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STUDIES ON THE A-B-O, M-N, AND RH-Hr BLOOD
FACTORS IN THE DOMINICAN REPUBLIC,
WITH SPECIAL REFERENCE TO THE
PROBLEM OF ADMIXTURE

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Does the mestizo exist in our country? This question came to my mind as a result of a meeting in one of our hospitals, at which the interne, on mentioning a patient's race, would classify some as mulattoes and others as mestizos. I asked him why he made that distinction since the word "mestizo" refers expressly to a mixture of White and Indian; he answered that it was customary to do so in the national hospitals. This answer did not satisfy me; what I really wanted to know was what racial characteristics were used to classify some as mestizos and others as mulattoes. The interne evidently wished to indicate that there are notable differences among the Dominican mulattoes, or rather that there are two kinds of mulattoes in the Dominican Republic. The first kind is the "pure" mulatto with manifest Negroid characteristics where there can be no question about using the label "mulatto." The second kind comprises lighter or darker skinned peoples with very straight black hair, high and pronounced cheekbones, prominent physiognomical features, with hardly detectable Negroid features, so that it seems improper to classify them as mulattoes. This is why the term "mestizo" is used to refer to the second group in our hospitals, but without implying that the lack of Negroid features is due in any way to mixture with Indians.

To put the question differently: Is admixture with Indians really responsible for the peculiar characteristics of the sec-

ond group, and is the term "mestizo" correctly applied; or is it a greater or smaller percentage of mixture with Whites which makes the two groups differ, in which case the term "mestizo" would be incorrectly applied, This anthropological problem I propose to solve in this paper by analyzing the distribution of blood group factors among Dominicans.

HYPOTHESES

We may assume from the mortality rates as given in the 1940 Statistics Annual of the Dominican Republic that the ethnic groups are distributed as follows:

Mulattoes	— 77%
Negroes	— 12%
Whites	— 11%

The 1935 Census gives similar statistics. As we see from these data the Dominican population is made up of a larger group of mulattoes with smaller groups of "pure" Negroes and Whites.

Two reasonable hypotheses suggest themselves to account for the differences between mulattoes and mestizos.

First hypothesis. The Spanish Conquistadors completely annihilated the aborigines without mixing with them, only to mix later with the imported Negroes to form a simple mixture of Negro and White, which makes up the great mass of mulattoes observed in our country today. This is the hypothesis generally accepted by modern historians, who consider that at present there exist no remnants of the Indian aborigines. Under this hypothesis the differences in skin color are due to different degrees of White-Negro mixture. For example, Rodolfo Barón (145) maintains this position.

Second hypothesis. The Spanish Conquistador's mixed with the Indians to a degree unknown to us, forming a mestizo population, which later crossed with the African Negro to give rise to a trihybrid mixture. According to this hypothesis, the bulk of Dominican mulattoes resulted from a cross between Spaniards and Negroes with some degree of Indian

admixture, and with smaller distinct groups of "pure" mulattoes and mestizos. That would explain why there is such a range of skin colors in our country, and the resulting ethnic groups may be classified as follows:

"Pure" negro
"Pure" mulatto
Mulatto-mestizo
Mestizo
White

The "pure" mulatto is defined as a simple cross of White and Negro. The "mulatto-mestizo" group is a mixture of the three races, White, Negro, and Indian, with varying proportions of each. In the ethnic group called "mestizo" the mixture of White and Indian predominates resulting in certain physical characteristics which enable a careful observer to detect the indigenous background.

In my work on paternity investigations using the blood groups and Rh factors in 1948, I suggested the second hypothesis for the first time. In this paper I propose to demonstrate the presence of the Indian component through a study of the blood group factors.

Theoretical basis of the application of blood grouping in anthropology

The first investigation on the racial distribution of blood groups was made by L. and H. Hirschfeld. Physicians in the Allied Armies in Salonica, Greece, during the First World War, they took advantage of the presence of troops and prisoners of war of many nationalities (and the native populations) to undertake an investigation of blood groups of different races, taking blood samples from 500 to 1,000 individuals of each nationality. By this means, they showed that the 4 Landsteiner groups occur in all races, but that their frequencies differ for each country (or ethnic group). After the work of L. and H. Hirschfeld, investigations on the distribution of blood groups were carried out in nearly all of the countries of the world.

Depending on the distribution of 4 blood groups (Ottenberg has classified peoples in 6 categories.

