Journal of Criminal Law and Criminology

Volume 31
Issue 5 *January-February*

Article 11

Winter 1941

Human Hair Studies: II Scale Counts

Lucy H. Gamble

Paul L. Kirk

HUMAN HAIR STUDIES

II. Scale Counts*

Lucy H. Gamble† and Paul L. Kirk‡

In the first publication of this series the general significance of scale counts of human head hair was briefly outlined. In order to evaluate more accurately the use of this factor for individualization of hair, a statistical study of some magnitude is necessary, to determine, (1) the degree of variability of the factor for the individual, (2) the degree of variability for the race, and (3) the statistical significance of the factor.

It may be stated at the outset that much data must be collected before the total possible range of scale counts for the population and the maximum possible range for the individual can be finally evaluated. Nevertheless, the data reported here are believed to be sufficient to establish certain essential points as well as could be accomplished with a larger amount, and in addition the value of scale counts in individualization is definitely shown.

Hausman (1) concluded that the scale diameter of human head hair was correlated only with the hair shaft diameter. The experimental basis for this conclusion was not given in sufficient detail for any direct comparison with the data given here. Wyncoop (2) found no correlation of scale diameter with age but again pointed out a direct inverse variation with shaft diameter. In neither of these publications was an exact statement given of the meaning of scale diameter or its method of determination. Presumably it is some reciprocal function of the scale count as defined in this study. If this is the case these authors still give no indication of the actual magnitude or significance of individual variations. Moreover, diameter data collected in this laboratory do not show any direct proportionality with scale count. Hair from one individual showed nearly 3-fold variations in the values of both minimum and maximum diameters of hair shaft, and a corresponding scale count range of from 18.6 to 30.6, a variation well within the range of other individuals showing from 1.5- to 2-fold variations in shaft diameters. This single case would be sufficient to prove the absence of a direct proportionality even if it were unsupported by other data, as it is. It does not preclude a statistical correlation and none of the data given here can be used to prove or disprove such a correlation.

* This is the second of a series of articles on human hair studies which were made with the aid of a grant from the Research Board of the University of California and of clerical assistance from the Works Progress Administration. The first article appeared in the previous issue of this *Journal*.

† A.B. in Technical Criminology (1939), University of California.

‡ Associate Professor of Biochemistry, University of California.

Experiment

All hairs were cleaned and mounted dry as described in the first paper of this series. The scales were counted in either of two ways, both of which yielded the same results on the same material. In the first method, the mounted hair was placed on the microscope in such a position that it was bisected longitudinally by one of the cross hairs of the ocular and overlaid by the markings of an ocular micrometer. A high dry objective (44 x) was usually employed in conjunction with a 10 x ocular. The ocular micrometer had been carefully calibrated against a stage micrometer using identical optical arrangements. The count was taken of all scale edges which crossed the longitudinal cross hair between the outside markings of the micrometer. This value was then converted by use of the calibration to the number of scales in 0.2 mm. of length as measured along a single straight line.

The second method utilized the ocular micrometer in identical fashion but allowed the elimination of the cross hair. The microscope was focussed on the exact edge of the hair and then upward just a trifle so that the scales on that portion of the periphery just above the exact edge were in focus. Owing to the almost vertical position of the part of the hair being observed, a very narrow longitudinal line was actually in focus and a count of the scales along that line was equivalent to a count along the line of a longitudinally placed cross hair. The conversion to a standard length was made in the same way as above.

In all, thirty-nine sets of hair were studied, these having come from thirty-seven persons. Two sets came from one person, a portion of whose hair was permanently waved, the waved and unwaved hair being studied separately. Two other sets came from the same person at widely different ages and were treated as though they came from two individuals. With one exception, at least one hundred counts were made for each set of hair and in one case 600 counts were made. The total number of counts used for statistical evaluation was 7846 which were obtained from 3267 hairs. In most instances two counts were made per hair, and never more than six except for the data dealing with single hairs in which 100 counts were made on each single hair. There were 21 of the latter cases, the number being determined by the fact that several individuals made scale counts but not all of them performed single hair studies. It was deemed inadvisable for other individuals to complete the data in these instances because of the possibility of personal error or disagreement due to differences in vision or interpretation. Theoretically this should not be a factor, but it is true that in some hair the scale markings are not normally distinct and some disagreement may be found depending on the individual interpretation.

