PRESIDENT'S ADDRESS.

THE report of the Council has entered so fully into the working of this Institute during the past session, that I think I should weary you if I were to attempt a fresh summary of my own, and to speak again of topics that are still fresh in your memory. It is therefore better that I should select some definite topic in my address, and dwell upon it at length. I will do this now in respect to the subject that has chiefly occupied my attention for some time past.

It will perhaps be recollected that, at the meeting last autumn of the British Association in Aberdeen, I chose for my Presidential Address to the Anthropological Section a portion of the wide subject of "Hereditary Stature." My inquiries were at that time advanced only to a certain stage, but they have since been completed up to a well-defined resting-place, and it is to their principal net results that I shall ask your attention to-night.

I am, happily, released from any necessity of fatiguing you with details, or of imposing on myself the almost impossible task of explaining a great deal of technical work in popular language, because all these details have just been laid before the Royal Society, and will in due course appear in their *Proceedings*. They deal with ideas that are perfectly simple in themselves, but many of which are new and most are unfamiliar, and therefore difficult to apprehend at once. My work also required to be tested and cross-tested by mathematical processes of a very technical kind, dependent in part on new problems, for the solution of which I have been greatly indebted to the

friendly aid of Mr. J. D. Hamilton Dickson, Fellow and Tutor of St. Peter's College, Cambridge. I shall therefore quite disembarrass myself on the present occasion from the sense of any necessity of going far into explanations, referring those who wish thoroughly to understand the grounds upon which my results are based, to the forthcoming memoir in the *Proceedings* of the Royal Society, and to that amplified and illustrated extract from my Address at Aberdeen, accompanied by tabular data, which appeared among the "Miscellanea" of the *Journal* of this Institute last November.

The main problem I had in view was to solve the following question. Given a group of men, all of the same stature, whatever that stature may be,—it is required to be able to predict two facts regarding their brothers, their sons, their nephews, and their grandchildren, respectively, namely, *first*, what will be their average height; *secondly*, what will be the percentage of those kinsmen whose statures will range between any two heights we may please to specify:—as between 6 feet and 6 feet 1 inch, 6 feet 1 inch and 6 feet 2 inches.

The same problem admits of another rendering, because whatever is statistically *certain* in a large number is the *most probable* occurrence in a small one, so we may phrase it thus: Given a man of known stature, and ignoring every other fact, what will be the probable average height of his brothers, sons, nephews, grandchildren, &c., respectively, and what proportion of them will probably range between any two heights we please to specify?

I have solved this problem with completeness in a practical sense. No doubt my formulæ admit of extension to include influences of a minor kind, which I am content to disregard, and that more exact and copious observations may slightly correct the values of the constants I use; but I believe that for the general purposes of understanding the nearness of kinship in stature that subsists between relations in different degrees, the problem is solved.

It is needless to say that I look upon this inquiry into stature as a representative one. The peculiarities of stature are that the paternal and maternal contributions blend freely, and that selection, whether under the aspect of marriage selection or of the survival of the fittest, takes little account of it. My results are presumably true, with a few further reservations, of all qualities or faculties that possess these characteristics.

Average Statures.—The solution of the problem as regards the average height of the kinsmen proves to be almost absurdly simple, and not only so, but it is explained most easily by a working model that altogether supersedes the trouble of calculation. I exhibit one of these: it is a large card ruled with horizontal lines 1 inch apart, and numbered consecutively in feet and inches, the value of 5 feet 8 inches lying about half way up. A pin-hole is bored near the left-hand margin at a height corresponding to 5 feet $8\frac{1}{4}$ inches. A thread secured at the back of the card is passed through the hole; when it is stretched it serves as a pointer, moving in a circle with the pin-hole as a centre. Five vertical lines are drawn down the card at the following distances, measured horizontally from the pin-hole: 1 inch, 2 inches, 3 inches, 6 inches, 9 inches. For brevity I will call these lines I, II, III, VI, and IX respectively. This completes the instrument. To use it: Hold the stretched thread so that it cuts IX at the point where the reading of the horizontal lines corresponds to the stature of the given group. Then the point where the string cuts VI will show the average height of all their brothers; where it cuts III will be the average height of the sons; where it cuts II will be the average height of the nephews; and where it cuts I will be the average height of the grandchildren. These same divisions will serve for the converse kinships; VI, obviously so; III, son to a parent; II, nephew to an uncle; I, grandson to a grandfather. Another kinship can be got from VI, namely, that between "mid-parent" and son. By "mid-parental" height I mean the average of the two statures: (*a*) the height of the father, (*b*)