	APPROXIMATE FREQUENCY OF BLOOD GROUPS		
	O	A	B
I. European	39	43	12
II. Intermediate (Arabs, Turks, Russians, etc.)	40	33	20
III. Human (Japanese, Southern Chinese, Hungarians, Rumanian Jews)	28	39	19
IV. Indo-Manchurian (Koreans, Northern Chinese, Gypsies, Hindus, Manchurians)	30	19	39
V. Afro-South Asiatic (Negroes, Malaysians, Indo-Chinese, Madagascan)	42	24	28
VI. Pacifico-American (American Indians, Australian aborigines, Filipinos, Oceanians, Icelanders)	67	29	3

The discovery of the blood factors M and N and, above all, of the Rh blood types has greatly enhanced the value of anthropological studies by means of blood group factors. For the Rh types fundamental differences among different races have been found: for example, the type Rh₀ is found in about 40% or more of Negroes, while in the Whites and Mongoloids its frequency ranges between only 1 to 3%. Among Whites the highest proportion of Rh-negative persons is found, and the type Rh₁ is found in abundance. In the Mongoloid group there is a virtual absence of Rh-negative individuals and the highest frequency of the rare gene R^2 .¹

Ottenberg's racial classification, based only on the A-B-O system, yields artificial results, not conforming with other anthropological evidence. Lahovary, making use in part of the M and N factors and occasionally of other factors besides Landsteiner's classic groups, proposed still another classification into 8 divisions: European, Mediterranean, Mongolian, African, American Indian, Oceanian, Indonesian, and Polynesian.

¹ Tablized symbols stand for groups as opposed to agglutinogens or blood groups.

Wiener ('46b), combining information recently acquired regarding the Rh blood types and the subgroups of A with that already known about the A-B-O groups, proposes the following racial classification.

I. *Caucasoid*. The characteristics of this group are the highest frequency of the gene r , the relatively high frequency of genes R^1 and A^2 , and moderate frequencies of the other blood group genes.

II. *Negroid*. Highest frequency of gene R^0 , moderately high frequency of gene R^1 , relatively high frequency of gene A^2 and of the rare intermediate A and Rh genes.

III. *Mongoloid*. Virtual absence of gene r and A^2 , and highest frequency of the rare R^2 gene.

This, according to Wiener, has permitted the solution of certain anthropological problems. For example, the Australian aborigines, whom Ashley Montagu ('45) places in an intermediate 4th group between the Negroid and Caucasoid, and Papuans, whom he places in the Negroid group, were shown by Wiener (46b) to belong more appropriately in the Mongoloid group, according to the results of tests for the Rh-III types and subgroups of A. Wiener's classification, besides being in perfect accord with fundamental anthropology, has the advantage that it is based on well determined characteristics and substantiated differences among the races. Nevertheless, it would seem convenient to classify the human species into more than three subdivisions. Wiener, himself, with the information given by the M and N factor subdivisions the Mongoloid group into Asiatic, Pacifico-Australian and Amerindian-Eskimo groups.

In his recent book, Boyd ('50) breaking with traditional anthropology, which classifies mankind on the basis of external phenotypic characteristics, proposes a racial classification based on modern concepts of human genetics, which differs only slightly from that proposed by Wiener just described. Boyd's classification is as follows:

1. Early European group (hypothesis) — Possessing the highest incidence (over 30%) of the Rh-negative type (frequency of

gene *rh* greater than 0.6), and probably no group B. A relatively high incidence of the genes Rh_1 and A_2 . Gene *N* possibly somewhat higher than in present-day Europeans. Represented today by their descendants, the Basques.

"II. European (Caucasoid) group—Possessing the next highest incidence of *rh* (the Rh-negative gene), and relatively high incidence of the genes Rh_1 and A_2 , with 'normal' frequencies of *M* and *N*. i.e., $M \approx \text{ca. } 30\%$; $MIN \approx \text{ca. } 49\%$; $N \approx \text{ca. } 21\%$.

"III. African (Negroid) group—Possessing a tremendously high incidence of the gene Rh^0 , a moderate frequency of *rh*, relatively high incidence of genes A_2 and the rare intermediate A ($A_1, 2$, etc.) and Rh genes, rather high incidence of gene B. Probably 'normal' *M* and *N*.

