

VARIATION IN WHORL OF THE HEAD HAIR

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ESCHRICHT³ made a study of the direction of the hair on the human body in 1837. He says (p. 49), "From the crown the (hair) always comes forth in a whorl, and it extends fairly symmetrically in rays in all directions. In rare cases there are two crowns; I have, however, seen no example of this during the present investigation. The whorl of the crown is as a rule directed to the right, and its principal stream falls on the left side of the head."[†]

Voigt¹² made a similar study in 1856. In 1903 Kidd published an account of the direction of the hair in animals and man and in discussing the head hair of man says⁸ (p. 76), "First, over the posterior fontanelle the familiar whorl or 'crown' is always present and may lie to the right or left of the middle line, seldom quite in the middle line, and it is double in a certain number of persons, one whorl lying on each side of the middle line."

Sano¹⁰ has called attention to a case of reversal in direction of the crown in a pair of identical twins, and Newman⁸ has referred to this condition as symmetry reversal. Brewster¹ in 1925 reported a study of heredity in whorl of the head hair, the crowns in this case being double and presumably whorling in the same direction.

In 1925, Lauterbach⁷ reported the results of a study of 212 pairs of twins. It was discovered that 24.2 percent of all twin pairs (13.7 percent of all individual twins) showed some variation from the usual clockwise whorl. It was further discovered that this variation was not always in the

form of a counter-clockwise whorl, but frequently assumed the form of double whorls which might combine in a number of ways.

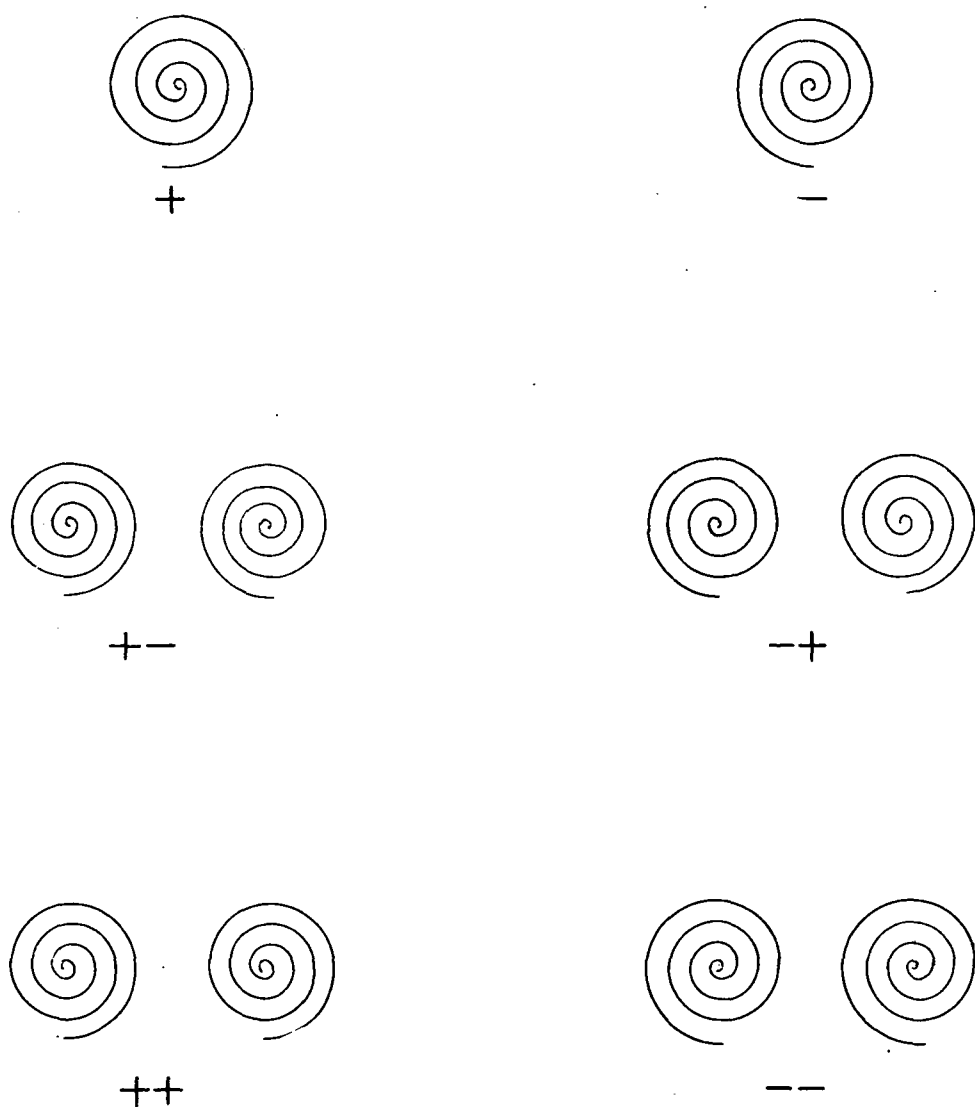
An extensive literature on the hair, mostly medical, has been developed. Friedenthal⁴ reports a bibliography of 1270 books and papers, presumably complete to that date (1908). But little reference, however, seems to have been made to variation in the whorl of the head hair or the frequency of its occurrence. The large percentage of variation in the whorls of twins suggested the possibility that this might be a phenomenon characteristic of twinning. There was a frequent coincidence, also, of left-handedness and left whorls. It seemed desirable, therefore, to find out what the variation in a random sampling of the population is.