the transmuted height of the mother. This process, I may say, is fully justified by the tables already printed in our *Journal*, to which I have referred. (It is a rather curious fact that the kinship between a given mid-parent and a son should appear from my statistics to be of exactly the same degree of nearness as that between a given man and his brother.) Lastly, if we transmute the stature of kinswomen to their male equivalents by multiplying them (in inches) by 1·08, or say, very roughly, by adding at the rate of 1 inch for every foot, the instrument will deal with them also.

You will notice that the construction of this instrument is based on the existence of what I call "regression" towards the level of mediocrity (which is 5 feet $8\frac{1}{4}$ inches), not only in the particular relationship of mid-parent to son, and which was the topic of my address at Aberdeen, but in every other degree of kinship as well. For every unit that the stature of any group of men of the same height deviates upwards or downwards from the level of mediocrity as above, their brothers will on the average deviate only two-thirds of a unit, their sons one-third, their nephews two-ninths, and their grandsons one-ninth. In remote degeees of kinship, the deviation will become zero; in other words, the distant kinsmen of the group will bear no closer likeness to them than is borne by any haphazard group of the general population.

The *rationale* of the regression from father to son is largely to be ascribed (as was fully explained in the Address) to the double source of the child's heritage. That heritage is derived partly from a remote and numerous ancestry, who are on the whole like any other sample of the past population, and therefore mediocre, and partly only from the persons of the parents. Hence the parental peculiarities are transmitted in a diluted form, and the child tends to resemble, not his parents, but an ideal ancestor who is always more mediocre than they. The *rationale* of the regression from a known man to his unknown brother is due to a compromise between two conflicting pro-

babilities: the one that the unknown brother should differ little from the known man, the other that he should differ little from the mean of his race. The result can be mathematically shown to be a ratio of regression that is constant for all statures. The results of observation accord with, and are therefore confirmed by, this calculation.

Variability of Kinsmen above and below their Mean Stature.—Here the net result of a great deal of laborious work proves, as in the previous case, to be extremely simple, and to be very easily expressed by a working model. A set of four scales can be constructed, such as I exhibit, one appropriate to each of the lines, I, II, III, and VI, and suitable for any position on these lines. They are so divided that when the centres of the scales are brought opposite to the points crossed by the thread, in the way already explained, we shall see from the divisions on the scales what are the limits of stature between which successive batches of the kinsmen, each batch containing 10 per cent. of their whole number, will be included. Smaller divisions indicate the 5 per cent. limits, or even narrower ones. The extreme upper and extreme lower limits are perforce left indefinite. Each of the scales I give deals completely with 99 per cent. of the observations.

The principal divisions on the movable scales that are appropriate to the several lines VI, III, II, and I, are given in the Table.

Per-cents. of included statures.	Divisions, upwards and downwards, from centres of the scales; in inches.		
	VI.	III.	II and I.
10 ..	0·5	0·6	0·6
20 ..	1·0	1·3	1·3
30 ..	1·6	2·0	2 1
40 ..	2·4	3·0	3·1
45 ..	3·1	3·9	4·0
49·5 ..	4·8	6·1	6·3

The divisions are supposed to be drawn at the distances there given, both upwards and downwards from the centres of the several scales, which have to be adjusted, by the help of the thread, to the average height of the kinsmen indicated in the

several lines. The percentage of statures that will then fall between the centre of each scale and the several divisions in it is given in the first column of the table. Example:—In line VI, 40 per cent. will fall between the centre and a point 2·4 inches above it, 40 per cent. will fall between the centre and a point 2·4 inches below it; in other words 80 per cent. will fall within a distance of 2·4 inches from the centre. Similarly we see that $2 \times 49{\cdot}5$, or 99 per cent. will fall within 4·8 inches of the centre.

