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Further Analysis of Korean Blood Types*

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ABSTRACT

In addition to the author's previous report (1960), a further analysis was made with more blood samples and more varieties of antisera. Those data with Rh-Hr, Kell, Duffy, MN systems and subgroups in the ABO system were compared with the previous data. As to some of the new antisera such as Cellano, Kp^a, Kp^b, S, s, P, Diego, Lutheran and Lewis, the first analysis on Korean blood samples was made of this time. The data were compared with the data on other racial groups as observed by others.

In general the present data of Rh-Hr system confirmed our previous findings. The most frequent cell types were $Rh_1 Rh_2$(CcdEe) and $Rh_1 Rh_1$(CDe). The frequency of rh (cde) cell was one in 332 or 0.3%. In addition to the eight phenotypes which were encountered in the author's (1960) previous series, two rare types were found in this study. Still two other phenotypes were identified in an Rh_0(D) negative family's family-study. The close association of gene R_z (CDE) with Asiatic races was discussed.

Kell factor seems even rarer than it was thought. Cellano and and Kp^b (Rautenberg) antigens appeared to be prevalent in Koreans while Kp^a (Penny) antigen appeared rare in Koreans as was the Kell factor. The Duffy factor seems more frequent than it was thought.

The S-factor was relatively low in Koreans as compared with the English. It seemed more associated with the N factor than with the M factor. The s-factor was almost universal in Koreans. The rarity of the A_2 and A_2B Cell was again demonstrated. The frequency of the P-factor was lower than that found in the English and higher than that of the Chinese and Japanese. The Diego factor was certainly present in Korean blood samples and the frequency was even higher than that found in the Japanese as reported by others. Out of random blood samples of 117 Koreans studied, 17 were found positive, a positivity of 14.5%.

No Lu (a+) blood was found in 95 random samples and apparently Lu^b is universal in Koreans. The frequency of Le (a+) was essentially the same range as in the English.

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INTRODUCTION

Ever since the discovery of Rh-Hr system in 1940, many new blood factors have been reported. Most of them are of genetic and anthropologic importance and many of them have been blamed as causes of erythroblastosis fetalis and hemolytic post-transfusion reaction.

Investigators through out the world have all contributed, submitting their statistical data concerning their local population. Concerning Mongolian blood, a considerable amount of work has been reportetd on Chinese and Japanese blood but very little work has been reported on Korean blood samples. In 1960 the present author analysed a few hundred of Korean blood samples as to Rh-Hr, Kell, Duffy, MN and ABO systems and reported their phenotypes and gene frequencies.

In the present paper an additional analysis of these blood types with more blood samples will be reported to supplement our previous data. Original observations of several other blood types

such as P, Diego, Ss, Lutheran and Lewis etc. will also be presented.

MATERIAL AND METHODS

All antisera used in this study were air-shipped from the U.S.A. directly to our laboratory under reasonably cooled conditions. Most of the antisera were supplied by the Knickerbocker Laboratory, N.Y. and a few of them were obtained from the Milwaukee Blood Center, Milwaukee. A set of Pan-O-Cell was also air-shipped from the Knickerbocker Laboratory and served as positive and negative control cells in some of our studies.

Blood samples for this study were taken from random blood donors dwelling in the Seoul area. Bloods were drawn into plane tubes and kept in the refrigerator until tested. Tests were perfomed while the blood was fresh and no blood more than 72 hours old was used in this study.

Our basic blood typing technique is a test tube method with light centrifugation using a special time controled machine, Serofuge of Adams. One drop of antiserum is placed into a 7×10mm test tube and a proper amount of cells is added with the aid of applicator sticks. When a saline suspension of cells is indicated, one drop of 2 to 4% suspension was added with a dropper. If any incubation is indicated the tubes are well mixed and placed at the indicated temperature for a specified period of time. Otherwise the tubes are centrifuged immediately at about 1,000 rpm for 45 seconds. Reading is made grossly unless specified.

Our indirect Coombs procedure is as follows. Antiserum and testing cells are placed in a test tube as described above and placed in a water bath at 37°C for 60 minutes. Then with a tubeful of saline the cells are carefully washed 3 to 4 times to remove all traces of serum. Then a drop of anti-human globulin is added and mixed well. After a light centrifugation a gross reading is made.

As to procedures for individual antisera, an effort was made to follow the manufacturers' directions as closely as possible.