With this purpose in view, the heads of 1003 children in the schools of Watertown, Massachusetts, ranging in age from 6 to 15 years, were examined. An attempt was made to group them according to nationality, thinking that such a grouping might afford some clue to racial differences if any exist. In this grouping the term "American" is used for convenience to include children of English extraction whose nationality could not be more accurately determined. No individuals of the black or yellow races are included.

In the report which follows, Lauterbach's⁷ method of designating whorls is used. A plus sign (+) indicates a whorl to the right, or clockwise; a minus sign (—), a whorl to the left, or counter-clockwise. Two signs

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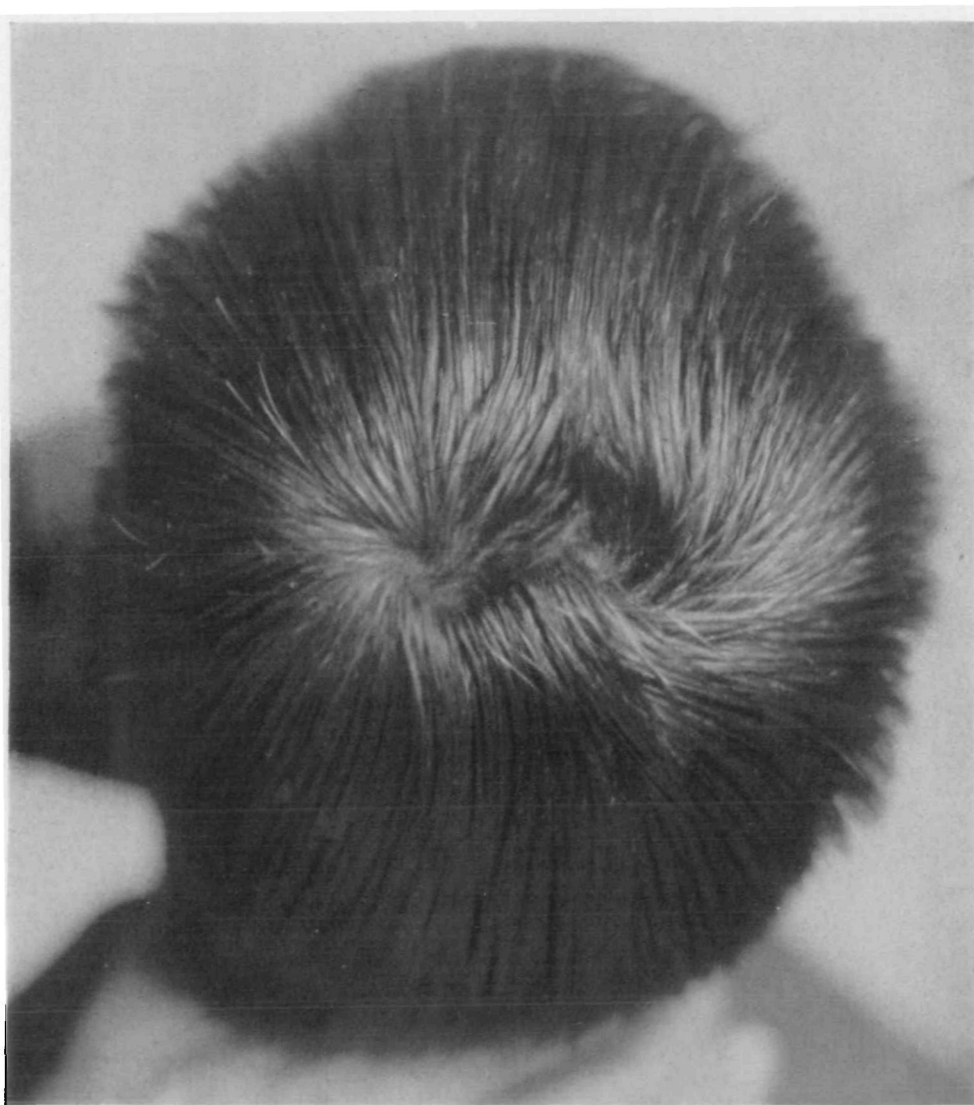
†"Von dem Scheitel fängt die Ausströmung immer mit einem Wirbel an. und erstreckt sich ziemlich gleichmässig in Strahlen nach allen Richtungen. In seltenen Fällen giebt es zwei Scheitelwirbel; ich habe aber hiervon kein Beispiel während dieser Untersuchung vor Augen gehabt. Der Scheitelwirbel ist in der Regel rechts gedreht, und seine Hauptströmung fällt auf die linke Seite des Kopfs."