In respect to the principle on which these scales are constructed, observation has proved that every one of the many series with which I have dealt in my inquiry, conforms with satisfactory closeness to the "law of error." I have been able to avail myself of the peculiar properties of that law and of the well-known "probability integral" table, in making my calculations. A very large amount of cross-testing has been gone through, by comparing secondary data obtained through calculation with those given by direct observation, and the results have fully justified this course. It is impossible for me to explain what I allude to more minutely now, but much of this work is given, and more is indicated, in the forthcoming memoir to which I have referred.[1]

I know of scarcely anything so apt to impress the imagination as the wonderful form of cosmic order expressed by the "law of error." A savage, if he could understand it, would

[1] The following will be of help to those who desire a somewhat closer idea of the reasoning than I can give in a popular address:—

m = mean height of race = 68·25 inches.

$m \pm x$ = height of a known individual.

$m \pm x'$ = the probable height of an unknown kinsman in any given degree.

$\frac{x'}{x}$ (which I designate by w) = the ratio of mean regression: it is shown by direct observation to = $\frac{2}{3}$ both in the case of mid-parent to son, and of man to brother; it is inferred to be $\frac{1}{3}$ in the case of parent to son. It is upon these primary kinships that the rest depend.

The "probable" deviations ("errors") from the mean values of their respective systems are—

p = that of the general population = 1·70 inch.

b = that of any large family of brothers = 1·0 inch.

f = that of kinsmen from the mean value of $m \pm x'$.

Since a group of kinsmen in any degree may be considered as statistically

worship it as a god. It reigns with serenity in complete self-effacement amidst the wildest confusion. The huger the mob and the greater the anarchy the more perfect is its sway. Let a large sample of chaotic elements be taken and marshalled in order of their magnitudes, and then, however wildly irregular they appeared, an unsuspected and most beautiful form of regularity proves to have been present all along. Arrange the statures side by side in order of their magnitudes, and the tops of the marshalled row will form a beautifully flowing curve of invariable proportions; each man will find, as it were, a pre-ordained niche, just of the right height to fit him, and if the class-places and statures of any two men in the row are known, the stature that will be found at every other class-place, except towards the extreme ends, can be predicted with much precision.

It will be seen from the large values of the ratios of regression how speedily all peculiarities that are possessed by any single individual to an exceptional extent, and which blend freely together with those of his or her spouse, tend to disappear. A breed of exceptional animals, rigorously selected and carefully isolated from admixture with others of the same race, would become shattered by even a brief period of opportunity to marry freely. It is only those breeds that blend imperfectly with others, and especially such of these as are at the same time prepotent, in the sense of being more frequently transmitted than their competitors, that seem to have a chance of maintaining themselves when marriages are not rigorously controlled—as indeed they never are, except by professional breeders. It is on these grounds that I hail the appearance of every new and valuable type as a fortunate and most necessary occurrence in the forward progress of evolution. The precise way in which a new type comes into existence is untraced, but we may well suppose that the different possibilities in the

identical with a sample of the general population, we get a general equation that connects f with w, namely, $w^2p^2+f^2=p^2$.