"IV. Asiatic (Mongoloid) group—Possessing high frequencies of genes A_1 and B, and the highest known incidence of the rare gene Rh^2 , but little if any of the genes A_2 and *rh* (the Rh-negative gene). Normal *M* and *N*. (It is possible that the inhabitants of India will prove to be an Asiatic subrace, or even a separate race, but information is still sadly lacking.)

"V. American Indian group—Possessing varying (sometimes high, sometimes zero) incidence of gene A_1 , no A_2 , and probably no *B* or *rh*. Low incidence of gene *N*. Possessing Rh^2 .

"VI. Australoid group—Possessing high incidence of gene A_1 , no A_2 ; no *rh*, high incidence of gene *N* (and consequently a low incidence of gene M). Possessing Rh^2 ."

It is not necessary to make a comprehensive analysis of the blood groups of different peoples to prove my thesis; it is only necessary to examine the distribution of the blood factors and groups among Caucasoids (especially the Spanish), the African Negro, and the American Indian aborigines, because the Dominican population had its origin in those three races. Later immigrations are of negligible importance since all attempts to attract immigrants have failed. The only one of any consequence, the Arabian immigration of the late 19th century, has not yet mixed with the native Dominican population sufficiently to have any noticeable effect.

Before entering into the comparative analysis of the blood groups of White, Negroes, American Indians, and Dominicans, it is necessary to clarify several principles of blood group genetics which are indispensable for the demonstration

of my thesis. Above all, the inheritance of blood groups is not influenced by environment. For example, the Jews of Macedonia, who have lived there since the 15th century, have a blood group composition which is different from other inhabitants of the Balkans. Also, the serological composition of the gypsies (of Hungary), who through 5 centuries have preserved their language and customs, does not differ appreciably from that of the natives of India from whom they came, but is different from that of the Hungarians. A German colony in Hungary, which emigrated in the 18th century and which has maintained itself without mixing with the Hungarians, has the same serological composition as other Germans.

Another advantage of using blood groups in anthropology is that mating takes place at random; that is, no one, when marrying, takes into consideration the partner's blood group. The same does not hold for external physical characteristics; for example, a tall person is more likely to marry another tall person than a short person.

As Bernstein has shown and Wiener ('43) notes, if it is known that a given population resulted from a mixture of two other peoples and the distributions of the blood groups in the original peoples are also known, then one can calculate the proportion of individuals from each race which took part in the cross. For example, Wiener ('43) was able to estimate the degree of mixture with Whites of Indian mestizos in the United States. Similarly, an increase of a blood factor in a population indicates mixture with another ethnic group; e.g., the high frequency of group B in the Germans is attributable to mixture with the Slavic peoples, and the high frequency of type Rh_1 among Puerto Ricans, according to Wiener, indicates mixture with Negroes. Applying the same principles we shall demonstrate that the high frequencies of group O, type M , and type Rh_1Rh_2 in the Dominican population establishes mixture in the past with the aborigine Indian.

Another fact shown by the science of genetics (see Stern, '49, ch. X) is that, when two populations mix, equilibrium

in the distribution of characters determined by allelic genes is established in the mixed population after a single generation of random mating, and that this equilibrium persists indefinitely, unless some new racial admixture changes it. This law was discovered independently by the mathematician Hardy and the physician Weinberg in 1908. This accounts for the establishment of a definite distribution of the blood groups in a hybrid population, a distribution which remains unchanged and permits us to determine by testing the blood of the present-day population the influence of a race which disappeared 400 years ago.

RESULTS

These principles settled, let us analyze the results obtained by blood examinations, using the A-B-O, M-N, and Rh-Hr systems of blood factors.

First 320 randomly selected, unrelated Dominicans were tested in order to establish the average distribution of the blood factors in the Dominican population in general, without regard to race. For this purpose, only Dominicans whose great grandparents were Dominicans were chosen. Then I took 100 individuals whose external physical characteristics are those of the "pure" mulatto, and 100 whom I would classify as mestizos, that is, whose physical traits suggest the possibility of mixture with Indians. In the latter study, I have had the collaboration of Drs. Fred W. Lithgow and José J. Jimenez, who provided me with blood samples of people whom they classified as mestizos.

