To Ranji and Alyse
with best wishes from Arthur Mourant

The Blood Groups and Haemoglobins of the Veddahs of Ceylon

BY

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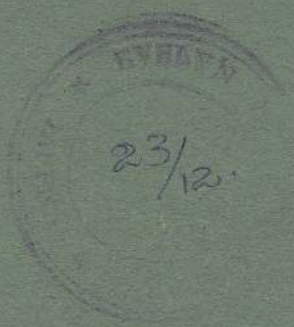

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The Blood Groups and Haemoglobins of the Veddahs of Ceylon

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The veddahs, the aboriginal inhabitants of ceylon, are now few in number, and are to be found only in a few restricted areas. They were probably once numerous and widespread, and they have certainly diminished in numbers in the last few hundred years. They have long aroused great interest among anthropologists, and because of their special physical characteristics they have given their name to the so-called 'Veddoid' race to which a number of tribes in India and elsewhere have been assigned. The appropriateness or otherwise of this term is discussed below. Lehmann & Cutbush (1953) were the first to show clearly that certain Veddoid tribes of southern India differed considerably in their blood-group and haemoglobin constitution from most of the other peoples of India. Very little was then known of the blood groups of the Veddahs themselves, and it was in order to fill this gap that the present investigation was undertaken.

Six groups of Veddahs, each mainly endogamous, have been investigated. Each group lives in a single village or two neighbouring villages. These groups, numbered 1 to 6, are listed in Table 1. In order to avoid repetition of the village names the separate populations will as a rule be referred to by these numbers. The situations of the villages are shown in the sketch-map (Fig. 1.). Every one of these groups has intermarried to some extent with its Sinhalese and Tamil neighbours, so that neither these nor indeed any Veddah population at the present time can be regarded as completely representative of the relatively unmixed Veddah populations of a few hundred years ago.

The Veddahs of communities 1 to 4 are the so-called 'Gan' or 'Village Veddahs'. From their physical characteristics and social customs, the least mixed group appears to be that of Pollebedde (community 1). The villages of Mullegama and Thimburunewewa (community 2) contain the remnants of the classical Danigala Veddahs. These villages are situated only a few miles from Pollebedde, but there had been, apparently, little intermarriage between the two communities up to the time of the investigation, owing to the fact that they belong to different *waruges* or clans, those of community 1 to the Unapane and those of community 2 to the Morane *waruge*. However, since the specimens were collected the expansion of irrigation schemes has made it necessary to settle the members of community 2 at Pollebedde. Members of communities 1 and 2 speak Sinhalese though a few of them know some words of Veddah.

The Veddahs of Dambana (community 3) were the only ones who, while speaking fluent Sinhalese as well, conversed among themselves in the Veddah language. Dambana is not very distant from Pollebedde but there has apparently been no intermarriage between the two villages, again owing to clan differences. The Dambana Veddahs belong to the Uru and Namadewa *waruges*, which are considered to be 'lower' than the Morane and Unapane *waruges*.

1. Pollebedde
2. Mullegama—Thimburunewewa
3. Dambana
4. Ginidamana—Dalukana
5. Vakarai
6. Adampane—Bukmikade

FIGURE 1. Distribution of villages.

Ginidamana and Dalukana (community 4) are situated in the North Central Province of Ceylon, and the Veddahs here have intermarried to a considerable extent with the Sinhalese and Tamil peoples, although still retaining some of the physical characteristics of Veddahs. They belong to the Aembala and Uru waruges.

The so-called 'Coastal Veddahs' of Vakarai (community 5) and of Adampane and Bukmikade (community 6) have intermarried freely with the neighbouring Tamils. They have retained scarcely any of the physical characteristics of Veddahs and have now forgotten their *waruge*, though the Seligmans (1911) state that they belong to the Aembala and Uru *waruges*. Members of communities 4, 5 and 6 speak only Tamil and have no knowledge of any other language.