Rh-Hr System: Five anti-sera, anti-Rh_0 (D), anti-rh'(C), anti-rh"(E), anti-hr'(c) and anti-hr"(e), were used routinely in this study. Anti-human globulin was also used when a D^u test was indicated.

In the present series, 178 random blood samples were studied, which made a total of 332 analyses of Korean blood samples together with our previous series.

Kell-Cellano System: Anti-K (Kell), anti-k (Cellano), anti-Kp^a (Penny) and anti-Kp^b (Rautenberg) were used in this study. The latter three antisera were not commercially available and were obtained through the courtesy of the Knickerbocker research group.

In the present series, 158 samples were tested against anti-K to make 210 analyses of Korean bloods together with our previous series. Another 15 random samples were analysed for the latter three antisera. In all cases, the indirect Coombs procedure was employed.

Duffy System: Anti-Fy^a serum alone was used in this study as the anti-Fy^b serum was not available. In the present series, fresh random samples of 45 Korean bloods were studied, which makes altogether 93 analyses when combined with our previous series. The testing technique was the indirect Coombs procedure.

MNSs System: Anti-M and anti-N sera were of animal origin. In this series, 223 unselected consecutive blood donors were analysed with these antisera. We have studied 105 samples in our previous series and both series will make 328 analyses for anti-M and anti-N. A test tube method was employed for these antisera.

Anti-S serum was used to analyse 68 samples, which consisted of 15 M, 34 MN and 19 N bloods. The procedure for anti-S testing was as follows. One drop of antiserum and one drop of 4% saline suspension of cells were mixed in a test tube and centrifuged without any incubation. If no agglutination was present, the same tube was incubated at 37°C for 30 minutes. Then a light centrifugation followed by a gross reading was made. The warm incubation, in general, enhanced the agglutination and statistics were taken with this result, but even with warm

incubation the degree of agglutination was weak, at most a one plus reading or so. Indirect Coombs technique was tried but was not satisfactory.

Anti-s serum was used to analyse random 66 Korean bloods, composed of 17 S-positives and 49 S-negatives. The indicated testing procedure was the indirect Coombs technique.

Subgroups of A and B bloods: Anti-A_1 Lectin was used for the subgrouping of A and AB bloods through out this study. A test tube technique was used in both ABO grouping and subgrouping.

One hundred and fifty random A type blood samples and 37 AB bloods were subgrouped this time. In our previous series we analysed 115 A bloods and 22 AB bloods. Thus both our series will make up a subgrouping of 264 A bloods and 59 AB bloods.

P System: Anti-P was of human origin and random samples of 106 Korean bloods were tested with this antiserum. A test tube method with one hour incubation at 4°C was employed.

Diego System: Anti-Di^a serum was supplied by the Knickerbocker research group. One hundred and seventeen random Korean bloods were analysed with this serum. An indirect Coombs technique was employed.

Lutheran System: Anti-Lu^a and anti-Lu^b sera were supplied by the courtesy of Dr. Greenwalt, Milwaukee Blood Center. There were three different lots of anti-Lu^a and one lot of anti-Lu^b.

Ninety-five random samples, consisting of 30 A, 25 B and 40 O bloods, were tested against appropriate lot of anti-Lu^a serum. Twenty random O bloods were tested with anti-Lu^b serum.

The procedure with anti-Lu^a and anti-L^b was as follows. One drop of antiserum and one drop of 4% saline suspension of cells were placed in a small test tube and incubated at 12°C for one hour. After a light centrifugation a microscopic reading was made. Positive and negative control cells were used in this study.

Lewis System: Anti-Le^a serum was supplied by the courtesy of Dr. Greenwalt, Milwaukee Blood Center. No anti-Le^b was available in this study. The anti-La^a was for group A and O bloods and 75 random A bloods were tested in this series.

A saline tube method was employed with gross reading. Positive and negative control cells were used in this system.

RESULTS AND DISCUSSION

Rh-Hr System: The positivities of five individual Rh-Hr factors among Koreans were calculated from the results of 178 blood samples tested with five antisera. As shown in Table 1, our present data was compared with our previous series and positivities of our combined series were included. Frequency distributions of these factors in other race groups as observed by others were also tabulated for comparison.

