stage 1 were counted all cases in which the lobe extended less than 5 mm. below the border

of the intertragal notch; stage 2, all between 5-10 mm.; stage 3, all between 10-15 mm.; stage 4, all over 15 mm. Cases of complete adhesion of the lobe were also noted.

Similarly four stages were recognised in the development of tragus and antitragus (see Fig. 1). In their fullest development these structures project as triangular plates in the outer wall of the concha of the ear, separated by a narrow and deep intertragal notch; in their lowest development they form mere elevations on the anterior and lower margin of the conchal fossa; between those two extremes, which constitute stages 4 and 1, two intermediate degrees may be recognised.

The anthelix (Fig. 1) assumes various degrees of development, but they may be roughly grouped into four stages:—

1. Those in which it is so little prominent that it projects outwards to a distinctly less extent than the posterior part (descending limb) of the helix.
2. Where it projects outwards to an equal extent with the descending limb of the helix (Fig. 2 B, 1, 2).
3. Where it is distinctly more prominent than the helix (Fig. 2 A, 1, 2).
4. Where it projects outwards 4 mm. or more than the descending helix.

To a certain extent I had followed the embryological divisions of His; the tragus, antitragus, lobule, descending helix and anthelix were distinguished by him as elementary parts of the ear, and it would have been better had I pursued in my investigations, as I had originally intended, two other divisions distinguished by him, the root and ascending helix (*tuberculum anterius*) and also the horizontal helix or upper margin (*tuberculum intermedium*, Fig. 1), but after some attempts I abandoned these for want of a suitable method of recording their forms. As it so happened an observation I included in my method to record the type of ear does express to some extent the condition of these parts.

Nearly every one who had before then inquired into the various

forms of the human ear had distinguished certain types, but the characters on which these types were based seemed to me arbitrary and artificial. Since the four kinds of anthropoid apes, the gorilla, the chimpanzee (Fig. 3), the orang and the gibbon, are admitted by all

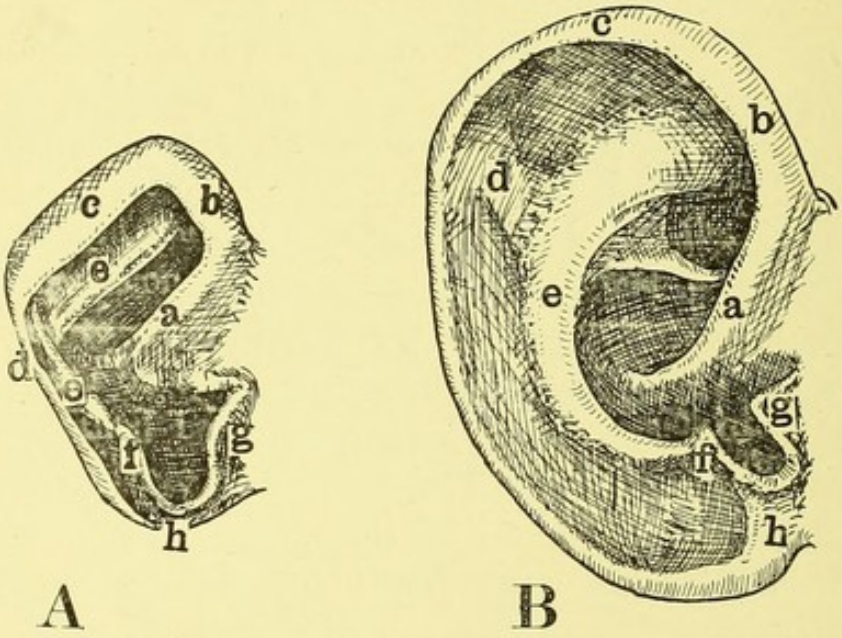

Fig. 3.—Ear of orang (A) and of chimpanzee (B) (natural size). a, root of helix; b, ascending helix; c, horizontal helix; d, descending helix; e, anthelix; f, antitragus; g, tragus; h, lobule.

to be co-descendants with man from a common stock, it seemed to me most probable that in the forms of ear met with in these animals—for each has a characteristic type—would be found a natural basis for the classification of the forms found in men. In Figs. 3 and 5 are given diagrams representing to scale the forms of ears found in the four anthropoids. The ear of the gibbon is interesting (Fig. 5 B), but may be at once excluded as far as our present purpose is concerned; it is apparently a type intermediate to that found in the other anthropoids and certain ear forms found in the lower primates of America. But in the gorilla, chimpanzee and orang we have forms of ear very similar to types found in men. The gorilline type is the more human; the orang and chimpanzee have ears which are sharply contrasted, and very little inquiry serves to show that among human ears types occur which correspond to the chimpanzee and to the orang forms.