Data were recorded so as to permit the abstraction of the figures for the first 25, 50, 75 and 100 counts which were statistically treated in the same way as the total number of counts for the individual (when there were more

than 100 counts). Statistical evaluation of the various groups of data was made by recognized methods as indicated hereafter in connection with Table I.

Results

The scale count data are summarized and calculated in Table I. Mean values as low as about 19.5 and as high as 33 were observed. The frequency distribution curves of scale counts for most individuals were normal ones and showed a satisfactory agreement between larger and smaller numbers of counts, the larger of course being the more representative. The agreement of both mean and range of 100 counts on a single hair with mean and range for the total counts on many hairs of the same individual is particularly striking. A very few exceptions to this regularity were found. It seems reasonably definite that a single hair is nearly always representative of all the hairs of the head, provided enough counts are taken to eliminate the normal variation of scales from point to point along the hair. The great desirability of taking 100 counts before computing means or ranges is also indicated from the data. In most cases the results from smaller numbers were definitely significant but necessarily demanded somewhat more latitude in their interpretation. In all but a very few cases, and regardless of the number of counts (above 25), the range of counts falls within the significant deviation determined statistically. No indication is given by the data reported of any scale count differences beween the sexes or between races. The numbers are insufficient to lend any high probability to such figures in any case. In one case only, where hair from two different ages of the same individual was available, a definite difference in both mean and range is observed. This may be interpreted only by the statement that scale counts may change with age. The data of Wyncoop (2) indicate no regular trend which might be used to determine age. In one case in which a portion of the hair was permanently waved, a definite and reproducible difference was observed between the portions that were waved and unwaved. This is in accord with the many changes observed in waved hair in various of its morphological characters.

From the standpoint of hair individualization the significant facts to be observed from the data quoted are that scale count means differ significantly from individual to individual but in the same individual are quite constant, even from hair to hair. They may therefore be used in the elimination of suspected individuals, or as a positive character in the description of the individual's hair. Moreover, the range is likewise variable from person to person but is reasonably constant with the individual and might be used in the analogous manner to scale count means. Neither the means nor the ranges so far available give any definite indication of falling on a normal frequency distribution curve. Since data are available on only 39 sets of hair, it is not possible to say as yet whether this is a general situation or one peculiar to the limited data of this investigation.

A value for the range of a set of scale counts is an inconvenient figure to use practically, and one which obviously has a variable significance depending on the actual magnitude of the count. Thus a range of 10 with a mean count of 20 is greater proportionately than the same range with a mean count of 30. In order to calculate a corrected figure or coefficient, we might divide the range by the mean count, obtaining a single value which would express the range in a convenient form. This was done for the data here presented and the values were in nearly all cases significant. Actually, in 4 instances out of 22 in which the value was calculated for a single hair and for multiple hairs, the deviations were greater than 0.05 between the two types of count. In more than half of the other cases the corresponding deviations were of the order of only 0.01. The discrepancy appeared to be due to several factors, the chief ones being (a) presence of gray hairs mixed with dark, and (b) deviations in the distribution curve at the very bottom due to a few erratic high or low counts which changed the range by a large amount without significantly affecting the mean. To correct for this situation, calculations were made using the statistical range, viz., $m \pm 3 \times S.D.$ Again discrepancies were found due to occasional skewness in the upper portions of the distribution curve. This effect had obviously no relation to the range and this method of calculation was abandoned. Adjusting the data by omitting erratic single counts was also not uniformly successful. Both skewness of the curve and erratic counts at the extreme ends of the range should be eliminated as primary factors in calculating range coefficients, since neither one is statistically significant in connection with the range. It is not entirely certain how the calculation of a significant scale count range coefficient may best be made, but it is obvious that the primary reason for obtaining such a figure is to get a value which is as nearly constant as possible for the individual and which will show as great variations as possible between individuals. In view of the relatively small number of individuals completely studied, it seems desirable to adhere for the moment to the range coefficient as defined and await further collection of data before attempting to correct or adjust the values. Since all but 4 individuals out of 21 showed differences of less than 0.05 between a single hair and 100 hairs, it is believed that this is to be taken as the minimum significant variation. It is probable that gray hair and dark hair from the same individual will show differences in this as well as perhaps other factors, and further study of this question is indicated.