POSSIBLE COMBINATIONS OF DOUBLE CROWNS

Figure 5

Showing the possible variations and combinations of single and double crowns.



A RARE FORM OF DOUBLE CROWN

Figure 6

Both whorls are counter-clockwise (— —), the only combination of this kind found on 1854 heads.

in a parenthesis indicate a double crown, and the position of the signs indicates the relative position of the whorls on the head. The possible combinations on a single head are sketched in Figure 5. One other condition has been observed, and that is a combination of more than two whorls, or *polywhorls*. Several cases of three whorls have been recorded, and one case of four.

From Table I may be derived the fact that 23.4 percent of the population have whorls which vary from the single clockwise condition. Eighteen and one-tenth percent have negative whorls; 4.9 percent have double whorls; and almost one-half of one percent have polywhorls.

The percentage of variation among right-handed individuals is 23.7 percent; among left-handed individuals, 20.0 percent. There is, therefore, apparently no correlation between handedness and variation in whorl of the head hair. There is an element of error in this result, however, due to the method of determining handedness. The children were asked to throw a ball or to indicate the hand in which a spoon was held while eating, or a needle, while sewing. The total amount of left-handedness in the group as determined by this method is 7.5 percent. This figure is almost twice that reported by Jones⁵ but only about a fourth of that reported by Parsons.⁹

The amount of variation in whorl

TABLE I
SHOWING WHORL OF THE HEAD HAIR OF 1003 NORMAL
CHILDREN GROUPED ACCORDING TO SEX AND HANDEDNESS

SEX	HANDED- NESS	Single Whorl		Double Whorl				Poly-whorl	Total	Recapitulation	
		+	-	+-	-+	++	--			Double Whorl	Total Variation
Male	+	354	88	24	4	5		2	477	33	123
Male	-	36	7	1				1	45	1	9
Total		390	95	25	4	5		3	522	34	132
Female	+	354	81	12		3		1	451	15	97
Female	-	24	6						30		6
Total		378	87	12		3		1	481	15	103

TABLE II
SHOWING WHORL OF THE HEAD HAIR OF
851 FEEBLE MINDED INDIVIDUALS

CLASS	Single Whorl		Double Whorl				Poly-whorl	Total	Recapitulation	
	+	-	+-	-+	++	--			Double Whorl	Total Variation
Idiots	159	45	17	7	2	1	2	233	27	74
Imbeciles	212	51	8	3	3		1	278	14	66
Morons	255	70	10	2	3			340	15	85
Total	626	166	35	12	8	1	3	851	56	225

of the head hair among the males is 25.3; among the females, 21.4 percent. The greater variability of the male is, therefore, once again demonstrated.