I therefore resolved to keep a record of these types, but I was not then aware of what I learned later, that the orang type represents an extreme degree of retrogression, while the chimpanzee ear represents an opposite stage, *viz.*, one which is at its fullest degree of development. Later I shall recur to these two contrasted types of ear and give more exact definition of their characters and the meaning of these characters. These were distinct types, but they included less than 40 per cent. of the whole—how were the others to be classified? It would have been wiser to group all that remained into one class, but I sought to divide the remaining 60 per cent. into four groups :—

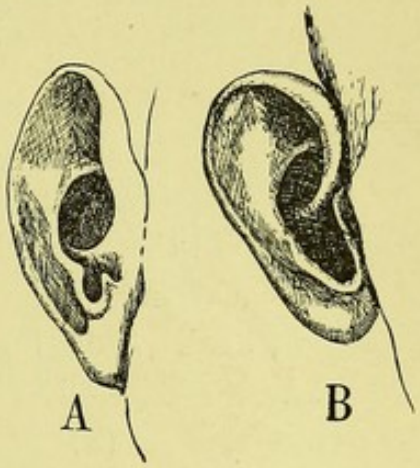

Fig. 4.—The ear of the chimpanzee (A) and of the "chimpanzee" type in man (B), seen on a full face view.

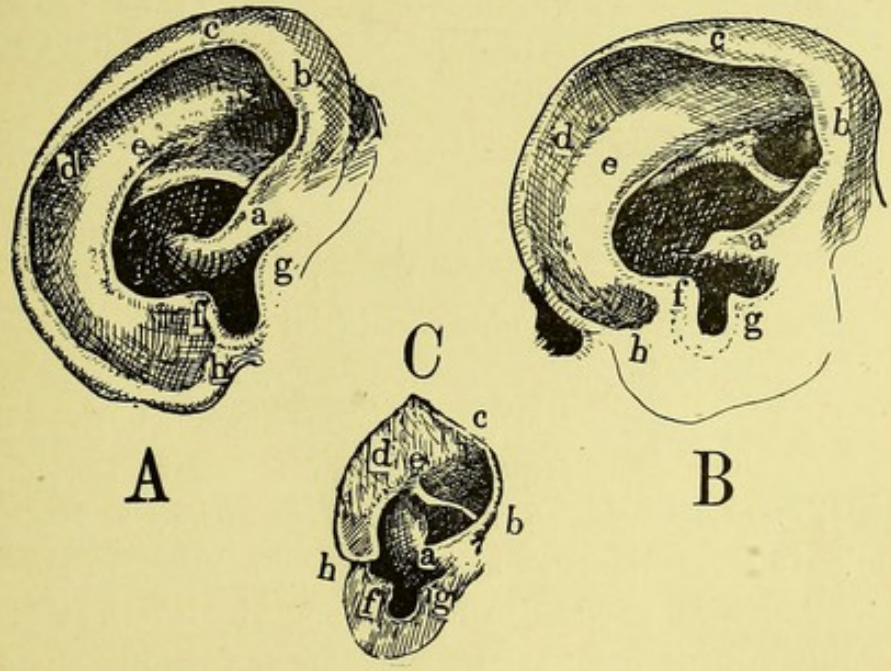

Fig. 5.—Ear of gorilla (A), of gibbon (Hylobates lar) (B), and of lemur (Nyctipithecus tardigradus) (C). a, root of helix; b, ascending helix; c, horizontal helix; d, descending helix; e, anthelix, f, antitragus; g, tragus; h, lobule. The ear of the lemur is reproduced for comparison with that of the gibbon. The gibbon is seen to retain the lemurine form of implantation, the lobule being undifferentiated from the tissues of the cheek.