The indications of this work are that on the average, one individual in at least four may be distinguished on the basis of scale count means alone, and that a definite further elimination may be made by use of range coefficients. The range itself, if not interpreted too closely, may have a significance as an individual factor. It should be emphasized that scale count work, like other investigation of hairs, should be carried out by one familiar with the technique and that it must be done care-

fully and as many counts made as are practical, preferably at least 100. One or a few counts are virtually worthless in the individualization of hair, due to the very considerable variations that can occur from point to point. Properly used, this factor can become most helpful in establishing a definite probability of the origin of a hair.

Summary

Multiple scale counts were run on thirty-nine samples of human crown hair and the data (7846 counts on 3267 hairs) statistically analyzed.

Both scale count means and ranges were found to be approximately constant for the individual, variable between individuals and useful in description of hair morphology. Both factors have a definite and individual value in eliminating suspected hair identities.

A single hair was found to be characteristic of all hairs counted for the individual with respect to mean and nearly always to range of scale counts.

References

1. Hausman, L. A., Amer. Naturalist, *59*, 529 (1925); *58*, 544 (1924).
2. Wynkoop, E. M., Am. J. Physiol. Anthropology, *13*, 177 (1929).

TABLE I

Scale Count Data

Case	Number of Hairs	Number of Counts	Arithmetic Mean[1] M_s	Standard Deviation[2] S.D.	Theoretical Range[3] (M—3x S.D.)—(M+3x S.D.)	Actual Range[4]	Percentage of Cases within Theoretical Range %
E. C. W.	100	200	24.70	2.45	17.4-32.0	18.4-31.2	100
Female	50	100	24.36	2.48	16.9-31.8	18.4-31.2	100
Middle-aged	38	75	24.00	2.35	17.0-31.1	18.4-28.4	100
Permanent	25	50	24.13	2.31	17.2-31.1	18.4-28.4	100
Gray and Dark	13	25	24.06	2.72	15.9-32.3	19.8-28.4	100
Mixture	1	100	25.15	3.09	15.9-34.4	18.4-32.6	100

[1] The *Arithmetic Mean*, or average of scale counts, was computed by grouping the data into a frequency distribution and applying the following standard formula:

$$M_s = M_a + \frac{h}{N}(\Sigma f\ d)$$

where M_s = the arithmetic mean of the sample
M_a = assumed mean of sample
h = value of class interval
N = number of scale counts in sample
f = frequency or number of items in class interval
d = deviation of mid value of class interval from M_a

[2] The *Standard Deviation* was selected as a measure of variation of the scale count data around the mean. It was computed by the following formula:

$$\text{S.D.} = h\left(\sqrt{\frac{\Sigma f\ d^2}{N} - \frac{(\Sigma f\ d)^2}{N}}\right)$$

where h, d, f, and N represent the same terms as defined for the arithmetic mean.

[3] In a normal frequency distribution 99.7% of the cases fall between M—3 x S.D. and M + 3 x S.D. For all practical purposes this can be considered as the *Theoretical Range.*

[4] The *Actual Range* represents the span between the lowest and highest scale count for each sample.