The ratio of regression in respect to brothers can be shown to depend on the equation $w=\frac{p^2-b^2}{p^2}=\frac{2}{3}$ nearly.

groupings of some such elements as those to which the theory of pangenesis refers, under the action of a multitude of petty causes that have no teleological significance, may always result in a slightly altered, and sometimes in a distinctly new and a fairly stable position of equilibrium, and which, like every other peculiarity, admits of hereditary transmission. The general idea of such a process is easy enough to grasp, and is analogous to many that we are familiar with, though the precise procedure is beyond our ken. As a matter of fact, we have experience of frequent instances of "sports" useful, harmful, and indifferent, and therefore presumably without teleological intent. They are also of various degrees of heritable stability. These form fresh centres, towards which some at least of the offspring have an evident tendency to revert. By refusing to blend freely with other forms, the most peculiar "sports" admit of being transmitted almost in their entirety with no less frequency than if they were not exceptional. Thus a grandchild, as we have seen, regresses on the average one-ninth. Suppose the grandfather's peculiarity refused to blend with those of the other grandparents, then the chance of his grandson inheriting that peculiarity in its entirety would be as one to nine; and, so far as the new type might be prepotent over the other possible heritages, so far would the chance of its reappearance be increased. On the other hand, if the peculiarity blends easily, and if it was exceptional in magnitude, the chance of inheriting it to its full extent would be extremely small.[1] The

[1] The chance that the stature of the son will at least rival the stature of the father is not uniform; it varies with the stature of the father. The following table shows the value of the probability in various cases. Columns A contain the height of the fathers; the columns B show how many *per cent.* of the sons will be of at least the same height as their fathers.

A.		B.	A.		B.	A.		B.
feet.	inches.	per cent.	feet.	inches.	per cent.	feet.	inches.	per cent.
5	8¼	50	6	0	15	6	4	1·4
5	9	42	6	1	9	6	5	0·7
5	10	31	6	2	5	6	7	0·3
5	11	22	6	3	3			

probability (easily to be calculated for any given instance by the "probability integral" tables) might even be many thousand times smaller. I will give for an example a by no means extreme case. Suppose a large group of men, all of 6 feet 5 inches in height, the statures of whose wives are haphazard, then it can be shown that, on an average, out of every thousand of the sons not more than seven will rival or surpass the height of his father. This consideration is extremely important in its bearing on the origin of species. I feel the greatest difficulty in accounting for the establishment of a new breed in a state of freedom by slight and uncertain selective influences, unless there has been one or more abrupt changes of type, many of them perhaps very small, but leading firmly step by step, though it may be along a devious track, to the new form.

It will be of interest to trace the connection between what has been said about hereditary stature and its application to hereditary ability. Considerable differences have to be taken into account and allowed for. *First*, after making large allowances for the occasional glaring cases of inferiority on the part of the wife to her eminent husband, I adhere to the view I expressed long since as the result of much inquiry, historical and otherwise, that able men select those women for their wives who on the average are not mediocre women, and still less inferior women, but those who are decidedly above mediocrity. Therefore, so far as this point is concerned, the average regression in the son of an able man would be less than one-third. *Secondly*, very gifted men are usually of marked individuality, and consequently of a special type. Whenever this type is a stable one, it does not blend easily, but is transmitted almost unchanged, so that specimens of very distinct intellectual heredity frequently occur. *Thirdly*, there is the fact that men who leave their mark on the world are very often those who, being gifted and full of nervous power, are at the same time haunted and driven by a dominant idea, and are therefore within a measurable distance of insanity. This weakness will

probably betray itself occasionally in disadvantageous forms among their descendants. Some of these will be eccentric, others feeble-minded, others nervous, and some may be downright lunatics.

It will clear our views about hereditary ability if we apply the knowledge gained by our inquiry to solve some hypothetical problem. It is on that ground that I offer the following one. Suppose that in some new country it is desired to institute an Upper House of Legislature consisting of life-peers, in which the hereditary principle shall be largely represented. The principle of insuring this being that (say) two-thirds of the members shall be elected out of a class who possess specified hereditary qualifications, the question is, What reasonable plan can be suggested of determining what those qualifications should be?

