INSTITUTO DE PRÉ-HISTÓRIA DA
UNIVERSIDADE DE SÃO PAULO

FRANCISCO M. SALZANO

GENTICS OF SOUTH AMERICAN INDIANS AND THE ORIGIN OF AMERICAN MAN

Separata do livro
ORIGENS DO HOMEM AMERICANO
II Encontros Intelectuais de São Paulo
Sob o patrocínio da UNESCO

1964

GENETICS OF SOUTH AMERICAN INDIANS AND THE ORIGIN OF AMERICAN MAN (*)

LIMITATIONS OF THE GENETIC APPROACH

Before we start to discuss in what way data which exist about the genetics of South American Indians can throw light upon the controversial problem of the origin of American man, it is important to have in mind the limitations of such method. Genetic characteristics are not static entities and their frequency can change in striking ways during a few generations. The occurrence of similar gene frequencies in two regions of the world do not necessarily imply that these populations have shared a common gene pool in the past. These similarities can be due to a series of causes, parallel evolution being one of them. On the other hand, the occurrence of divergent results in two populations indicates only that they are different *now*. They could have evolved from a common source. The genetic approach alone therefore is of little use for the study of past migrations of man. Its results should always be interpreted in the light of what is already known by other means of anthropological evidence.

Modern genetic theory recognizes four ways in which gene frequencies can change: a) mutation; b) selection: c) genetic drift; d) migration. Any one of these factors can be of importance in the diversification process, and they generally interact in complex ways making historical reconstructions very difficult. In the past many authors have expressed the idea that human racial classifications should be based on "non-adaptive" characters, because they would be the least likely to be changed by the action of evolutionary forces. This point of view is only partially correct; if the action of selection is minimized it would be easier to reconstruct the past history of the stock which is being studied by means of successive migrations. On the other hand this attitude leads to the neglection of an evolutionary factor which can be important: genetic drift. Many geneticists, however, doubt that there could exist such a thing as a "neutral gene". The genotype integration in man or any other organism is such that characters which seem of little value or importance may be connected with far-reaching physiological processes.

Human populations are always in a process of change. They are dynamic entities which condemn any attempt to simplify the problems posed by them in terms of "racial types". Keeping these restrictions in mind it is now possible to examine what evidence the genetics of South American Indians can give to the problem under discussion.

(*) Paper read in the "Second Intelectual Meetings of São Paulo", held in this Brazilian city from August 21 to 27, 1961. The author's researches in this subject have been supported in part by Rockefeller Foundation grants.

THE VARIOUS HYPOTHESIS ABOUT THE EARLY PEOPLING OF AMERICA

A number of investigators have presented several hypothesis concerning the peopling of the New World. Rivet (1958) has summarized the majority of them. The French scientist himself assembled a large amount of evidence to support his opinions, maintained for almost half a century, that the American aborigines are the product of populations which migrated to this continent not only through the Bering strait, but across the Pacific Ocean as well. These points of view plus others of the so-called "polyracialists" (Birdsell, 1951) were not accepted by a large group of North American scientists. This was due in large part to A. Hrdlicka's extreme position in the subject; still the prevailing opinion among physical anthropologists in the United States seems to have remained unchanged after Hrdlicka's death: the American stock was formed exclusively from Asiatic populations who came to this continent through the Bering strait (Birdsell, 1951; Stewart, 1960).

Indeed no one can deny the large Mongoloid component existent among American Indians; the discussion which exists is about the importance of other contributions to their gene pool. Birdsell (1951) suggests a dihybrid origin for them; according to him besides the Mongoloid element an archaic Caucasoid contribution from the Amurians would be present. Rivet (1958) presents the thesis that the American Indians are the result of a certain number of migrations of four main racial groups, Mongoloid, Eskimoid (both coming through the Bering strait), Australoid and Melanesoid (coming across the Antarctic and Pacific Ocean, respectively). He admits the possibility of other migrations of Asiatic archaic Caucasians and Pygmoids but emphasizes the need of new studies in relation to the possible influence of these groups. Rivet presents also a chapter in his book about the commercial relations which would have existed in prehistoric times between America and Polynesia but does not mention possible influences of this commercial exchange in the physical make-up of the populations.