For the A-B-O groups, I have used various statistics published in the Dominican Republic, the first made by Dr. Angel M. Ponce Pinedo, under the direction of Dr. Hector Reid — 2100 cases — in 1941; the second by Dr. Rogelio Baron Castro — 4980 cases — in 1943-1944; and the third by Dr. José V. Fernandez Sanchez — his doctor's thesis in 1948. In no case have these workers taken into consideration the racial characteristics of the persons examined. In addition, Dr. Fernandez Sanchez has obtained for me various studies made

TABLE 1
Distribution of the A-B-O groups and Rh factors in the Dominican Republic

INVESTIGATOR AND YEAR	LOCALITY	NUMBER OF INDIVIDUALS EXAMINED	BLOOD GROUPS (%)				Rh FACTOR (%)	
			O	A	B	AB	Rh -	Rh +
Angel Ma. Ponce Pinedo ¹ 1941	S. P. de Macoris	2100	52.9	28.2	15.7	3.2		
Rogelio Cordero Castro 1944 (Doctor's thesis)	Trujillo	4980	52.7	31.9	12.2	3.2		
José V. Fernandez 1948 (Doctor's thesis)	Santiago	250	54.0	28.0	12.0	6.0		
José de Js. Alvarez 1950 (Present study)	Santiago	400	50.25	34.50	11.0	4.25	89.13	10.87
	Northwest Boundary, Monto Cristi, Dajabon, etc.	432	51.1	31.2	14.8	2.9	88.90	11.10
	Trujillo (Soldiers)	294	53.8	32.3	11.2	2.7	95.90	4.10
	South-Bahoruco, Neyba, Jimani, Pedernales	569	53.6	24.8	16.9	4.7	87.90	12.10
	Puerta Plata (Soldiers)	59	62.7	25.4	6.8	5.1	100.0	0
General average		9084	52.75	30.50	13.34	3.41		

¹ Revista de la Cruz Roja Dominicana, '41.

TABLE 2
The A-B-O blood group system

NATURE OF SAMPLE	NUMBER OF INDIVIDUALS EXAMINED	PHENOTYPES (%)				GENE FREQUENCIES (%)			$p - q - r$	DEVIATION FROM 100%
		O	A	B	AB	r	p	q		
Dominicans (general average)	9,084	52.75	30.50	13.34	3.41	72.62	18.56	8.68	99.86	- 0.14
Dominican Mestizos ¹	100	54	32	11	3	73.48	19.40	7.30	100.18	+ 0.18
Dominican Mulattoes ¹	100	48	33	16	3	69.28	20.00	10.00	99.28	- 0.72
Spaniards ²	50,791	38.2	47.2	10.1	4.5	61.74	30.19	7.60	99.52	- 0.48
Negroes	General average	46.8	25.4	23.4	4.4	68.41	16.11	15.01	99.53	- 0.47
American Indians	Hypothetical	100	0	0	0	100	0	0	100	
First hypothesis: Simple mixture of Whites and Negroes		42.5	36.3	16.75	4.45	65.19	22.86	11.20	99.25	- 0.75
Second hypothesis:		52.4	29.8	14.3	3.5	72.32	18.25	9.31	99.88	- 0.12
Whites 40%										
Negroes 43%										
Indians 17%										
Deviations for the first hypothesis of gene frequencies						7.43	4.30	2.56		
Deviations for the second hypothesis of gene frequencies						0.30	0.31	0.63		

¹ Present investigation.

² After de Hoyos Sainz ('47).

by Army doctors in different parts of the country. In table 1 these data are shown by region, and the data have also been combined into a total of 9084 individuals tested by the different investigators in different parts of the country, thereby arriving at a general average for the Dominican population.

TABLE 3
The M-N system

NATURE OF SAMPLE	NUMBER OF INDIVIDUALS EXAMINED	PHENOTYPES (%)			GENE FREQUENCIES		
		M	N	MN	m	n	m + n
Dominicans (Present study)	320	40.0	18.66	41.34	63.25	43.25	106.5
Dominican mestizo (Present study)	100	48	15	37	69.30	38.70	108.0
Dominican mulattoes (Present study)	100	32	25	43	58.60	50.00	106.6
Spaniards (Hoyd, '50)	134	26.9	17.9	55.2	51.87	42.31	104.1
Negroes (New York) (Landsteiner — Levine, Wiener) ¹	278	28.42	21.94	49.64	53.20	46.80	100.0
Navajo Indians (Hoyd, '50) (New Mexico)	361	84.5	1.1	14.4	91.87	10.49	102.1
First hypothesis		27.66	19.92	52.41	52.54	44.61	97.1
Second hypothesis		38	18	44	61.24	42.43	103.6
Deviations for the first hypothesis of gene frequencies					10.71	0.36	
Deviations for the second hypothesis of gene frequencies					2.01	0.82	

¹ Blood groups and transfusion (Wiener, '43).