The high incidence of Rh_0 (D) factor among Mongoloids is a well known fact but the high incidences of rh'(C) and rh"(E) factors are not so well documented. Our data proves that the positivity of not only Rh_0 factor but also of rh' and of rh" factors in Koreans are much higher than in the English, while the positivity of hr'(c) and hr"(e) factors in Koreans are much lower than that of the English. The same tendencies were observed in the data of Chinese bloods by Simmons (1950). There seems to be a definite preponderance of Rh factors (D,C and E) among Mongolians over Hr factors (d, c and e).

Table 2 shows the phenotype frequencies of present series, previous series and the combined series. Data on other Mongolian groups and English are also included. It should be worth while to mention that in the present series the antisera were supplied from Knickerbocker Laboratory while in our previous series the antisera were supplied from DADE Laboratory. Dispite these different sources of antisera, our data of two different series are very well in agreement, which makes the calculated frequencies more reliable.

As shown in Table 2, the most frequent cells among Koreans are Rh_1Rh_2(CcdEe) and Rh_1Rh_1 (CDe). The Rh_1Rh_0(CcDe) cell, the most frequent cell in the English, is only the third or fourth most frequent cell among Koreans. The Rh_1Rh_2(CDEe) cell, one of the rare types among

Table 1. Positivities to five Anti Rh-Hr sera

	Number tested	Anti-C	Anti-c	Anti-D	Anti-E	Anti-e
Korean		%	%	%	%	%
by Lee, Previous series	154	87.69	62.34	99.35	59.09	87.01
Present series	178	86.8	61.72	98.56	63.28	87.36
Combined series	332	87.3	61.8	98.7	61.2	87.1
Chinese						
by Simmons et al. (1950)		94.8	41.2	100.0	35.6	95.6
English						
by Race et al. (1954)		67.82	81.49	83.16	28.67	97.59

Tabl 2. Phenotype frequencies of Rh-Hr system defined by Anti-D, C, E, c and e sera

	Number tested	rh	Rh_1 Rh_1	Rh_1 Rh_0	Rh_2 Rh_2	Rh_2 Rh_0	Rh_1 Rh_2	Rh_1 Rhz	Rh_2 Rhz	Rh_0	Rhz	rh rh'
Anti-C		−	+	+	−	−	+	+	+	−	+	+
Anti-c		+	−	+	+	+	+	−	+	+	−	+
Anti-D		−	+	+	+	+	+	+	+	+	+	−
Anti-E		−	−	−	+	+	+	+	+	−	+	−
Anti-e		+	+	+	−	+	+	+	−	+	−	+
Korean		%	%	%	%	%	%	%	%	%	%	%
by Lee, Previous series	154	0.7	31.2	9.1	7.1	3.9	35.7	6.5	5.8	0	0	0
Present series	178	0	26.4	9.0	9.5	3.4	37.0	10.5	2.2	0	0.6	1.2
Combined series	332	0.3	28.5	9.0	8.4	3.6	36.1	8.7	3.9	0	0.3	0.0
Chinese												
by Simmons	250	0	58.2	5.6	4.4	0.8	29.6	0.8	0	0.8	0	0
Japanese												
by Lewis	145	0	40.69	4.14	9.65	2.07	42.76	6.9	0	0	0	0
English												
by Race	927	14.8	19.7	35.2	2.2	11.7	13.6	0.1	0	2.5	0	0

the English, is as frequent as the Rh_1Rh_0(CcDe) cell in Koreans.

The lows incidence of rh(cde) cell in Mongoloids is a well known fact and in our present series there was no single rh blood in 178 samples, although we did have one rh blood in 154 samples in our previous series. Therefore the frequency of rh blood among Koreans would become one in 332 or 0.3%. In the present series we had two blood samples which did not react with anti-Rh_0(D) serum but those were not rh(cde) but rhrh'(Ccde) cells. These cells were re-tested by indirect Coombs technique to see if those were so-called D^u variants and proved those were not.

It should be note worthy that the only possible genotype for rhrh'(Ccde) cell would be R'/r (Cde/cde). Therefore the existance of this cell proves naturally the existance of gene R'(Cde) in Korean although its calculated frequency is zero as shown in Table 4.

Another interesting finding is the existance of Rh_2Rh_z(CDE) cell among Koreans. This type of cell was expected to be found because in our previous series we found rather high incidence of Rh_1Rh_z and Rh_2Rh_z cells.