Imbelloni (1938, 1939, 1950) admits the migration of seven distinct human types in the following sequence: Tasmanians, Australians, Melanesians, Proto-Indonesians, Mongoloids, Indonesians and Eskimos. According to him they have originated eleven human types throughout the continent.

Heyerdahl (1952) most persuasively put forward the inverse hypothesis that the Polynesians are the result of two distinct migrations from America. First a fair-bearded race arrived on balsa-log rafts from South America. The other main contributors are said to have arrived later and to have been American Indians from the West coast of Canada — indeed they are positively identified as members of the still-existent Kwakiutl tribe.

Genetic traits of the first immigrants would be very difficult to demonstrate presently in South America. This evidence, therefore, will not be considered. The comparison of blood groups of Polynesians and North American Indians, however, presents, according to Mourant (1954) and Simmons (1956), a strong suggestion that Polynesians and North American Indian in a not too distant past had received many genes from a common gene pool. The direction of the migrations, however, could be not only from North America to Polynesia, but the opposite or even in both ways. The discussion of this point, however, is not pertinent here, since I am going to discuss the evidence concerning South American Indians only.

Table 1 summarizes the standpoints of the authors mentioned above about the origins of American Man. No attempt will be made here to analyze in detail the evidence presented by them. Newman (1951) has already presented a highly critical paper about Imbelloni's approach which

he calls "ultra-migrationist". Instead I will try to assemble the available genetic evidence to find out if it is in any way compatible with these hypothesis.

GENETIC DATA

For the same reason as Heyerdahl's Birdsell's points of view cannot be discussed here. The Amurian element, according to him, would be present in some Californian Indians of today. Suffice to say here that he recognizes how meager his data are. And indeed no genetic evidence is available in South America which could give support to this hypothesis.

But Rivet's thesis can be subjected to closer scrutiny. The Australoid influence alleged by this author for the Fueguidos is not confirmed by data of the ABO system (table 2). The Fueguidos probably were all from group 0 (frequencies of I^A and I^B equal to zero) before their contact with Europeans, while the Australian aborigines present large amounts of gene I^A (from 18.59 to 37.81%) and certain quantity of gene I^B (0.00 — 4.06%). In relation to the Melanesians their largest influence would be among the Laguidos, former inhabitants of a large region of North and South America. Presently this influence would be detectable mainly at the NW coast of North America, in the Amazon basin and Colombia (table 1). Table 3 presents the pertinent genetic information. The frequency of genes in six genetic systems is completely different in Melanesians and Brazilian Indians. For the Amazon Indians in particular data is available for four genetic systems only. In three of them the frequencies are clearly discordant. As to the Rh system no detailed data is known about their gene arrangements. If they should be similar to the results obtained among other Brazilian Indians, it is possible that they would be discordant in this system also and not concordant as the values of D only might suggest. As far as the Colombian Indians are concerned only data about three systems are available. In one the results are discordant and in two others possibly concordant. Pending further studies among the Colombian Indians, therefore, the Melanesian influence is not supported by the genetic evidence.