Case	Number of Hairs	Number of Counts	Arithmetic Mean[1] M_s	Standard Deviation[2] S.D.	Theoretical Range[3] (M—3x S.D.)—(M+3x S.D.)	Actual Range[4]	Percentage of Cases within Theoretical Range %
J. D. M.	100	200	28.42	3.23	18.7-38.1	21.3-35.5	100
Male	50	100	28.30	3.11	19.0-37.6	21.3-35.5	100
Gray and Dark	38	75	27.86	2.92	19.1-36.6	21.3-34.0	100
Mixture	25	50	27.89	2.64	21.0-35.8	22.7-34.0	100
	13	25	27.71	2.24	21.0-34.4	24.1-31.2	100
	1	100	27.89	2.58	20.2-35.6	22.7-34.0	100
S. H.	100	200	26.72	2.60	18.9-34.5	21.3-32.6	100
Female	50	100	26.91	2.45	19.4-34.1	21.3-32.6	100
9 years	38	75	26.72	2.45	19.4-34.1	21.3-32.6	100
	25	50	26.22	2.35	19.2-33.3	21.3-32.6	100
	13	25	25.90	2.77	17.6-34.2	21.3-32.6	100
	1	100	26.63	2.18	20.1-33.2	21.3-32.6	100
B. L.	100	200	26.01	2.04	19.9-32.1	21.3-31.2	100
Male	50	100	26.07	1.97	20.2-32.0	22.7-29.8	100
30 years	38	75	25.84	1.84	20.3-31.4	22.7-29.8	100
Part Indian	25	50	25.81	1.75	20.6-31.1	22.7-28.4	100
	13	25	25.73	1.91	20.0-31.5	22.7-28.4	100
	1	100	25.27	1.94	19.5-31.1	21.3-31.2	99
L. H. G.	100	200	25.12	1.82	19.7-30.6	22.7-28.4	100
Female	50	100	25.19	1.68	20.2-30.2	22.7-28.4	100
23 years	38	75	25.23	1.67	20.2-30.2	22.7-28.4	100
	25	50	25.10	1.60	20.3-29.9	22.7-28.4	100
	13	25	25.33	1.57	20.6-30.0	22.7-28.4	100
	1	100	25.15	1.27	21.3-29.0	22.7-28.4	100
L. H. G.	100	200	23.02	2.07	17.8-29.2	18.4-26.9	100
Female	50	100	23.27	2.08	17.0-29.5	18.4-26.9	100
21 months	38	75	23.32	2.27	16.3-30.0	18.4-26.9	100
	25	50	23.10	2.27	16.3-30.0	18.4-26.9	100
	13	25	22.87	2.17	16.4-29.4	18.4-26.9	100
	1	100	23.01	2.03	16.9-29.1	18.4-26.9	100
B. D.	52	104	21.98	2.26	15.2-28.8	17.0-26.9	100
Male	50	100	22.05	2.24	15.3-28.8	17.0-26.9	100
	38	75	22.30	2.20	15.7-28.9	18.4-26.9	100
	25	50	22.78	2.03	16.7-28.9	18.4-26.9	100
	13	25	22.78	1.63	17.9-27.7	19.8-25.5	100
	1	100	21.77	2.27	15.0-28.6	17.0-26.9	100
L. V.	50	100	28.73	2.92	20.0-37.5	22.7-35.5	100
Male	38	75	29.02	3.13	19.6-38.4	22.7-35.5	100
	25	50	28.68	3.06	19.5-37.9	22.7-35.5	100
	13	25	28.51	2.84	20.0-37.0	24.1-32.6	100
	1	100	28.67	2.94	19.9-37.5	22.7-35.5	100
A. F.	50	100	32.90	3.48	22.5-43.3	25.5-39.7	100
Male	38	75	32.54	3.56	21.9-43.2	25.5-39.7	100
	25	50	32.12	3.42	21.9-42.4	25.5-39.7	100
	13	25	31.92	3.55	21.3-42.6	25.5-39.7	100
	1	100	33.17	3.02	24.1-42.2	25.5-39.7	100
S. D.	36	72	24.38	2.26	17.6-31.2	19.8-28.4	100
Male	25	50	24.53	2.27	17.7-31.3	19.8-28.4	100
	13	25	25.01	2.01	19.0-31.0	21.3-28.4	100
	1	100	24.23	2.26	17.5-31.0	19.8-28.4	100