Among the Armenians the variation is 27.3 percent; among the Irish it is 20.8 percent; among the Italians, 24.0 percent. These are the only groups (except the "American," which probably has little if any significance) large enough to afford results approaching reliability. The percentages do not vary markedly from the 23.4 percent established for the population as a whole. (See Table III.)

The number of families with twinning histories, forty-two, and the actual number of twins, seventeen, is too small to yield reliable results. It may be noted, however, that the percentage of variation is somewhat larger for both of these groups than for the normal group. (See Table IV.)

Because of the occasional coincidence of variation in whorl of the head hair with low intelligence quotients, the heads of a group of feeble-minded individuals were examined. This investigation was made possible through the cooperation of Dr. R. A. Greene and his assistants at the Walter E. Fernald State School for the Feeble Minded, at Waverly, Massachusetts. The group included 457 males and 394 females ranging in age from 9 to 50 years. Three classifications, idiots, imbeciles, and morons, based on intelligence quotients, were made. (See Tables III and IV.)

Each of these groups was subdivided into three types, type 1, germ plasm; type 2, accidental; and type 3, unknown. The germ plasm type includes those individuals whose feeble-mindedness is hereditary as determined by family history (Tredgold's "intrinsic" type). The accidental type includes those whose feeble-mindedness is due to environmental influences like disease or other "accident" (Tredgold's "extrinsic" type). The "unknown" type includes all subjects, the cause of whose defect is uncertain or unknown.

Table II reveals a variation in the

whorl of the head hair of the feeble-minded of 26.4 percent. The variation in the whole population was established at 23.4 percent (Table I). While the variation among the feeble-minded is, therefore, greater than the "normal" group, it is apparently not significantly so.