1. Those which I called typically human (that is, represented a degree of development intermediate to the orang and chimpanzee types) ;
2. Anomalous or atypical ears ;
3. A form which is distinguished from the chimpanzee type only by the smallness of its size (see Fig. 6) ; and
4. A cercopitheque form, which I soon abandoned because I found that in reality the peculiarity of the type depended on the absence of infolding of the posterior border of the helix.

Thus, finally, I distinguished—or rather attempted to distinguish—five types of ear : (1) Typically human, (2) orang, (3) large chimpanzee, (4) small chimpanzee, and (5) anomalous or atypical forms. But the attempt brought home to me the truth that in the distinction of types, or rather, in classifying forms into groups, one attempts to draw lines of demarcation where Nature has drawn none, for between every type distinguished there occurs a chain of intermediate forms, some of which belong as much to one type as to the other. It is a difficulty which is encountered in every branch of anthropological investigation, whether one is inquiring into the form of head, the form of face, of nose, or the degree of pigmentation ; everywhere artificial lines have to be drawn. The results we obtain in such a method as this cannot have a mathematical exactness ; the personal error must be large, but not so large as to invalidate the general truth of the results acquired or to prevent the comparison of the results obtained at one time and place with those acquired at another time and place. At least such a method would serve the useful purpose of finding out whether the vast labour, which accurate measurement by tape and compass entails, would repay the man who undertook the task. Were I again to commence observations I would adopt the ear of the typical West Coast negro as another type.

Fig. 6.—The form of ear distinguished as the small chimpanzee type (⅔ natural size). The ear is small, but the upper parts of the helix and anthelix are wide.

In making my observations two other considerations were taken into account. Dr. Beddoe, as I have already mentioned, used the degree of pigmentation as a means of distinguishing racial affinities; I wished to see if there were a correlationship between the type or form of ear and the colour of hair. I classified the observed individuals into three groups: the fair-haired, the black-haired, and the intermediates. In the black-haired group I placed those with dark or distinctly red hair, and in the fair-haired those in which the red was a fawn or sandy hue. Besides noting colour of hair, I also took into consideration the question of age, and excluded those whom I considered under twenty, and those who appeared to me over sixty, for Schwalbe had clearly demonstrated that the ear enlarges rapidly after sixty, and before twenty it has not attained its adult form and size, nor is the colour of hair finally determined.

The method I adopted in making observations was the following. They were made in the street or market place, and I found that, with practice, I could note five points or features on those whom I casually passed. For instance, I noted colour of hair, sex, type of ear, degree of infolding, condition of the auricular tip. In the palm of my hand I carried slips of stiffish paper, of convenient size and ruled into six vertical columns—three for fair, intermediate and black males, and three for the corresponding grades of females. Suppose, for example, that the individual just passed is a man, with fair hair, orang type of ear, infolding of the helix to the extent I have classed as Stage 1, the auricular tip represented by a slight elevation (Stage 3), then the record made (in the column for fair-haired men) was "Or., 1, 3".

The number of individuals I wished to include in each group was 250 of each sex, but in reality the number was twice that, because after observing the points just mentioned in 250 of each sex, I had to begin an equally extensive series for observations on the lobule, tragus, antitragus and the anthelix. Thus at each place of observation I intended that my observations should extend over a series of a thousand individuals. Observations on the insane and criminals were made

more leisurely, and all the points were recorded from the same series of individuals. Only the ear of one side was examined—always, when possible, the right ear.

The following table shows the order of places in which observations were made, the number of individuals examined (or rather half the individuals examined, for, as already mentioned, the observations were made on two series of individuals), and the date at which the work was done :—

Table I.