Despite the amount of intermarriage which is known to have taken place between Veddahs on the one hand and Tamils and Sinhalese on the other, the Veddah communities studied still maintain to a large extent their characteristic physical features and, as will be shown, they also differ markedly from their neighbours in their blood-group frequencies. Moreover, despite the apparent varying degrees of purity of the various communities, they show remarkably little variation in their blood-group frequencies. There is thus little doubt that, if due allowance is made for the effects of intermarriage, the results of a study of blood groups and haemoglobins can be used with some confidence in attempting to determine the relationships between the Veddahs and the other peoples of southern Asia.

THE COLLECTION AND TESTING OF SPECIMENS

Blood specimens were collected by venepuncture by a number of colleagues to whom we express our thanks at the end of the paper. They were sent to Colombo, whence certain of them were forwarded to London by air in vacuum flasks with ice. Blood group tests on communities 1, 2, 3 and 5 were carried out in London and those on communities 4 and 6, as well as $A_1 A_2$ BO tests on community 1, in Colombo. A preliminary series of haemoglobin tests, reported elsewhere, was performed in London, as was a subsequent series of forty-three from community 4, the latter being also tested in Colombo. The remaining haemoglobin tests were done in Colombo. Tests were carried out by standard methods for the blood group antigens A_1, A_2, B, M, N, S, P_1, C, D,D^u, E, c, Lu^a, K, Le^a and Fy^a, but not all specimens were tested for every antigen. Tests for abnormal haemoglobins were performed by means of electrophoresis on paper. The results of all the tests, and gene frequencies calculated from them by the methods recommended by Mourant (1954), are shown in Tables 2–7. The results of observations are shown separately for each community, but as the differences between communities are, in most cases, small and not statistically significant, the results have been added together for purposes of calculation. From the data given, however, gene frequencies for the separate communities can readily be calculated.

DISCUSSION

The blood-group frequencies of the Veddahs have been compared with those of numerous other populations in southern Asia. Except where other specific references are given the blood-group data for these populations, used for comparison, together with references to the original publications, are included in the tables of Mourant (1954) and Mourant *et al.* (1958).

The most striking feature of the blood groups of the Veddahs is their very low frequency of the A genes (A_1 and A_2), combined with a rather high frequency of B. In this they differ considerably from their neighbours the Tamils and Sinhalese. The numbers tested in each separate Veddah community are too small to enable the results to be used as a reliable test for genetical 'purity', but they are consistent with communities 5 and 6 being racially more mixed than the others. The Veddahs differ greatly not only from the Tamils and Sinhalese, but also from most Indian communities, including most of the 'Veddoid' and other tribal peoples of Madras and Kerala. They show a resemblance, however, to the Kotas and Nayadi who have practically no A at all, and the Mulla Kuruma who have very little.

The only other peoples known who show similar ABO frequencies are certain tribesmen of the valleys of Upper Burma, and the Senoi, especially the Semai Senoi, of Malaya (but not the Negritos or the Aboriginal Malays) (Polunin & Sneath 1953). Cole (1945, p. 92) has suggested on quite other grounds that the Senoi are related to the Veddahs.

If we assume that the present Veddah communities have acquired many genes of all kinds from the Tamils and Sinhalese, it may be that the aboriginal Veddahs at one time had even less A, and perhaps none. While it is possible that all the populations mentioned, with very low or absent A and high B frequencies, are closely related, the possibility of

convergent evolution must be considered. All the tribes concerned appear to have lived in the region for a very long time, and the whole of India and south-east Asia are subject to frequent epidemics of smallpox. Vogel *et al.* (1960) have shown that the virus of smallpox carries an A-like antigen, and have suggested that natural selection resulting from infection with it has been an important factor in lowering the frequency of the A gene in affected populations.