In framing an answer, we have to keep the following principles steadily in view:—(1) The hereditary qualifications derived from a single ancestor should not be transmitted to an indefinite succession of generations, but should lapse after, say, the grandchildren. (2) All sons and daughters should be considered as standing on an equal footing as regards the transmission of hereditary qualifications. (3) It is not only the sons and grandsons of ennobled persons who should be deemed to have hereditary qualifications, but also their brothers and sisters, and the children of these. (4) Men who earn distinction of a high but subordinate rank to that of the nobility, and whose wives had hereditary qualifications, should transmit those qualifications to their children. I calculate roughly and very doubtfully, because many things have to be considered, that there would be about twelve times as many persons hereditarily qualified to be candidates for election as there would be seats to fill. A considerable proportion of these would be nephews, whom I should be very sorry to omit, as they are twice as near in kinship as grandsons. One in twelve seems a reasonably severe election, quite enough to draft off the eccentric and incompetent, and not too severe to discourage the ambition of the

rest. I have not the slightest doubt that such a selection out of a class of men who would be so rich in hereditary gifts of ability, would produce a senate at least as highly gifted by nature as could be derived by ordinary parliamentary election from the whole of the rest of the nation. They would be reared in family traditions of high public services. Their ambitions, shaped by the conditions under which hereditary qualifications could be secured, would be such as to encourage alliances with the gifted classes. They would be widely and closely connected with the people, and they would to all appearance—but who can speak with certainty of the effects of any paper constitution ?—form a vigorous and effective aristocracy.

I will not make any further claim on your kind attention to-night. There has been much business, the meeting has been a long one, and it is late. But before sitting down I should deny myself a pleasure if I did not advert to the many agreeable and instructive evenings that we have spent during the past session in this room, and to the apparently growing success of the Anthropological Institute. No small part of that success, and of the stability of this Society, is due, in my opinion, to the unostentatious, solid and judicious management of our Director that was, but whom I must now call by his new title, our Secretary, Mr. Rudler, and I am grateful for this opportunity of making so public an acknowledgment of his help. It now remains to express a fervent wish, that I know you will all share, that our Institute may continue to progress and ever worthily to fill its important and self-adopted post of the representative of Anthropology in this country.

It was moved by Professor FLOWER, seconded by Dr. BEDDOE, and carried unanimously—

> "That the thanks of the meeting be given to the President for his address, and that it be printed in the *Journal* of the Institute."

The SCRUTINEERS gave in their report, and the following gentlemen were declared to be duly elected to serve as Officers and Council for the year 1886 :—

President.—Francis Galton, Esq., M.A., F.R.S.

Vice-Presidents.—Hyde Clarke, Esq.; Lieut.-Col. H. H. Godwin-Austen, F.R.S.; Prof. A. H. Keane, B.A.

Secretary.—F. W. Rudler, Esq., F.G.S.

Treasurer.—F. G. H. Price, Esq., F.S.A.

Council.—S. E. B. Bouverie-Pusey, Esq.; Sir W. Bowman, Bart.; E. W. Brabrook, Esq., F.S.A.; Sir George Campbell, K.C.S.I.; C. H. E. Carmichael, Esq., M.A.; W. L. Distant, Esq.; A. W. Franks, Esq., M.A., F.R.S.; J. G. Garson, Esq., M.D.; A. L. Lewis, Esq.; Prof. A. Macalister, F.R.S.; R. Biddulph Martin, Esq.; Prof. Meldola, F.C.S.; Prof. Moseley, F.R.S.; C. Peek, Esq., M.A.; J. E. Price, Esq., F.S.A.; Charles H. Read, Esq., F.S.A.; Charles Roberts, Esq., F.R.C.S.; Lord Arthur Russell, M.P.; Prof. G. D. Thane; M. J. Walhouse, Esq., F.R.A.S.

Dr. GARSON moved, and Mr. COLLINGWOOD seconded, a vote of thanks to the retiring members of the Council, to the Auditors, and to the Scrutineers, which was carried unanimously.