Place.	Males.	Females.	Year.	Class.
Leipzig	588	605	1895	Town inhabitants
Hamburg	578	456	1895	Town inhabitants
Elmshorn	672	570	1895	Country inhabitants
Aberdeen	631	655	1896	Town inhabitants
Turriff	119	—	1896	Country inhabitants
Cornhill	385	121	1896	Country inhabitants
Whitechapel	700	492	1896	Town inhabitants
Jews (Whitechapel, mostly Polish)	109	62	1896	Town inhabitants
Peterborough	306	227	1897	Town and country
Liverpool	453	243	1897	Town inhabitants
Carlisle	241	248	1897	Town and country
Preston	264	190	1897	Town inhabitants
Dumfries	305	170	1897	Town and country
Castle Douglas	270	81	1897	Country inhabitants
Larne	129	100	1897	Country inhabitants
Lisburn	128	89	1897	Country inhabitants
Belfast	336	226	1897	Town and country
Dublin	278	268	1897	Town inhabitants
Killorglin	281	205	1897	Country inhabitants
Cork	256	245	1897	Town inhabitants
Caermarthen	296	256	1897	Country inhabitants
Royal Asylum, Aberdeen	190	211	1896	Town and country
County Asylum, Durham	211	208	1896	Town and country
Richmond Asylum, Dublin	189	204	1897	Town and country
Cork Asylum	202	205	1897	Town and country
Profile photographs of criminals, Scotland Yard	526	200	1896	Town and country
Vagrants, London	60	28	1896	Town and country
Vagrants, Liverpool	74	12	1897	Town and country
Photographs of various races and antique statues in British Museum	150	38	1896	
Anthropoids and apes	170 both sexes			

Altogether my records extend to 8,567 males and 6,577 females belonging to Central and Western Germany, Scotland, England, Wales and Ireland; and include representatives of the insane, criminal and vagrant classes. To give at length all the data I have accumulated and to discuss the various results and conclusions I have reached would occupy far too much of your time. I intend to deal with my subject only in so far as it relates to the people in the North of Scotland.

I take this opportunity of expressing my indebtedness to those gentlemen who have afforded me the opportunity of obtaining data relating to the insane. In this matter I am particularly indebted to Dr. William Reid.

So far I have merely mentioned the manner in which I have noted down the observations as they were made in the street. When a sufficient number of observations had been made, they were then classified and summed up. For an illustration I will take the observations made on the lobule of the ear of inhabitants of Aberdeen. The accompanying table shows the result :—

TABLE II.

DEVELOPMENT OF LOBULE IN INHABITANTS OF ABERDEEN.

	Males.				Females.			
	Fair.	Interm.	Black.	Total.	Fair.	Interm.	Black.	Total.
Stage 1 - -	34	66	17	117	28	66	27	121
Stage 2 - -	36 (4)	64 (14)	11 (2)	111	23 (6)	64 (17)	15 (5)	102
Stage 3 - -	32 (8)	76 (7)	11 (1)	119	27 (1)	100 (7)	28 (4)	155
Stage 4 - -	46 (1)	56 (2)	24 (2)	126	37 (2)	102 (1)	46 (1)	185
	148	262	63	473	115	332	116	563

Note.—The figures in brackets represent the numbers in which the lobule was completely adherent.

Thus, in 473 men I estimated that the lobule was less than 5 mm. in depth in 117, between 5-10 mm. in 111, between 10-15 mm.

in 119, and over 15 mm. in 126. In 563 women the results will be seen to be approximately similar. For purposes of comparison it is necessary to estimate what may be named the mean or index development of the lobule; this was obtained as follows: The lobule of Stage 1 was taken as a unit, Stage 2 as two units, Stage 3 as three and Stage 4 as four, so that in the group of males at present under consideration the mean development of the lobule was :—

$$\frac{117 \times 1 + 111 \times 2 + 119 \times 3 + 126 \times 4}{473} = 2{\cdot}53.$$

The index for the female series is 2·71. That is to say, the average development of the lobule in the groups I examined lay between Stages 2 and 3, but it reaches a distinctly greater development in the women than in the men.

It will be observed that the number of individuals is nearly equally divided among the four stages (117, 111, 119, 126), and it will occur to those who are familiar with the manner in which anthropological data group themselves into a maximum near the mean and diminish towards the extremes, that either my method is artificial or inaccurate, or that the lobule is not subject to the laws that regulate the development of other parts of the body. It will be noticed that the observations made on the females show a similar distribution, so that at least if the method is artificial it has evidently been applied in a similar manner to each group. But there can be no doubt that in my earlier work I placed many examples of the two intermediate stages into the two extreme groups.