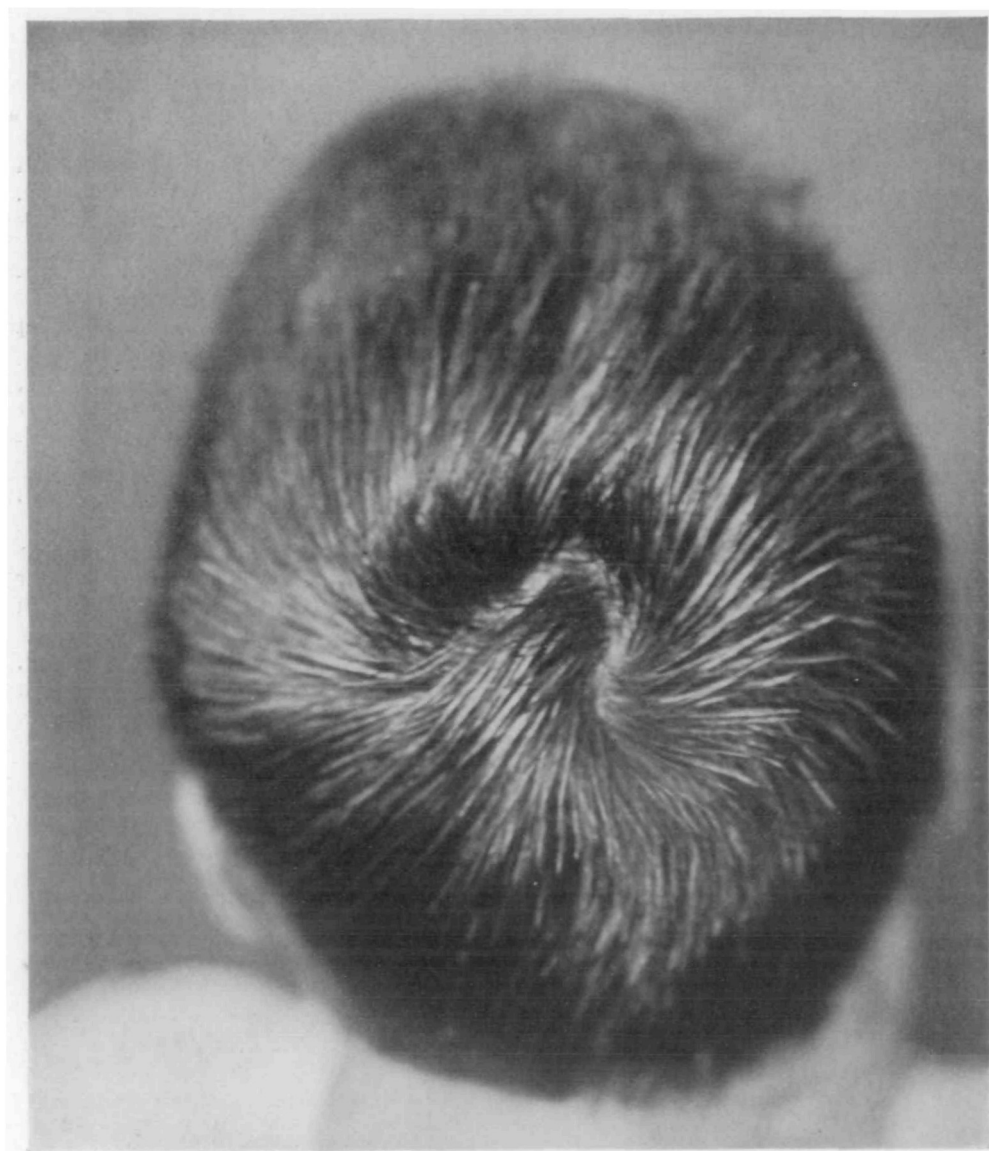
The variation among the idiot group, however, is 31.8 percent, higher than for either the imbeciles or the morons, and considerably higher than the normal group.

When the 851 cases are divided according to sex and type, we find the variation for the males to be 28.4 percent; for the female, 24.1 percent. The variation among the female idiots runs up to 28.1 percent; among the male idiots, to 34.0 percent. Variation is greatest in the idiot group, particularly among the *males*. (Tables IV and V.)

It should be noted that variation among the feeble-minded is greater than among the normal group in all traits. This is true of stature, of weight, or deformities of the ears, asymmetry of the head, etc. Church and Peterson² (p. 715) for example, record reported abnormalities of the palate ranging from 43 to 82 percent. A variation of 34 percent in whorl of the head hair is therefore not conspicuously high for the idiot group.

The correlation between variation and type is not convincingly high. It may be noted that where percentage comparisons are possible between types 1 and 2, type 1 shows a greater variation in 13 out of 22 instances. A comparison with type 3 would not be valid, since the "unknown" group is composed of subjects from both type 1 and 2.