Case	Number of Hairs	Number of Counts	Arithmetic Mean[1] M_s	Standard Deviation[2] S.D.	Theoretical Range[3] (M—3x S.D.)—(M+3x S.D.)	Actual Range[4]	Percentage of Cases within Theoretical Range %
E. D.	36	72	24.55	2.59	16.8-32.3	18.4-29.8	100
Male	25	50	24.72	2.77	16.4-33.0	18.4-29.8	100
	13	25	24.84	3.16	15.4-34.3	19.8-29.8	100
	1	100	25.75	2.52	18.2-33.3	18.4-29.8	100
R. C.	35	70	28.33	3.26	18.6-38.1	21.3-34.0	100
Male	25	50	28.49	3.50	18.0-39.0	21.3-34.0	100
Middle-aged	13	25	27.35	2.71	21.9-32.8	22.7-32.6	100
	1	100	27.25	2.44	19.9-34.6	21.3-34.0	100
G. H.	25	50	28.63	2.44	21.3-36.0	22.7-34.0	100
Male	13	25	27.89	2.39	20.7-35.1	22.7-32.6	100
	1	100	28.58	2.88	19.9-37.2	22.7-34.0	100
P. W. F.	100	100	22.35	1.46	18.0-26.7	19.1-25.8	100
Male	75	75	22.43	1.48	18.0-26.9	19.1-25.8	100
21 years	50	50	22.43	1.41	18.2-26.7	19.1-24.9	100
	25	25	22.51	1.67	17.5-27.5	20.1-24.9	100
	1	100	22.09	1.38	18.0-26.2	18.2-25.8	100
R. E. J.	100	100	26.37	2.02	20.3-32.4	22.2-30.6	100
Female	75	75	26.39	2.19	16.4-29.5	18.7-29.2	100
20 years	50	50	26.40	2.03	20.3-32.5	22.2-30.6	100
Permanent	25	25	26.70	1.91	21.0-32.4	22.2-30.6	100
	1	100	24.87	2.26	18.1-31.7	21.1-29.6	100
R. C. M.	100	100	26.81	1.81	21.4-32.2	22.5-30.4	100
Male	75	75	26.81	1.73	21.6-32.0	23.5-30.4	100
22 years	50	50	26.86	1.67	21.9-31.9	23.5-29.4	100
	25	25	26.82	1.61	22.0-31.7	23.5-29.4	100
	1	100	26.76	1.81	21.3-32.2	22.5-30.4	100
W. J. C.	100	100	24.13	2.44	16.8-31.5	18.9-29.5	100
Male	75	75	24.59	2.39	17.4-31.8	18.9-29.5	100
20 years	50	50	24.46	2.41	17.2-31.7	18.9-27.4	100
	25	25	23.49	2.16	17.0-30.0	18.9-27.4	100
	1	100	24.02	2.36	17.0-31.1	18.9-29.5	100
H. A. E.	100	100	23.17	2.08	16.9-29.4	18.7-29.3	100
Male	75	75	23.13	2.11	16.1-29.5	18.7-29.3	100
21 years	50	50	23.17	2.03	17.1-29.3	18.7-29.3	100
	25	25	23.09	1.68	18.1-28.1	20.0-26.7	100
	1	100	23.39	1.94	17.6-29.2	18.7-29.3	99
D. Q. B.	100	100	23.44	2.94	14.6-32.3	18.2-32.7	99
Male	75	75	23.16	2.75	14.9-31.4	18.2-31.5	99
20 years	50	50	22.93	2.60	15.1-30.7	18.2-31.5	98
	25	25	23.56	2.85	15.0-32.1	19.4-31.5	100
	1	100	23.50	2.15	17.1-29.4	18.2-27.9	100
B. P.	100	100	22.26	1.93	16.5-28.1	17.6-26.5	100
Male	75	75	22.19	1.99	16.2-28.2	17.6-26.5	100
23 years	50	50	21.78	1.77	16.5-27.1	17.6-26.5	100
	25	25	21.92	1.73	16.7-27.1	17.6-25.5	100
	1	100	21.75	1.58	17.0-26.5	17.6-25.5	100