Imbelloni's ideas can now be discussed (table 1). According to him the Fueguidos have been influenced by the Tasmanians. If it is supposed that the latter had gene frequencies similar to the Australoids, the results of the ABO system are against such influence (table 2). Imbelloni assumed further that the Australians would have influenced the Pampidos. Data on the ABO system are not incompatible with this hypothesis, but those of the MN system are (table 2). He also mentioned a Melanesoid influence in the Indians of the Brazilian Eastern Plateau. This, as mentioned above, is not compatible with the data at hand which show a completely different pattern of gene frequencies, in Brazilian Indians and Melanesoids (table 3). According to Imbelloni there would be a Protoindonesian influence in the Amazonian Indians and an Indonesian influence in the Istmidos. The last-named Indians are almost extinct and no clear information about their distribution in South America is available (Imbelloni, 1938). Imbelloni (1957) suggests that the Chibcha of Colombia and Ecuador could perhaps be ascribed to them. The only genetic frequency available about the Chibcha is from unpublished results of Layrisse, Layrisse and Wilbert, who found 1.00% of Diego positives among 100 Tunebo. This number is compatible with those found among the Indonesians (Di^a = 0.00-4.91%). On the other hand, the comparison of Brazilian Indians and Indonesians in eleven genetic systems yield the following results: dissimilar in 10 and similar in 1 (table 3). Again, no indication of genetic similarity is available.

TABLE 1

Table 1: Summary of the three more generalized hypothesis concerning the origins of American Man. (*)

Author	*Additional strain (besides the Mongoloid)*	*Influence in America*	*Evidences*	*Route*
Birdsell, 1951	Amurian (archaic Caucasoid)	In Californian Indians	Mainly morphological	Terrestrial, via Bering strait
Rivet, 1958	Australoids	Mainly in the inhabitants of Tierra del Fuego	Mainly linguistic	Terrestrial, via Antarctica
	Melanesoids	In the laguidos, former inhabitants of a large region in America. Presently mainly in the NW Coast of N. America, in the Amazon basin and Colombia	Cultural, linguistic and of comparative pathology	Maritime, through the Pacific Ocean
Imbelloni, 1938, 1939, 1950	Tasmanians	In the Fueguidos, extinct or alive	Morphological and osteological	Terrestrial
	Australians	In the Pampidos and inhabitants of Northern prairies	Morphological and osteological	Terrestrial
	Melanesians	In the Indians of Brazilian Eastern Plateau	Morphological and osteological	Terrestrial
	Protoindonesians	In the Amazonian Indians	Morphological and osteological	Maritime
	Indonesians	In the Istmidos	Morphological and osteological	Maritime

(*) There is little dispute about Eskimo origins and therefore they are not included in the above tabulation.

TABLE 2

Table 2: ABO and MN gene frequencies in four groups mentioned in table 1. (*)

Genetic system	*Gene*	*Pampidos*	*Australoids*	*Tasmanians*	*Fueguidos*
ABO	I^A	0.45 - 20.33	18.59 - 37.81	Possibly similar to Australoids	Possibly 0.00
	I^B	0.00 - 3.12	0.00 - 4.06		0.00
	I^O	79.67 - 100.00	62.19 - 80.14		100.00
MN	m	87.59	14.3 - 31.25	—	—

(*) *Sources:*

Mourant, 1954; Mourant, Kopec and Domaniewska — Sobczak, 1958; Salzano, 1957

As mentioned above, there are no doubts about the existence of a large Mongoloid component which contributed to present day American Indian populations. In table 3, as a check to our method, is made a comparison of the available genetic data among Brazilian Indians and Asiatics. Of the 12 systems listed frequencies are dissimilar in 8 and similar in 4 cases. Theoretically a larger amount of concordance would be expected. But it should de pointed out that in the majority of cases the available data comes from Japan and regions of China far from Mongolia or the Asiatic part of the USSR from which, as it is supposed, came the ancestors of the American Indians. As mentioned by Mourant (1954), however, from where they came or how they evolved cannot be genetically investigated until politics allow closer cooperation between scientists of the Far West and the Far East.