The result so far obtained is that the index of development for the lobule of the ear in Aberdeen men is 2·53; the female index is greater by ·18. Is there constantly a sexual difference and what is its meaning? The lobule always obtains a greater development in the female ear. The lobule represents tissue which in lower primates is utilised in the formation of the lower part of the helix; that is, it represents a retrograde change in the outer ear. Its greater size in the female is probably due to the fact that the outer ear of the female shows more evidence of retrogression than that of the male.

In the two following tables are given data relating to the lobules of the insane of the Aberdeen asylum, and of the country people of Cornhill and Turriff—people living on the confines of the shires of Aberdeen and Banff:—

TABLE III.

ABERDEEN ASYLUM.

	Males.				Females.			
	Fair.	Interm.	Black.	Total.	Fair.	Interm.	Black.	Total.
Stage 1 - -	9	4	4	17	5	13	4	22
Stage 2 - -	26 (12)	32 (9)	26 (9)	84	25 (14)	31 (10)	28	84
Stage 3 - -	26 (5)	26 (4)	14 (2)	66	11 (4)	32 (8)	25	68
Stage 4 - -	9 (1)	7 (2)	10 (2)	26	10	10	16	36
	70	69	54	193	51	86	73	210

Index for males, 2·52. Index for females, 2·56.

TURRIFF AND CORNHILL.

	Males.				Females.			
	Fair.	Interm.	Black.	Total.	Fair.	Interm.	Black.	Total.
Stage 1 - -	16	38	5	59	1	7	2	10
Stage 2 - -	36 (14)	67 (14)	7	110	9 (1)	19 (2)	1	29
Stage 3 - -	52 (7)	78 (14)	10 (2)	140	8	34 (2)	4	46
Stage 4 - -	29 (2)	71 (8)	13 (1)	113	5	17	4	26
	133	254	35	422	23	77	11	111

Index for males, 2·72. Index for females, 2·79.

It was not until I had collected the greater part of my data that I calculated and compared my results; had I compared the figures for Aberdeen city and Aberdeen asylum I should have paused before proceeding further, for it is now quite clear to me that the observa-

tions which I made on the insane—made without any need for haste—are by far the more reliable; the distribution of the individuals in the tables for the insane are in conformity with what is expected of anthropological measurements, while those drawn from the city are certainly not. With the exception of those for Hamburg, Elmshorn and Aberdeen city, the earliest obtained, my figures and data are in conformity with data obtained by exact measurements.

Having thus estimated that the mean development of the lobule of the ear is 2·52 for the males in the city and the asylum, and 2·72 for the men of Cornhill, I shall now compare these results with the figures obtained in other localities, shown in the following table :—

Table IV.

	Males.					Females.				
	Stages.				Mean.	Stages.				Mean.
	1.	2.	3	4.		1.	2.	3.	4.	
Hamburg	125	173	137	164	2·56	89	153	134	159	2·67
Elmshorn	70	72	54	56	2·38	37	44	42	41	2·52
Durham Asylum	24	88	72	27	2·48	40	50	59	57	2·64
Peterborough	33	79	45	25	2·34	27	49	50	14	2·35
Whitechapel	108	233	200	107	2·47	65	118	142	58	2·76
Whitechapel Jews	17	32	34	36	2·75	6	26	22	29	2·90
Scotland Yard (criminals)	32	147	108	43	2·52	11	82	67	41	2·68
Liverpool	66	227	186	51	2·41	43	173	169	41	2·48
Preston	31	94	104	35	2·54	22	40	81	53	2·84
Carlisle	27	86	87	43	2·60	23	87	109	39	2·63
Dumfries	25	101	123	45	2·63	14	45	72	34	2·76
Belfast	37	138	109	52	2·49	24	83	95	25	2·53
Dublin	30	71	114	52	2·70	15	73	119	61	2·84
Richmond Asylum, Dublin	20	78	68	23	2·49	17	67	90	29	2·64
Killorglin	18	121	121	22	2·52	8	61	129	11	2·68
Cork City	14	87	118	35	2·68	9	76	122	47	2·81
Cork Asylum	6	56	104	36	2·86	13	60	75	57	2·85
Caermarthen	12	104	129	57	2·76	10	76	115	54	2·83
Aberdeen City	117	111	119	126	2·53	121	102	155	185	2·71
Aberdeen Asylum	17	84	66	26	2·52	22	84	68	36	2·56
Cornhill	59	110	140	113	2·72	10	29	46	26	2·79

Having thus compiled the results of observations made on the lobule of forty-two groups of people (twenty-one male and twenty-one female), are we in any better position to answer the inquiry on which we set out—the relationship of one group of people to another? In such an inquiry we proceed on the belief that those groups which show a similarity in form and size in their corresponding parts owe that similarity to a community of descent, and are therefore related.