Case	Number of Hairs	Number of Counts	Arithmetic Mean[1] M_s	Standard Deviation[2] S.D.	Theoretical Range[3] (M—3x S.D.)—(M+3x S.D.)	Actual Range[4]	Percentage of Cases within Theoretical Range %
R. L.	100	100	20.60	1.52	16.0-25.2	17.1-23.8	100
Male	75	75	20.65	1.50	16.2-25.2	18.4-23.8	100
22 years	50	50	20.55	1.53	16.0-25.1	18.4-23.8	100
	25	25	20.27	1.34	16.3-24.3	18.4-23.8	100
	1	100	20.70	1.46	16.3-25.1	17.1-23.8	100
J. E. D.	100	100	22.88	2.45	15.5-30.2	17.3-30.7	99
Male	75	75	22.92	2.19	16.4-29.5	18.7-29.2	100
20 years	50	50	23.41	2.03	17.3-29.5	20.0-29.2	100
	25	25	23.15	1.99	17.2-29.1	20.0-26.7	100
E. J. S.	100	600	21.86	1.83	16.4-27.4	17.2-27.2	100
Male	17	100	21.64	1.80	16.2-27.0	17.2-25.7	100
23 years	13	75	21.63	1.84	16.1-27.2	17.2-25.7	100
	9	50	21.27	1.81	15.8-26.7	17.2-25.7	100
	5	25	20.81	1.70	15.7-25.9	17.2-24.3	100
A. J.	75	75	26.01	2.07	19.8-32.2	18.6-30.6	99
Male	50	50	25.99	2.14	19.6-32.4	18.6-30.6	98
24 years	25	25	25.64	2.14	19.2-32.1	21.3-30.6	100
G. W. O.	100	200	27.81	1.21	24.2-31.4	25.3-30.6	100
Male	50	100	27.50	1.23	23.8-31.2	25.3-30.6	100
22 years	38	75	27.40	1.17	23.9-30.9	25.3-30.6	100
	25	50	27.50	1.24	23.8-31.1	25.3-30.6	100
	13	25	27.66	1.19	24.1-31.2	25.3-30.6	100
L. T. R.	99	297	24.36	2.30	17.5-31.3	18.4-31.2	100
Male	34	100	24.26	2.42	17.0-31.5	18.4-31.2	100
21 years	25	75	24.03	2.47	16.6-31.4	18.4-29.8	100
	17	50	23.85	2.45	16.5-31.2	18.4-28.4	100
	9	25	22.85	2.38	15.7-30.0	18.4-28.4	100
F. I.	100	100	19.66	1.68	14.6-24.7	17.6-23.8	100
Male	75	75	19.66	1.64	14.7-24.6	17.6-23.8	100
27 years	50	50	19.78	1.73	14.6-25.0	17.6-23.8	100
	25	25	19.58	1.84	14.1-25.1	17.6-23.8	100
C. C.	100	100	21.90	1.24	18.2-25.6	19.7-23.8	100
Male	75	75	21.87	1.23	18.2-25.6	19.7-23.8	100
30 years	50	50	21.88	1.18	18.3-25.4	19.7-23.8	100
	25	25	22.17	1.02	19.1-25.2	19.7-23.8	100
L. M. W.	100	100	20.46	2.79	12.0-29.0	16.6-30.0	100
Female	75	75	20.54	3.02	11.6-30.3	16.6-30.0	100
19 years	50	50	20.95	3.11	11.6-30.3	16.6-30.0	100
Permanent	25	25	20.99	3.22	11.3-30.7	16.6-30.0	100
X.	100	100	24.80	1.43	20.5-29.1	21.8-26.9	100
Male	75	75	24.90	1.41	20.7-29.1	21.8-26.9	100
37 years	50	50	24.90	1.47	20.5-29.3	21.8-26.9	100
	25	25	24.76	1.55	20.1-29.4	21.8-26.9	100
Y.	100	100	23.31	1.88	17.7-29.0	18.6-26.9	100
Male	75	75	23.46	1.92	17.7-29.2	18.6-26.9	100
Middle-aged	50	50	23.17	1.78	17.5-28.5	18.6-26.9	100
	25	25	23.17	1.88	17.5-28.8	18.6-26.9	100