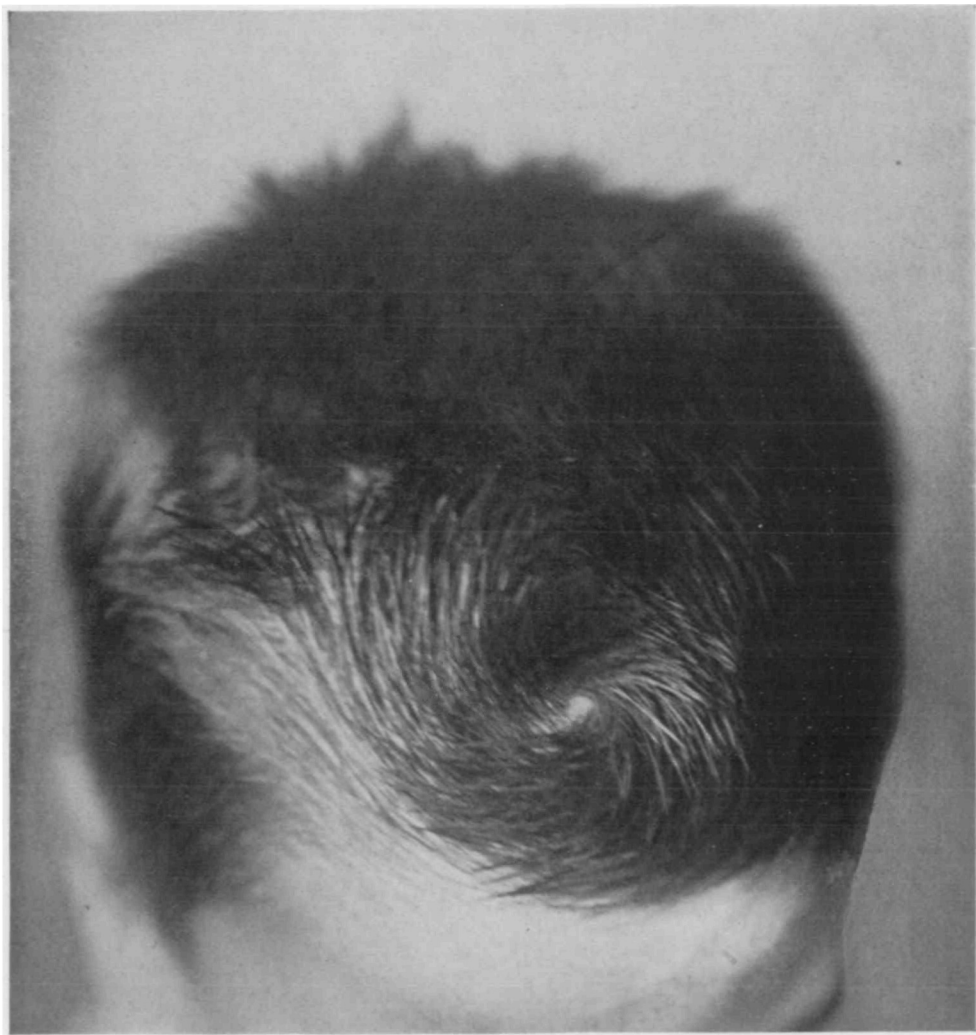
It will be observed that the most frequent variation is a single whorl to the left. Among the normal group this variation is 18.1 percent (Table I); among the feeble-minded, 19.5 percent (Table II). Of double whorls the plus-minus (+ -) combination is most frequent. It is interesting to note that among the 1854 heads ex-



THREE CROWNS ON A SINGLE HEAD

Figure 7

In addition to a double crown in the occipital region, this boy had one just above his forehead, as is shown in Figure 8.



A "CROWN" ON THE FOREHEAD

Figure 8

This "much crowned" individual also has two crowns in the normal position. This one is a perfect whirlpool which cannot be disturbed in the least by combing.

TABLE IV

SHOWING WHORL OF THE HEAD HAIR AND HANDEDNESS
IN RELATION TO TWINNINGTABLE III
SHOWING HANDEDNESS AND WHORL OF THE HEAD HAIR OF 1003 NORMAL CHILDREN
GROUPED ACCORDING TO NATIONALITY

NATIONALITY	Frequency Distribution			Percentage Distribution		
	Right-handed	Left-handed	Total	Positive Whorl	Negative Whorl	Total Variation
American	312	35	347	271	61	13
Armenian	126	13	139	101	28	1
French	15	1	16	13	2	1
Greek	13	2	15	9	5	1
Irish	111	9	120	95	19	6
Italian	251	11	262	199	47	14
Slav	115	1	116	100	15	1
Scandinavian	110	1	111	95	15	1
Scottish	25	3	28	20	5	5
Others	50	3	53	39	10	4
Total	928	75	1003	768	182	49