A second marked difference from the Sinhalese and Tamils lies in the comparatively low frequency of total M genes in the Veddahs. The MS frequency is nevertheless relatively high, as in India generally, as distinct from south-east Asia. Similar MNS frequencies to those of the Veddahs are found in south India in the Chenchu (Simmons *et al.* 1953) and similar MN frequencies in the Pallar, Malpantaram, Mala-Vedan, and Mala-Kuruvan (Büchi 1955a, 1955b, 1958–9, 1959–60). The Canarese and Coorgis (Lehmann & Cutbush 1962) also appear to have low M frequencies but very few of them have been tested. The majority of the 'Veddoid' tribes have considerably higher M frequencies.

A third well-defined difference from the Tamils and Sinhalese lies in the high frequency of CDe and low frequency of cde in the Veddahs. This feature is seen also in some south Indian tribes, especially the Malpantaram, Pallar, Paniyans, and Kotas, and to a less marked degree in the Chenchu.

The blood-group systems other than those already mentioned yield relatively little information of value for purposes of comparison of populations. As in nearly all Asiatic populations, the frequency of Lu^a is very low. It may, however, be of some importance that the Veddahs are the only population in the Indian region in whom Lu^a has been found at all, and that one Lu^a-positive was found among 101 Malayan Senoi. The high frequency of Fy^a is similar to that found throughout Asia. The frequencies of P_1 and K are high compared with most Indian populations (as well as with those of the rest of Asia) but in each case the Chenchu show similar frequencies to the Veddahs.

The frequency of Le^b-positives is somewhat high by European standards, and considerably higher than that recorded for the Chenchu. No other Lewis blood-group frequency data appear to have been published for any population in the Indian region. There are indications that such data, especially for the other peoples of Ceylon, and for southern India, would be of great interest. The frequencies of the ABH-secretor character are exceptionally low in many of the tribal peoples of south India (though unusually high in the Chenchu). This should considerably modify the expression of the Lewis genes, and give an unusually favourable opportunity for the testing of theories of the genetics of the Lewis system and the relations between the Lewis and secretor systems. If the secretor character should prove to be rare also in the Veddahs, they too should if possible form the subject of a comprehensive anthropological and genetical investigation of the complex relationship between the Lewis and secretor systems.

However, the genetical system which throws most light on the anthropological connexions of the Veddahs is that of the haemoglobins. Haemoglobin E, as first shown in a preliminary communication by Graff *et al.* (1954), is exceptionally common in the Veddahs. It has now also been found in Sinhalese (de Silva *et al.* 1959). This haemoglobin is widespread in Malaya (Lehmann & Bhagwan Singh 1956) and south-east Asia generally (Lehmann & Ager 1960). Lehmann & Bhagwan Singh (1956) found the one

Senoi whom they tested to be heterozygous for haemoglobin E, and recent work (see Note 2), though on small numbers only, has confirmed the high frequency in the Senoi. In India haemoglobin E has not been found anywhere in the south, though it occurs with a low frequency in Bengal. Haemoglobin S (sickle-cell haemoglobin) has not been found in the Veddahs but is common in many of the aboriginal tribes of India, especially in the extreme south. This is particularly remarkable since where the gene for haemoglobin S is present at all it tends to reach high frequencies as a response to endemic malignant tertian malaria (that due to *plasmodium falciparum*), which was until recently common in Ceylon. The occasional examples of the thalassaemia gene in the Veddahs might show a relationship either to India or to south-east Asia, since it is present in both regions, though commoner in the latter.

Taking the haemoglobin and the blood-group data together, one may perhaps conclude that the Veddah stock has received contributions both from Malaya and from the aboriginal tribes of southern India. The absence of haemoglobin E from the latter region indicates that a major contribution came from south-east Asia, and that this did not come via India. Perhaps the very early inhabitants were of proto-Malay stock, closely related to the present Senoi. It would, however, be impossible to account for many of the blood-group characteristics of the Veddahs solely on the basis of a derivation from south-east Asia. Such features as the presence of A_2 and cde (r), and a high frequency of MS, are typical rather of India. It is impossible to prove that they were not derived from relatively recent intermarriage with the Sinhalese and Tamils, but it would not be surprising if, as a result of pressure from the repeated invasions which India has received from the north, members of the aboriginal populations which now find a refuge in the hills of the extreme south had, before the coming of the ancestors of the present Sinhalese, gradually infiltrated into Ceylon, perhaps in some variety, and had interbred with the older-established population.