If such a principle could be accepted as even probable, then from the above inquiry we should infer that the Aberdeen people find their near relatives amongst the groups examined in Kerry (Killorglin), Scotland Yard, Lancashire and Hamburg. Now, if there is any well-marked race in Great Britain and Ireland, it is the tall, dark, excitable men from Kerry; they are very different from the people of Aberdeen. I have raised the point simply to emphasise the fact that one cannot determine the relationship by taking into consideration one point only, whether it be size of lobule, shape of ear, colour of hair, characters of mind; to settle the affinities of a people one must take into consideration every one of the characters of body and mind. One point in my inquiry impressed me, and that was the resemblance of the people living near the coast, north of the mouth of the Elbe (Elmshorn), to those of Peterborough, a superficial resemblance in physical characters, which was also manifest long after, when I worked out the observations I had made on their ears.

In the groups examined (with one exception—Cork Asylum), the lobule was larger in the female than in the male, but the degree of sexual difference varied: in seven groups the difference was ·01 to ·10, in nine groups from ·10 to ·20, in three groups ·20 to ·30, and in one group between ·30 and ·40. In Cork Asylum the female lobule was ·01 less than the male.

If colour of hair is distinctive of race—if fair-haired people are fair-haired because of their community of origin and descent, and black-haired are allied to black-haired, then one would expect that this character of pigmentation would be accompanied by many others. Does the lobule of the fair-haired individuals differ from that of the

black-haired? To answer this question I worked out the mean development in the fair-haired and black-haired individuals, and found in every group examined in this country the lobule was ·04 to ·60 larger in the black than in the fair-haired. This was also the case at Elmshorn; but in Leipzig and Hamburg the case was reversed—there the fair-haired had the larger lobule. These were the brachycephalic, fair-haired people, while those at Elmshorn and in this country are in the majority mesocephalic or dolichocephalic.

Many of those who have inquired into the condition of the ear in the insane, the criminal and vagrant classes have regarded what they have called the absence—in reality the smallness—and adhesion of the lobule as a mark or stigma of degeneration. My inquiries, made on a more extensive basis, show no grounds for such an inference. But, on the other hand, I found that the auricular tip and a marked degree of inrolling of the helix were distinctly more frequently present in criminals and in congenital idiots than in normal people (*Nature*, Nov. 7, 1901, p. 16).

It would exceed the bounds of this paper were I to discuss the results of my observations on the infolding of the helix, the occurrence and significance of Darwin's point, the development of the tragus and antitragus to the extent with which I have dealt with the lobule. I propose to bring my paper to a conclusion by a brief description of the characters, significance and distribution of the two types of ear I have distinguished as the "orang" and "chimpanzee".

The orang type (see Figure 2 A) of ear is small, its long diameter measuring under 60 mm.; the helix is markedly inrolled, the anthelix is well developed deepening the concha of the ear, and projecting outwards beyond the level of the helix. It is commonly closely applied to the head. In the chimpanzee type (see Figure 2 B) the helix, especially the upper part, is wide, expanded and inrolled to a slight degree, the anthelix is neither prominent nor markedly convex, and usually is not closely applied to the head, but projects outwards (see Figure 3 B).

These two types represent the extremes of a developmental pro-

cess which can be observed in the ear of all primates. In this mammalian order there is a rivalry between the helix and anthelix as to which will play the chief part in forming the external ear. In the orang type is to be seen the pre-eminence of the anthelix ; in the chimpanzee type, the helix. In man and the gorilla the majority of individuals show forms between these extremes ; in the remarkable ear of the gibbon (which is set at a peculiar angle, and has its lobule undifferentiated from the tissues of the cheek, see Figure 5 B) one finds, in the majority of individuals, a type which resembles the chimpanzee rather than the orang. Schwalbe is the only writer who has rightly recognised the nature of the change at work in the ear of man, namely, that it is not a rudimentary or vestigial structure, but one in which a great transformation is taking place, whereby the anthelicial part is superseding and replacing the helicial part in forming a receiver for sound waves.