It is important to point out one important limitation to my approach. If the migration route of the hypothetical populations which contributed to the peopling of the Americas is known with some degree of certainty, the changes which occurred during their passage can be followed and can yield regular trends. This seems to be the case with the haptoglobin system. As pointed out by Sutton et al. (1960) the frequency of the gene Hp^1 increases from a low value of 24% in Japan to intermediate values in Alaska (30 — 52%) to fairly high values in North America, Mexico and Peru (59, 57-59 and 73%, respectively). Unpublished data by Sutton and Salzano, presented in table 3, show for the Brazilian Indians a pattern similar to that found among other Central and South American tribes (55 — 79%) and therefore different from the Asiatic values (24 — 30%). With the intermediary frequencies found among the Alaska and North American aborigines, however, this could be cited as a beautiful example of a cline. On the other hand, the Oceanic populations sampled until now present frequencies which are very similar to those found in South America (50-60%). And therefore the doubts persist about the possible migration routes. Fig. 1 summarizes graphically the results just discussed.

TABLE 3

Table 3: Gene frequencies in six groups mentioned in table 1. (*)

Genetic system	*Gene*	*Melanesoids*	*Amazon Indians*	Colombian Indians	*Brazilian Indians*	*Indonesians*	*Asiatics (**)*
ABO	I^A I^B I^O	9.35-29.7 5.11-25.2 45.1 -79.57	0.00-0.81 0.00-0.09 99.10-100.00	0.00-5.40 0.00-3.65 91.70-100.00	0.00 0.00 100.00	2.22-30.16 5.36-41.77 50.86-89.31	13.13-35.70 12.62-28.90 48.96-77.53
MN	m	8.87-38.64	69.85		64.83-90.91	43.51-63.17	50.67-63.00
Rh	D R_z R_1 R_2 R_0	100.00 0.00- 1.58 80.27-94.42 1.99-12.71 2.01-9. 84	100.00	Possibly 100.00	100.00 2.3 - 5.63 34.39-58.59 29.73-52.86 6.57-18.1	91.75-100.00 0.00- 3.01 74.00-89.21 5.98-15.15 2.83-10.85	87.63-100.00 0.00- 0.40 60.20-71.36 18.15-30.81 0.00- 3.07
Lutheran	Lu^a	0.00			8.59	0.00	
P	P_1				22.15-23.25	50.00	14.67-17.92
Kell	k				Maybe 100.00	100.00	100.00
Kidd	Jk^a				41.85	High	31.03
Duffy	Fy^a				0.00-23.72		90.15
Diego	Di^a	0.00	6.46- 7.52	0.50	7.58-28.44	0.00- 4.91	1.15- 6.39
Haptoglobins	Hp1				55.0 -79.0	50.0	24.0 -30.0
Hemoglobin	Hb^a				0.00	2.0	0.00
Color vision (***)	c	0.82			4.39		2.58 (J) - 4.99 (Ch)
Glucose -6-phosphate dehydrogenase deficiency	Gl-d				Possibly 0.00	Possibly 12.7	0.00- 2.00

(*) *Sources:* Layrisse and Wilbert, 1 960; Lehmann, 1 957; Motulsky, 1 960; Mourant, 1 954; Mourant, Kopec and Domaniewska — Sobczak, 1 958; Salzano, 1 957, 1 961a, 1 961b, 1 961c; Simmons, 1 958; Sutton, 1 960: Tondo and Salzano, 1 960.

(**) *ABO:* data from the Asiatic part of USSR; *MN:* Chinese and Japanese; *Rh:* Chinese, Koreans and Japanese; *Kell, P, Duffy* and *Kidd:* Chinese; *Diego:* Chinese and Japanese; *Color vision:* Ch: Chinese; *J:* Japanese.

(***) Data on males only.