Case	Number of Hairs	Number of Counts	Arithmetic Mean[1] M_s	Standard Deviation[2] S.D.	Theoretical Range[3] (M—3x S.D.)—(M+3x S.D.)	Actual Range[4]	Percentage of Cases within Theoretical Range %
E. O. G.	50	100	24.37	1.63	19.5-29.3	21.8-28.0	100
Male	38	75	24.33	1.60	19.5-29.1	21.8-26.9	100
26 years	25	50	24.36	1.70	19.8-30.0	21.8-26.9	100
	13	25	24.94	1.80	19.5-30.3	22.8-26.9	100
A.	25	100	24.41	1.93	18.6-30.2	20.7-31.0	97
Female	19	75	24.56	2.08	18.3-30.8	20.7-31.0	96
20 years	13	50	24.24	1.79	18.9-29.6	20.7-29.0	100
Permanent	7	25	24.23	2.02	18.2-30.3	20.7-29.0	100
B.	25	100	26.38	1.88	20.7-32.0	23.8-31.1	100
Female	19	75	26.32	1.72	21.2-31.5	23.8-31.1	100
21 years	13	50	26.07	1.34	22.1-30.1	23.8-29.0	100
Permanent	7	25	26.07	0.94	23.3-28.9	24.9-28.0	100
E. S.	100	100	22.57	0.99	19.6-25.5	20.2-24.7	100
Female	75	75	22.58	1.02	19.5-25.6	20.2-24.7	100
23 years	50	50	22.48	0.99	19.5-25.5	20.2-24.7	100
	25	25	22.39	0.92	19.6-25.2	20.2-24.7	100
E. S.	100	100	23.99	1.38	19.9-28.1	20.2-25.9	100
As above	75	75	23.94	1.00	20.9-26.9	20.2-25.9	99
Permanent	50	50	23.95	1.18	20.4-27.5	22.5-25.9	100
	25	25	24.12	1.16	20.6-27.6	22.5-25.9	100
J. T.	100	200	27.90	2.92	19.2-36.7	22.2-35.6	100
Male	50	100	28.20	2.86	19.6-36.8	22.2-35.6	100
19 years	38	75	28.10	2.83	19.6-36.6	22.2-34.4	100
	25	50	27.77	2.87	19.2-36.4	22.2-34.4	100
	13	25	27.70	2.86	19.1-36.3	23.3-34.4	100
B. B.	100	500	22.17	2.11	15.8-28.5	17.8-28.9	99
Male	20	100	22.06	2.57	14.4-29.8	17.8-28.9	100
23 years	15	75	22.05	2.61	14.2-29.9	17.8-28.9	100
	10	50	22.22	2.78	13.9-30.6	17.8-28.9	100
	5	25	22.80	2.65	14.9-30.8	17.8-28.9	100
D. H.	103	206	23.60	1.50	19.1-28.1	20.7-27.2	100
Male	50	100	23.50	1.42	19.2-27.8	20.7-27.2	100
22 years	38	75	23.48	1.49	19.0-28.0	20.7-27.2	100
	25	50	23.65	1.45	19.3-28.0	20.7-27.2	100
	13	25	23.65	1.29	19.8-27.5	21.8-26.1	100

TABLE II.

Scale Count Range Coefficients

Case	Number of Hairs	Number of Counts	Range	Range / Mean
E. C. W.	100	200	12.8	0.50
	1	100	14.2	0.56
J. D. M.	100	200	14.2	0.50
	1	100	11.3	0.40
S. H.	100	200	11.3	0.42
	1	100	11.3	0.42
B. L.	100	200	9.9	0.38
	1	100	9.9	0.39

Case	Number of Hairs	Number of Counts	Range	Range / Mean
L. H. G.	100	200	5.7	0.22
23 years	1	100	5.7	0.22
L. H. G.	100	200	8.5	0.36
21 months	1	100	8.5	0.36
B. D.	52	104	9.9	0.45
	1	100	9.9	0.45
L. V.	50	100	12.8	0.44
	1	100	12.8	0.45
A. F.	50	100	14.2	0.43
	1	100	14.2	0.43
S. D.	36	72	8.6	0.35
	1	100	8.6	0.35
E. D.	36	72	11.4	0.47
	1	100	11.4	0.44
P. W. F.	100	100	6.7	0.30
	1	100	7.6	0.34
R. E. J.	100	100	8.4	0.32
	1	100	8.5	0.34
R. C. M.	100	100	7.9	0.30
	1	100	7.9	0.30
W. J. C.	100	100	10.6	0.44
	1	100	10.6	0.44
H. A. E.	100	100	10.6	0.46
	1	100	10.6	0.40
D. Q. B.	100	100	14.5	0.70
	1	100	9.7	0.41
B. P.	100	100	8.9	0.40
	1	100	7.9	0.36
R. L.	100	100	6.7	0.33
	1	100	6.7	0.32
R. C.	35	70	12.7	0.44
	1	100	12.7	0.47
G. H.	25	50	11.3	0.39
	1	100	11.3	0.39
J. E. D.	100	100	13.4	0.59
E. J. S.	100	600	10.0	0.46
A. J.	75	75	12.0	0.46
G. W. O.	100	200	5.3	0.19
L. T. R.	99	297	12.8	0.52
F. I.	100	100	6.2	0.32
C. C.	100	100	4.1	0.19
L. M. W.	100	100	13.4	0.65
X.	100	100	5.1	0.23
Y.	100	100	8.3	0.35
E. O. G.	50	100	6.2	0.25
A.	25	100	10.3	0.42
B.	25	100	7.3	0.28
E. S.	100	100	4.5	0.20
E. S. (permanent)	100	100	5.7	0.24
J. T.	100	200	13.4	0.50
B. B.	100	500	11.1	0.50
D. H.	103	206	6.5	0.27

[*The third article of this series will appear in an early issue of the Journal.*]