For the M-N types, the only data previously published are those included in my work on disputed paternity. The number of individuals tested is now greater and to date I have examined 520 persons for these blood factors. The results are summarized in tables 3 and 4. (I have had to test the blood

TABLE 4
The Rh blood types

NATURE OF SAMPLE	NUMBER OF INDIVIDUALS EXAMINED	Rh BLOOD TYPES (%)							
		Rh ₀	Rh ₁	Rh ₂	Rh ₁ Rh ₂	rh	rh'	rh''	rh'rh''
Dominicans (Present study)	320	20.0	44.2	10.9	14.03	10.0	0.87	0	0
Dominican Mestizos (Present study)	100	15	45	8	21	10	0	0	0
Dominican Mulattoes (Present study)	100	28	40	13	7	10	2	0	0
Spaniards (Boyd, '50)	223	0.5	63.2	13.0	9.4	13.0	0	0.5	0
Negroes (N.Y.C.) (Wiener et al. ['44])	133	45.9	23.7	16.3	4.4	7.4	1.5	0.7	0
American Indians (pure) (Wiener et al. ['45])	95	1.1	48.1	9.5	38.1	0	0	0	0
Expected distribution under first hypothesis (White-Negro mixture)		23.2	43.4	14.7	7.0	10.2	0.8	0.6	0
Expected distribution under second hypothesis Negro 43% White 40% Indian 17%		20.2	43.8	13.7	12.4	8.5	0.7	0.5	0

of each person myself, in my private laboratory, and for that reason it has been impossible to carry out a more imposing number of examinations.)

Let us consider the serological characteristics of the peoples who give rise to the Dominican population, that is, the White (or Spanish), the Negro, and the American Indian. Based on the calculations of Wiener, Dujarric de la Riviere and Kossovich, the characteristics of these races are as follows: In the Spanish there is a high frequency of group A (46 to 51%), a low proportion of group B, while group O is slightly above 40%. These are, for the most part, the characteristics of the peoples of Western Europe; group A diminishes from West to East in Europe, and the proportion of group B increases as one approaches Asia. Negroes possess a high B component (in comparison with Spaniards) with approximately 20 to 29% belonging to that blood group, a low proportion of group A, and about 45% of group O. On the other hand, the American Indian is characterized by a very high percentage of group O (primitive Central and South American Indians belong almost exclusively to this blood group). For the M-N types, the proportions in Whites and Negroes differ little, while in the American Indian we find a high proportion of M and a low proportion of N.

For the Rh types the findings are very different for each racial group. Type Rh₀ is relatively rare in Whites, who have a high proportion of type Rh₁, and a percentage of type rh (Rh-negative) higher than the other two races. American Negroes (Wiener et al., '44) are characterized by a high percentage of type Rh₀,² about 40%, with less type Rh₁ and type rh than Whites. The American Indians, on the other hand, have a high percentage of type Rh₁Rh₂, between 38 to 53%, while types Rh₀ and rh are rare.

Thus, the three peoples who may have formed the Dominican population have very different serological characteristics. High percentages of group A, types Rh₁ and rh, and low percentage of B characterize the Whites; the Negro has a

²In Africa, no doubt, the frequency of type Rh₀ is even higher.

high proportion of group B, type Rh₀, and lower proportion of group A. These two races have properties M and N in similar proportions. The serological properties of Indians are a high frequency of group O, high proportion of type M, type Rh, and type Rh₁Rh₂, with a virtual absence of type rh.

For the comparative study, the distribution of the blood group factors in the races in which we are interested are listed in tables 2, 3, and 4. On the 7th line of these tables are given the distribution to be expected in a population resulting from a mixture of Whites and Negroes, without any outside mixture, according to the first hypothesis, which is the one favored by our contemporary historians. On the 8th line of these tables are given the figures which would be obtained if we mixed three races, Negro, White and Indian in proportions 43%, 40%, and 17% respectively, which is the hypothesis that I maintain. The blood group distribution of Dominicans may be compared with the figures given by these calculations, and it will be observed that the findings which were to be expected according to the second hypothesis are strikingly similar to those actually found in the Dominican population.