QUADRO 1

PORCENTAGENS DOS COMPONENTES RACIAIS

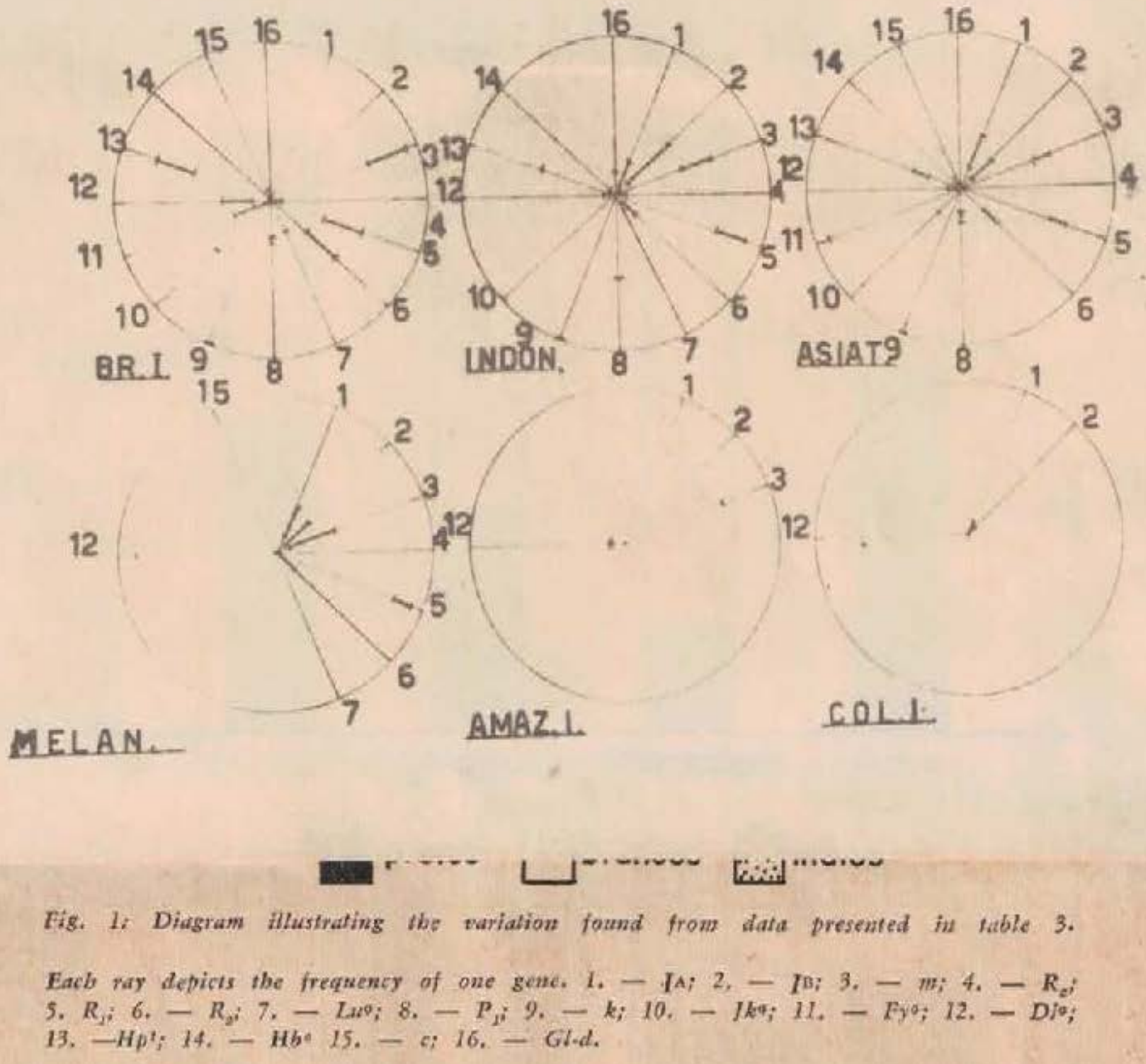

Fig. 1: Diagram illustrating the variation found from data presented in table 3.

Each ray depicts the frequency of one gene. 1. — I^A; 2. — I^B; 3. — m; 4. — R_2; 5. R_1; 6. — R_0; 7. — Lu^a; 8. — P_1; 9. — k; 10. — Jk^a; 11. — Fy^a; 12. — Di^a; 13. —Hp^1; 14. — Hb^s 15. — c; 16. — Gl-d.