In Table V. I reproduce the results I obtained as regards the frequency with which the orang and chimpanzee types occur in the various groups of people examined. From that Table it will be observed that I attempted to distinguish six types in all, but saving the two types mentioned—the orang and chimpanzee (named large chimpanzee in Table)—I regard the others as of little value. The type distinguished as the average human type lies, as regards its characters, in an intermediate position to the orang and chimpanzee types. At the commencement I was impressed with a type of ear, which in all its characters, save its size, resembled the chimpanzee type ; I named it the small chimpanzee, but its distinction frequently caused me perplexity and difficulty (see Fig. 6). The type called cercopitheque was one in which the ear was, as in most cercopithecus monkeys, as broad in its lower as in its upper part, and its helix was not inrolled, but it too I found difficult to discriminate. In the anomalous group I placed ears which were abnormal in form, or could not be classified with any of the other five groups.

TABLE V.

THE PERCENTAGE WITH WHICH THE VARIOUS TYPES OF EXTERNAL EAR OCCURRED IN THE VARIOUS GROUPS OF PEOPLE EXAMINED.

H = The human type (see Fig. 1).
O = Orang type (see Fig. 2 A).
Ch′ = Large chimpanzee type (see Fig. 3 B).
Ch″ = Small chimpanzee type (see Fig. 6).
Cerco = Cercopitheque type.
An = Anomalous forms.

	Males.						Females.					
	H.	O.	Ch′.	Ch″.	Cerco.	An.	H.	O.	Ch′.	Ch″.	Cerco.	An.
Hamburg	23	20	20	29	4	4	44	32	10	10	2	1
Aberdeen City	31	28	15	21	1	3	36	43	5	12	1	2
Cornhill and Turriff	37	26	14	16	3	3	56	31	2	6	3	1
Elmshorn	24	28	23	20	1	2	39	36	13	10	½	1
Peterborough	32	19	19	22	1	1	30	50	6	8	5	1
Aberdeen Asylum	38	23	16	17	3	2	37	40	8	8	3	3
Durham Asylum	29	26	18	18	5	3	45	39	3	10	1	1
Scotland Yard	34	36	15	8	5	2	34	34	13	10	5	3
Richmond Asylum (Dublin)	37	29	12	17	10	3	50	33	3	10	1	1
Cork Asylum	52	12	19	14	½	3	45	37	3	10	3	2
Cork City	32	22	28	15	1	1	45	42	3	6	3	—
Killorglin (Kerry)	41	18	27	13	—	1	52	42	1	2	1	1
Dublin City	26	22	33	17	1	—	44	41	6	5	3	1
Belfast	34	29	28	11	½	1	36	52	5	4	1	1
Castle Douglas	43	27	17	11	1	1	41	49	9	1	—	—
Dumfries	32	30	23	11	1	2	41	49	3	2	3	1
Carlisle Market	38	27	18	16	½	½	40	43	5	9	2	1
Preston	38	30	12	19	1	—	35	54	½	8	1	1
Liverpool City	40	28	11	18	2	1	43	48	2	4	2	1
Liverpool (vagrants)	40	16	22	18	4	—	50	42	—	8	—	—
Caermarthen Market	44	17	19	19	—	—	38	47	5	7	1½	1½
Mansfield	38	20	20	21	1	—	39	38	5	12	5	1
Whitechapel (East London)	43	17	13	23	—	3	45	44	2	8	—	—
Whitechapel (Polish Jews)	43	16	17	18	—	5	40	19	20	7	—	3
Whitechapel (vagrants)	45	10	18	25	—	2	57	43	—	—	—	—

One point comes out very distinctly from my data—*viz.*, that there is a very marked sexual difference in the orang and chimpanzee types of ear. The orang type of ear is met with much more frequently in women, while the chimpanzee type is seen more frequently in men. In the twenty-five groups of women given in the table, the proportion in which the orang type occurs varies from 30

to 55 per cent., while in only two groups (at Elmshorn and Scotland Yard) does the proportion of the chimpanzee type exceed 10 per cent. In nineteen of the male groups the proportion of the orang type varies from 15 to 30 per cent., the chimpanzee type occurring in a nearly equal proportion.