Let us now analyze the results obtained in the Dominicans in relation to the blood group distributions of the original races. In the statistics given for the Landsteiner A-B-O blood groups among 9084 Dominicans, the first thing which attracts one's attention is the high proportion of persons which belong to group O. Obviously, if the component races were only White and Negro, the percentage of group O among Dominicans could not exceed 45%, because that percentage is not exceeded by either of these races. But in Dominicans we find 52.75% group O which indicates the presence of a hidden element from some other race, with a high frequency of group O. The aborigines had precisely that characteristic. On the other hand, the percentage of group A might be expected to be greater due to the high percentage of this group in Spaniards; but the same factor which raises the percentage of group O does not permit a high proportion of group A. The results obtained from the group of individuals labelled

as mestizos confirm this hypothesis, for here there is an even higher proportion of group O. In the "pure mulatto," on the other hand, group O is lower and group B is higher due to the greater mixture of Negroes.

As already mentioned, the distribution of the M-N factors is similar in Negroes and Whites. Accordingly, a mixture of these two races should give about the same proportion of these blood types. However, while type M has a frequency of 30% in Whites and Negroes, in Dominicans the frequency is about 40%, indicating mixture with a race having a higher frequency of this blood type, namely, the Indian aborigines. An examination of the Dominican "mestizo" and "mulatto" confirms the second hypothesis, because the mestizo has a still higher percentage of type M, while the mulatto has a percentage of type M approximately equal to that of Negroes and Whites due to a virtual absence of Indian admixture. The frequency of gene M among Spaniards is 51.87% and among Negroes 53.20%, while among the American Indians (using statistics for the Navajo of New Mexico from Boyd's book, which is the most complete which I can find for these factors) it is found in 91.87%. The gene occurs in the Dominicans with a frequency of 63.75% which is considerably higher than the value for Spaniards and Negroes, clearly indicating mixture with a race such as the American Indian, having a high frequency of gene M.

With regard to the Rh factors, type Rh₁Rh₂ is found in the Dominicans as a whole in proportion of 14%, but the frequency varies from 21% in the group classified as "mestizo" to 7.5% in the group classified as "mulatto." As has already been pointed out, a high frequency of type Rh₁Rh₂ is a characteristic of Mongoloids and American Indians, in whom it is found with a frequency of 38 to 53%, while, in contrast, Spaniards (again referring to Boyd) have an incidence of 9.4% of this type and Negroes 4.4% to 7%. Here again the results suggest mixture with the aborigines; a simple White (Spanish) Negro mixture would give a figure

close to 7%, while as just pointed out the actual frequency is 14%.

In short, therefore, the high frequencies of group O, type M, and type Rh₁Rh₂ in Dominicans indicate the presence in our country of an Indian component as well as a mixture of Whites and Negroes. This does not seem extraordinary when one considers the biological probabilities of the Spanish conquistadors having mixed with the aborigines.

Let us now examine tables 2, 3, and 4 further. One observes that type Rh₁ is found in 20% of the Dominicans, a figure which indicates a high percentage of Negroid admixture, in conformity with the physical characteristics of our people. If the original Negroid ancestors had a type Rh₁ percentage of 45.9, the Spanish 0.5%, and the Indians 1.1%, then by applying Bernstein's calculations one finds that the figure of 20% for the Dominicans indicates that the negroid component makes up approximately 43% of the population. This same percentage is obtained from calculations with the frequencies of *q* and *p*. What makes up the remaining 57%? According to our historians it should be the White race, but in that case we would expect 44% of group O instead of 53%, 38% of group A instead of the 30% actually found, and 30% of type M instead of 40%. For the Rh types there should be less type Rh₁Rh₂. Thus, none of the results obtained support the first hypothesis.

Let us now test the second hypothesis, which I maintain. According to this hypothesis the remaining 57% is made up principally of Spanish but with a small proportion of American Indian in addition. Calculations based on the frequency of the blood groups in the Dominican population indicate the proportions to be 40% Spanish and 17% Indian. For the A-B-O system, data are available for a total of 9084 individuals, a series large enough to make possible reliable conclusions in spite of the statistical error. Let us compare the actual findings with those to be expected for a population resulting from a mixture of 43% Negro, 40% Spanish, and 17% American Indian:

	O	A	B	AB
Results obtained for 9084 Dominicans examined by various investigators	52.75	30.50	13.34	3.41
Distribution for a population resulting from a mixture of 43% Negro, 40% Spanish, and 17% Indian	52.40	29.80	14.30	3.50

It is apparent that the calculations made according to the second hypothesis agree closely with the actual results obtained from the 9084 examinations. The results obtained for the M-N types and Rh types serve further to confirm my hypothesis that there does exist an Indian component in the Dominican population.