CLASS TYPE	Frequency Distribution			Percentage Distribution		
	Single Whorl	Double Whorl	Polywhorl	Positive Whorl	Negative Whorl	Total Variation
Idiot	22	2	1	100.0	0.0	0.0
Imbecile	10	1	1	100.0	0.0	0.0
Feeble-minded	48	4	1	100.0	0.0	0.0
Borderline	43	10	1	100.0	0.0	0.0
Normal	33	124	5	100.0	0.0	0.0
Total	63	15	2	100.0	0.0	0.0
Idiot	30	11	2	100.0	0.0	0.0
Imbecile	27	11	2	100.0	0.0	0.0
Feeble-minded	27	11	2	100.0	0.0	0.0
Borderline	27	11	2	100.0	0.0	0.0
Normal	27	11	2	100.0	0.0	0.0
Total	27	11	2	100.0	0.0	0.0

(A) Families With Twinning Histories

GROUP	Frequency Distribution			Percentage Distribution		
	Right-handed	Left-handed	Total	Positive Whorl	Negative Whorl	Total Variation
Twinning Families	36	6	42	31	6	4
Non-Twinning Families	891	70	961	737	178	48
Total	927	76	1003	768	182	52

(B) Actual Twins

GROUP	Frequency Distribution			Percentage Distribution		
	Right-handed	Left-handed	Total	Positive Whorl	Negative Whorl	Total Variation
Frequency	17	17	34	17	17	0
Percentage	100.0	100.0	100.0	50.0	50.0	0.0

TABLE IV

SHOWING WHORL OF THE HEAD HAIR OF 457 FETTER-BORN TWINS

CLASS TYPE	Frequency Distribution			Percentage Distribution		
	Single Whorl	Double Whorl	Polywhorl	Positive Whorl	Negative Whorl	Total Variation
Idiot	10	1	1	100.0	0.0	0.0
Imbecile	13	1	1	100.0	0.0	0.0
Feeble-minded	13	1	1	100.0	0.0	0.0
Borderline	13	1	1	100.0	0.0	0.0
Normal	13	1	1	100.0	0.0	0.0
Total	13	1	1	100.0	0.0	0.0

amined, only one minus-minus (— —) combination was found. Polywhorls appear infrequently. The combinations observed are (+ — +), four cases; (+ + —), one case; (— — +), one case; (+ — + —), one case.

These whorls are located usually in the parietal region on a line with the sagittal suture, slightly anterior to the posterior superior angle. They may, however, assume any position on the scalp within the area covered by the head hair. Perfect whorls have been observed below the occipital protuberance, as well as in the very edge of the hair on the forehead. Double whorls may lie very close together, so close in fact that one whorl merges with the other; or they may assume positions on entirely different parts of the head. In the case of polywhorls, two whorls may be closely associated,

while the third assumes a distant position. (See Tables V and VI.)

Hair streams appear in a variety of forms on the scalp. Kidd⁶ gives sketches of eight variations in the frontal region of young human subjects. Irregularities in these streams tend to form "cowlicks," which sometimes suggest incomplete whorls.

Determination of the direction of the whorl of the head hair is not difficult except in occasional instances in which the hair is very long or very curly or has entirely disappeared. In this investigation forty cases were left undetermined for such reasons. Frequently observation is all that is necessary, but a sterilized comb facilitates examination. The criminal and insane classes offer an opportunity for further study which may yield interesting results.

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Breeding and Geography

INDUSTRIAL AND COMMERCIAL GEOGRAPHY (New Edition) by J. RUSSELL SMITH, pp 959, price \$3.00. Henry Holt and Company, 1925.

Smith's text is widely used in collegiate schools of commerce, finance and business administration but it is worthy of wider reading. The aim has been to interpret the earth in terms

of its usefulness to humanity. It is noteworthy in that much emphasis is placed on plant breeding as an important economic activity with which the business man must become familiar.

Professor Smith discusses cereals, starch foods, the animal industries, the vegetable, fruit, and wine industries. (Concluded on page 142)



ABACA IN THE PHILIPPINES

Figure 9

View in a Manila hemp plantation at Davao, P. I. Manila hemp is a species of banana, and the two are very similar in appearance. Photograph courtesy of Bureau of Agriculture, Manila, P. I.