BR. I. = Brazilian Indians; Indon. = Indonesians; Asiat. = Asiatics; Melan. = = Melanesoids; Amaz. I. = Amazon Indians; Col. I. = Colombian Indians.

CONCLUSIONS

The genetic data give no support to the alleged influence of Australians, Melanesians, Tasmanians and Protoindonesians in the peopling of the New World. This is not to say that this influence did not occur. The validity of comparing gene frequencies of widely distant populations was already discussed. The solution of the problems of American Indian origins

can therefore be solved only through an interdisciplinary approach involving especially the populations living in the Asiatic part of the USSR. Until this can take place the problem will have to remain open as far as genetics is concerned.

BIBLIOGRAPHY

Birdsell, J. B. 1951. The problem of the early peopling of the Americans as viewed from Asia. *In:* Laughlin, W. S. (Ed.). *The Physical Anthropology of the American Indian.* Edwards Brothers Inc., Ann Arbor, U.S.A.

Heyerdahl, T. 1952. *American Indians in the Pacific: the theory behind the Kon-Tiki expedition.* Allen und Unwin, London.

Imbelloni, J. 1938. Tabla classificatória de los Indios. Regiones biológicas y grupos raciales humanos de America. Physis, 12: 229-249.
1939. Estado actual de la sistemática del hombre con referência a America. Physis, 16: 309-321.
1950. La tabla classificatória de los Indios a los trece años de su publicación. Runa, 3: 200-210.
1957. *In* Biasutti, R. *Le razze e i popoli della terra.* 2*and* Edition. Unione Tipo grafico-Editrice Torinese, Torino, Italy.

Layrisse, M. and J. Wilbert. 1960. *El antigeno del sistema sanguineo Diego.* Editorial Sucre, Caracas, Venezuela.

Lehmann, H. 1957. Variations of hemoglobin synthesis in man. Acta Genet. et Stat. Med., 6: 413-429.

Motulsky, A. G. 1960. Metabolic polymorphisms and the role of infectious diseases in human evolution. Human Biology, 32: 28-62.

Mourant, A. E. 1954. *The distribution of the human blood groups.* Charles C Thomas, Springfield, U. S. A.

Mourant, A. E., A. C. Kopec and K. Domaniewska — Sobczak, 1958. *The ABO blood groups.* Blackwell Scientific Publications. Oxford, England.

Newman, M. T. 1951. The sequence of Indian physical types in South America. *In:* Laughlin, W. S. (Ed.). *The Physical Anthropology of the American Indian.* Edwards Brothers Inc., Ann Arbor, U. S. A.

Rivet, P. 1958. *As origens do homem americano.* Anhambi, São Paulo.

Salzano, F. M. 1957. The blood groups of South American Indians. Amer. J. Phys. Anthrop., 15: 555-579.
1961a. Studies on the Caingang Indians. III. Blood groups. Amer. J. Phys. Anthrop. (in press).
1961b. Studies on the Caingang Indians. IV. Rare genetic conditions. General conclusions. Annals Human Genet. (In press).
1961c. Sangue, genes e populações. Problemas de Genética Humana Biofísica (MS).

Simmons, R. T. 1956. A report on blood group genetical surveys in Eastern Asia, Indonesia, Melanesia, Micronesia, Polynesia and Australia in the study of man. Anthropos, 51: 500-512.
1958. A review of blood group gene frequencies in aborigines of the various Australian States. Proc. 7th Cong. Intern. Soc. Blood Transf.: 287-292.

Stewart, T. D. 1960. A physical anthropologist's view of the peopling of the New World. Southw. J. Anthrop., 16: 259-273.

Sutton, H. E., G. A. Matson, A. R. Robinson, and R. W. Koudky. 1960. Distribuition of haptoglobin, transferrin, and hemoglobin types among Indians of Southern Mexico and Guatemala. Am. J. Hum. Genet., 12: 338-347.

Tondo, C. V. and F. M. Salzano, 1960. Hemoglobin types of the Caingang Indians of Brazil. Science, 132: 1893-1894.