In table 2 is given the deviations of the frequencies *p*, *q*, and *r* for the first and second hypothesis. For the first hypothesis (simple White and Negro mixture) the deviation for gene *r* is 7.43%, for *p* 4.30%, and for *q* 2.56%, while for the second hypothesis the deviations are only 0.30, 0.31, and 0.63, respectively, none of which is significant when one takes into account the statistical error. For gene *M*, the deviation under the first hypothesis is 10.71 and under the second only 2.01.

Further evidence of the continued existence of an aborigine element is the Dominican "mestizo." Were the mestizo merely the result of a higher proportion White ancestors mixed with the Negro, then one would expect 44% of group O instead of 54%, 42% of group A instead of 32%, 30% of type M instead of 48%, while type Rh₁Rh₂ could never approach 21%. The higher proportion of O, M, and Rh₁Rh₂ in the Dominican "mestizo" are merely a sign of its higher proportion of the Indian component. On the other hand, the figures obtained for the "pure mulatto," where the mixture with the Indian has been very slight, shows that my reasoning has been correct because one finds lower frequencies of O, M, and Rh₁Rh₂, and higher frequencies of B and Rh₁. It is significant that

for each of the three systems of blood groups, which are inherited independently, the findings indicate presence of admixture with the aborigine, and that this influence manifests itself most in the group which exhibit external physical traits considered characteristic for Indians. If this were due entirely to chance, one would expect to find discrepancies between the results for the different systems of groups and in the different ethnic types.

*Blood type distribution in different parts
of the Dominican republic*

The figures which I have calculated for the percentages of White, Negro, and Indians which crossed to produce the present population of the Dominican Republic are not absolute, but approximate figures which serve to fix certain concepts. To state simply that aborigine admixture exists in our country might suggest a higher percentage than is actually present. It must be emphasized that the calculated percentages refer to the Dominican population taken as a whole. This does not mean that the same proportions exist in all parts of the country. In urban areas, where people have come from all regions, and where the different types are continually mixing, there are very low proportions of Indian admixture. Moreover, there are parts of the country where there is no evidence of Indian mixture, due to the case with which the 'conquistador' was able to drive out the Indians, and due to the continual importation of (first) African slaves and (second) of Haitian and British West Indian Negroid farm workers. This is true, for example, of the regions of the sugar plantations in the South and East. It is in the mountains and other regions not easy to reach, where the aborigines were able to isolate themselves, that the highest percentage of Indian blood is found. Everyone who is familiar with our mountainous regions has had the opportunity to notice that the natives there show very definite Indian physical characteristics.

Consult table I again and observe how the distribution of the blood groups and the racial characteristics of the inhabitants of each region coincide. Above all, look at the statistics supplied by Ponce Pinedo, from San Pedro de Macoris. These show a decrease of group A and an increase of group B, indicating a greater influence of the Negroid race in this region. This is explained by the long standing custom of the sugar plantations of this region to import Negroid workers. The statistics of Rogelio Cordero Castro, for Ciudad Trujillo, really do not represent the population of that city but of the entire country at large since they include examinations of members of the National Army. That is why these results are almost the same as the general average of the Dominican population. The same applies to the data of Dr. Fernandez. In the group examined in the Province of Santiago by the author, there is a noticeable increase of group A and decrease of group B, which reveals a higher percentage of White blood in this region—a fact which is supported by observation of the physical characteristics of these individuals.

In the statistics for the Northwest and Bahoruco, regions bordering on Haiti, one observes an increase of group B due to the influence of the neighboring Negroid race. Another interesting result is that obtained in Bahoruco, the last stronghold of the native Indian. In this region we find 53.5% of group O, a figure almost equal to that obtained by me for the group which I classified as "mestizo," but we find a great difference between the A and B groups of the two groups of people. In the mestizo, I found 32% of group A and 11% of group B, while in Bahoruco group A is 24.8% and group B 16.9%, which is entirely reasonable because the mestizo of the North (Santiago and the Cibao region) have a higher percentage of White blood, while the mestizo of Bahoruco is a mixture of the Indian and the Haitian Negro.

Ciudad Trujillo, on the other hand, shows a high frequency of group O and a scarcity of Rh negative (both of which indicate Indian admixture). The apparent contradiction—Ciudad Trujillo is noted for an absence of the mestizo element—is

due to the fact that the statistics were obtained from examination of members of the National Army, who were probably not all from that city.