A fuller application of serological and genetical tools already available could be used to test this hypothesis much more precisely than we have been able to do. Such work would demand special financial support and require the collaboration of a number of specialized laboratories. It must be done soon if it is to be done at all, as is instanced by the fact that even in the few years since the present investigation was begun the Veddahs have become further displaced and dispersed. If such an investigation were combined with similar work in southern India and Malaya it might yield very important information on population movements in south-east Asia during the last 5,000 years.

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NOTES

1. Since this investigation was completed one of us (R.L.W.) has begun an investigation of the Padhu or Bathgamuwa of eastern Ceylon. The presence, among the nineteen persons so far tested, of sickling, of the Rh gene complex CDE (or R_z), and of a high frequency of the blood group A gene, suggests that, while not at all closely related to the true Veddahs, they may be the representatives in Ceylon of the so-called 'Veddoid' race of southern India.

2. The only source of information on the blood groups of the Senoi, other than the ABO groups, is the work of Polunin & Sneath (1953), who tested 101 individuals. In view of this relative paucity of data, and of the connection which we have suggested between the Senoi and the Veddahs, we include in this paper (Tables 8 and 9) the results of recent haemoglobin tests on twelve Senoi and of a detailed blood group examination of eleven of these. We are indebted to Dr Margaret Strickland, Medical Officer of the Department of Aboriginal Affairs, Kuala Lumpur, for giving one of us (H.L.) access to these persons, and permission to take blood samples. The blood-group results agree well with those of Polunin & Sneath, while the observations on the haemoglobins confirm the previous finding of a high frequency of haemoglobin E in Malaya in general (Lehmann & Bhagwan Singh 1956), and support the suggested connection with the Veddahs.

TABLE 1. *List of Veddah communities tested* (*See Fig.* 1)

Community	Villages
1	Pollebedde
2	Mullegama Thimburunewewa
3	Dambana
4	Ginidamana Dalukana
5	Vakarai
6	Adampane Bukmikade

TABLE 2. *The A_1A_2BO blood groups of the Veddahs*

Phenotype	Villages*						Total number observed	Frequency observed	Frequency expected	Number expected
	1	2	3	4	5	6				
O	10	20	10	36	22	17	115	0·4527	0·4529	115·04
A_1	1	2	3	4	2	3	15	0·0590	0·0566	14·38
A_2	0	0	0	2	0	1	3	0·0118	0·0140	3·56
B	24	21	12	44	5	8	114	0·4488	0·4486	113·94
A_1B	0	0	2	1	1	1	5	0·0197	0·0222	5·64
A_2B	0	0	0	0	0	2	2	0·0079	0·0057	1·45
Total	35	43	27	87	30	32	254	0·9999	1·0000	254·01

Gene frequencies
p_1 = 0·0402
p_2 = 0·0103
q = 0·2765
r = 0·6730
1·0000

* For names of villages see Table 1.

TABLE 3. *The MNS blood groups of the Veddahs*

Phenotype	Villages				Total number observed	Frequency observed	Frequency expected	Number expected
	1	2	3	5				
MMS	0	10	1	4	15	0·1415	0·1975	20·94
MsMs	0	3	1	6	10	0·0943	0·1229	13·03
MNS	2	12	8	14	36	0·3396	0·2508	26·58
MsNs	5	16	8	5	34	0·3208	0·2405	25·49
NNS	1	0	2	1	4	0·0377	0·0706	7·48
NsNs	1	2	4	0	7	0·0660	0·1177	12·48
Total	9	43	24	30	106	0·9999	1·0000	106·00

Chromosome frequencies

MS	=	0·2155
Ms	=	0·3505
NS	=	0·0909
Ns	=	0·3431
Total		1·0000

TABLE 4. *The MN blood groups of the Veddahs of Ginindamana and Dalukana**

Phenotype	Number observed	Frequency observed	Frequency expected	Number expected
MM	19	0·2184	0·2167	18·85
MN	43	0·4943	0·4976	43·29
NN	25	0·2874	0·2857	24·85
Total	87	1·0001	1·0000	86·99

Gene frequencies

M	=	0·4655
N	=	0·5345
Total		1·0000

* Not tested for the S antigen.