There is also a correlationship between the colour of hair and the ratio in which these types of ear occur. In every one of the groups examined the fair-haired individuals showed a distinctly greater percentage of the orang type than the black-haired ; while the chimpanzee type occurred in a larger proportion of black-haired than of fair-haired.

From an examination of the data given in Table IV. it will be found that there is no correlationship between the ratio in which these two types of ear occur and the bias to insanity. The insane men in Aberdeen and Cork asylums show the orang type less frequently than the sane ; in Dublin the case is the reverse ; so, too, as regards the occurrence of the orang type in women of these asylums. Nor is there any constant difference in the ratio in which the chimpanzee type is found in the sane and insane.

The types of ear described by Continental writers as Wildermuth and Morellische, and regarded by them as occurring with undue frequency amongst the insane forms are marked examples of what is here regarded as the orang type.

In the criminal population of Scotland Yard there is a distinct departure from the usual ratio in which the orang and chimpanzee types occur. In the males the orang type occurs more frequently than in any other group of men examined, whilst amongst the women criminals exactly the opposite obtains—the orang type occurs less frequently than in any other group of women. There is here a sexual inversion. The chimpanzee type occurs among male criminals with a normal frequency, but amongst the women this type is abnormally frequent.

When, however, we wish to put the data to the main purpose for which this investigation was undertaken, namely, to discover the

relationship of the various groups examined, the indications afforded are indefinite. Take the Aberdeen inhabitants, for instance : amongst the males the orang type occurs in 28 per cent. in the sane, 23 per cent. in the insane ; a similar percentage is found in people so widely apart as Hamburg and Cork ; the percentage with which the chimpanzee type occurs associates the Aberdeen people with the South Welsh and Whitechapel Jews. Yet in some instances the type of ear is characteristic of race. Nearly 80 per cent. of the Bushmen and Hottentots have ears of the orang type. The chimpanzee type prevails in the south-west and north-east of Ireland, and from descriptions given by travellers it is evidently the common form met with in Northern Mongolia and in Siberia. In estimating the value of these two types of ear, as anthropological characters, one has to remember that they are the result of a tendency to be seen at work on the ears of all the higher primates.

In the genus cynocephalus (baboons) alone is the helix fully developed and pointed ; in the order in which the various genera of primates are named below there is to be seen a reduction of the helix and an increased prominence of the anthelix : cynocephalus, macacus, cercopithecus, colobus, semnopithecus, mycetes, lagothrix, cebus, chimpanzee, gibbon, man, gorilla, orang. The processes which have given the primate ear its peculiar form are evidently a common inheritance, and have been in operation in all the members of the order—in some more and in some less—so that it is doubtful how far similarity in form of ear can be utilised as a guide to genetic relationship.

My main reason for bringing this investigation before the members of the Anatomical and Anthropological Society of Aberdeen University is because I believe it to be true of anthropological as of medical investigation, that more is to be learned from men's failures than from their successes. For the main purpose of my inquiry—the relationship of one group of people to another—this labour of mine has been a complete failure. Nor do I believe, had my methods been more exact and all my observations made by measurement, that

the result, as far as the end I had in view, would have been more valuable. The chief gain I derived from it was this : it brought me face to face, in a more extensive manner than happens to most inquirers, with the method of statistical inquiry and showed me how far that manner of inquiry is likely to help us in settling racial affinities. It brought home to me the fact that the statistical method is one which raises rather than answers questions ; it produces data but it cannot explain them. The second lesson my inquiry taught me, and one which I mean to apply to every piece of work of this kind I may undertake, is that any statistical inquiry to be of value must be made on structures whose function and significance are completely understood, and the measure of whose function can be accurately represented by the data recorded. That is to say, my inquiry ended at the point where it should have commenced, namely, in a complete investigation by physiological and comparative methods, into the meaning and use of each part of the outer ear.

It would have been a matter of the greatest satisfaction could I have brought before you a piece of work which was more worthy of our University, and a better acknowledgment of the debt which I, in common with thousands of men of the North of Scotland, owe her. These 400 years she has provided her graduates with the means of joining the ranks of those who, all the world over, seek to keep natural knowledge not only living but also growing.