The small number of examinations carried out in the Puerto Plata region does not permit any definite conclusions. Those made show definite mestizo characteristics, a high frequency of group (I) (around 62%), a decrease of group B, and absence of Rh-negative. But on closer observation we notice that the greatest racial influence in Puerto Plata is that of the Negro. The cases examined in that region were members of the National Army, who were most likely not originally from that city. The people of the nearby region of (Abreera have definite mestizo characteristics (due to its isolation throughout the last 4 centuries), as have those of the rural areas of Puerto Plata.

SUMMARY AND CONCLUSIONS

1. The high frequencies of the group O, type M, and type Rh₂ in the Dominican population suggest the presence of an Indian component in addition to the original White and Negro components. This Indian component is not uniformly distributed. In the cities, towns and easily accessible rural regions there is little evidence of Indian admixture, while in the mountainous and other isolated regions the Indian influence is pronounced.

2. The Indian component is estimated as 17% for the population as a whole, with, in addition, about 43% Negroid and 40% White ancestry. These proportions vary considerably, depending on the region of the country.

3. Based on the distribution of blood groups in different ethnic types of the Dominican Republic, these types may be classified as follows:

Negro
Mlatatto
Mlatatto-mestizo
Mestizo
White

The largest groups are the mlatatto and the mlatatto-mestizo.

4. Finally, answering the question with which I began, the distribution of blood group factors in the ethnic group which I classified *a priori* as mestizo (because of its external physical characteristics) shows that in fact there still exists an Indian mestizo in the Dominican Republic, and that these mestizo elements exist particularly in the mountainous and other less accessible regions of the country.

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SPECIALIZED VS. PRIMITIVE.—I suggest that, from the point of view of anatomy, the Australian and Tasmanian aboriginals should be regarded as examples of one of the most highly specialized of the races of *Homo sapiens*—so specialized that even without the effects of contact with civilization they were probably doomed to extinction in a geologically speaking, relatively short time. I suggest that it is absurd to continue to regard them as "primitive" in the sense in which that word is commonly used by anatomists. . . .

While there still appears to be a good deal of argument in regard to the real age of prehistoric skulls in Australia, such as those of Talgai, Colonna and elsewhere, it is usually agreed that they are *not* of very recent age, and belong at least to the Upper Pleistocene.

If *Homo sapiens*, as a species, is not at least as old as the Middle Pleistocene, it becomes difficult to understand how a race of this species could have reached Australia in the Upper Pleistocene times. For clearly this race must have been very well established and have had considerable control of materials to have been able to reach a continent which other Euro-Asian Plio-Pleistocene mammals failed to reach.

. . . it would not be surprising to learn that a true hand-axe culture had been found in Australia or Tasmania in deposits which could be geographically dated to the late Middle Pleistocene.

If and when such a site is found, and if human remains are found with it, the writer, for one, will expect them to be examples of a much less specialized type of *Homo sapiens* than is represented by the present-day aborigines.—L. S. B. LEAKEY. The age of *Homo sapiens*. *Mankind*, vol. 4, no. 5, September, 1950, pp. 196-200.

AN ANATOMICAL RELATIONSHIP PREDISPOSING TO LUMBOSACRAL FUSION

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ONE FIGURE

Man has developed lumbar curvature as an essential part of fully erect posture. Yet it is not inherited as such, but developed anew in each individual as he learns to walk erect (Bavdean, '05). It seems that the essential spinal adjustment for typical human upright posture is one made during the life of the individual, and that it has not yet become a part of the human genetic heritage.

The functional requirements of erect posture, superimposed on a vertebral column inherited from primate ancestors, demand that skeletal and anatomical adjustments be made during the life of each individual. As the form of the skeleton is closely related to its use or function, it is the purpose of this paper to investigate whether lumbosacral fusion is one such functional adaptation to the mechanical requirements of erect posture. In detail, it will examine the anatomical relationship which apparently is the weakness predisposing to anomalous lumbosacral fusion.

BACKGROUND

Erect posture has been a very early postural adaptation in the evolution of man. The pelvic bones of *Australopithecus promethicus*, together with the details of the limb bones and skull, indicate that this man-ape form walked erect (Dart, '49). In fact, from the evidence at hand, it is a fairly safe assumption that the very earliest fossil men, although transitional from anthropoid to modern man in skull capacity, were