TABLE 5. *The Rh blood groups of the Veddahs*

Phenotype	Villages						Total number observed	Frequency observed	Frequency expected	Number expected
	1	2	3	4	5	6				
CCDE	1	0	0	0	0	0	1	0·0039	0·0039	1·00
CCDee	24	34	13	58	18	17	164	0·6457	0·6605	167·77
CCD^{u}ee	0	0	0	0	1	0	1	0·0039	0·0011	·28
CCddee	0	1	0	0	1	0	2	0·0079	0·0017	·43
CcDE	7	3	0	5	6	6	27	0·1063	0·0962	24·43
CcDee	3	3	13	20	4	8	51	0·2008	0·1913	48·59
CcD^{u}ee	0	0	0	0	0	0	0	0·0000	0·0026	.66
Ccddee	0	0	0	1	0	0	1	0·0039	0·0091	2·31
ccDE	0	0	0	1	0	1	2	0·0079	0·0180	4·57
ccDee	0	0	0	1	0	0	1	0·0039	0·0031	·79
ccddee	0	2	1	1	0	0	4	0·0157	0·0124	3·15
Total	35	43	27	87	30	32	254	0·9999	0·9999	253·98

Chromosome frequencies (per cent)

CDE	=	0·0024
CDe	=	0·7620
CD^{u}e	=	0·0115
Cde	=	0·0409
cDE	=	0·0585
cDe	=	0·0131
cde	=	0·1115
Total		0·9999

TABLE 6. *Sundry blood groups of the Veddahs*

System	Phenotype	Phenotypes classified by villages				Total number observed	Phenotype frequency observed	Gene	Gene frequency
		1	2	3	5				
P	P_1+	5	29	15	26	75	0·7075	P_1	0·4592
	P_1-	4	14	9	4	31	0·2925	$P_2(+p)$	0·5408
Lutheran	Lu(a+)	0	n.t.	0	1	1	0·0159	Lu^a	0·0080
	Lu(a−)	9	n.t.	24	29	62	0·9841	Lu^b	0·9920
Lewis	Le(a+)	0	3	4	10	17	0·2881		
	Le(a−)	4	19	5	14	42	0·7119		
Kell	K+	n.t.	5	5	n.t.	10	0·1493	K	0·0777
	K−	n.t.	38	19	n.t.	57	0·8507	k	0·9223
Duffy	Fy(a+)	7	43	22	24	96	0·9057	Fy^a	0·6929
	Fy(a−)	2	0	2	6	10	0·0943	$Fy^b(+Fy)$	0·3071

n.t. = none tested

TABLE 7. *The haemoglobins of the Veddahs*

Villages	Number tested	Genotypes		
		AA	AE	EE
1	38	33	5*	0
3	27	27	0	0
4	87	59	26	2
6	32	27	5	0
Total	184	146	36	2

* This includes one individual with only haemoglobins E and F who is to be regarded as of genotype AE, complicated by β thalassaemia.

TABLE 8. *The blood groups of some Senoi**

Phenotype	Number
O	4
A_1	4
B	2
A_1B	1
CCDee	9
CcDEe	2
MMS	3
MsMs	7
MsNs	1
P_1+	7
P_1-	4
K+	1
K−	10
Total tested	11

* All eleven persons were found to be, C^w-V-, Lu(a−), Fy(a+), Js(a−), Di(a−).

TABLE 9. *The haemoglobins of some Senoi**

Genotype	Number
AA	9
AE	3
Total	12

* See also Lehmann & Bhagwan Singh (1956).

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