Including these two rare phenotypes, it now becomes 10 different phenotypes that we have proved in Korean. The Rh_0(cDe) cell was never found in either of our series but we did find two such examples in a family study as illustrated in Table 3. In this family an Rh_0(D) negative child

Table 3. Genotype study of a Korean $Rh_0(D)$ negative family

	Phenotypes					Possible Genotypes
	C	c	D	E	e	
1st Child	−	+	−	+	+	R″/r (cdE/cde)
2nd Child	−	+	+	−	+	R_0/R_0 (cDe/cDe) or R_0/r (cDe/cde)
3rd Child	−	+	+	−	+	
4th Child	−	+	+	+	−	R_0/R_0 (cDe/cDe) or R_2/R″ (cDE/cdE)
Mother	−	+	+	+	+	R_2/r (cDE/cde) or R″/R_0 (cdE/cDe)

Table 4. Gene frequencies of Rh-Hr system

	R_1(CDe)	r(cde)	R_2(cDE)	R_0(cDe)	R′(Cde)	R″(cdE)	Rz(CDE)	Ry(CdE)
Korean by Lee	0.5335	0.0547	0.4086	0	0	0	0.0031	0
Chinese by Simmons	0.760	0	0.195	0.040	0	0	0	0
Japanese by Lewis	0.638	0	0.310	0	0	0	0.052	0
English by Race	0.4172	0.4113	0.1278	0.0915	0.0121	0.0106	0.0015	0

was born from an $Rh_0(D)$ positive mother. Subsequent study revealed that this child's cell was a Rh_2rh(cdEe) type and the only possible genotype would be R"/r(cdE/cde). Two of her brothers were found to be the Rh_0(cDe) type with possible genotypes of either R_0/R_0(cDe/cDe) or R_0/r(cDe/cde). In any case, this family study proves several facts. Namely, there are two additional phenotypes over forementioned 10 different phenotypes, and genes R_0(cDe) and R″ (cdE) exist among Koreans though the calculated frequencies are zero.

As shown in Table 4, genes R_1(CDe) and R_2 (cDE) are the most frequent ones among Koreans. Gene r(cde) is decidedly infrequent while gene Rz(CDE) is in considerably high frequency comparied with the data of the English. Gene Rz(CDE) seems to have a close association with Asiatic races. Sussman (1950) called this gene as "Pacific gene" when he found this in Philipinoes and Lewis (1957) also reported a high incidence of this gene in his study of Japanese bloods. Our data on Korean bloods would be an additional support to their view in this regard.

Kell-Cellano System: In the present series, all 158 bloods tested with anti-K serum gave negative results. In our previous series there was one K-positive sample in 52 bloods. Therefore the positivity of Kell factor among Koreans would become 0.48% or 1 in 210 bloods as shown in Table 5.

Table 5. Frequencies of kell factor

	Number tested	K+		K−	
		No.	%	No.	%
Korean by Lee, Previous series	52	1	1.92	51	98.08
Present series	158	0	0.00	158	100.00
Combined series	210	1	0.48	209	99.52
Chinese by Miller (1951)	103	0	0.00	103	100.00
English by Race et al. (1954)	797	69	8.66	728	91.34

Miller's data on Chinese bloods (1951) and Race's data on English (1954) are included in the table for comparison. From our data as well as that of Miller (1951) it appears that the Kell factor is one of the rare antigens in Mongolians if not absent absolutely. The calculated gene frequency for *K* is 0.0024 and for *k* is 09976.

Due to the limited amount of antisera only 15 samples of Korean blood were tested with anti-k (Cellano), anti-Kp^a(Penny) and anti-Kp^b(Rautenberg). It was found that every one of these turned out to be positive against anti-k and anti-Kp^b but negative against anti-Kp^a. Though the group is too small to put any interpretation on it, we got an impression that factor Penny must be rare like the Kell while the factors Cellano and Rautenberg must be quite common among Koreans.

Duffy System: In our previous series we tested 48 Korean bloods with anti-Fy^a serum and found 44 positive ones or a positivity of 91.67%. In the present series we tested an additional 45 bloods and they turned out to be all positive. Thus the positivity of Duffy factor based on our two series would become 89 out of 93 or 95.7%.

Table 6. Phenotype frquencies of Duffy system

	Total number tested	Fy(a+)		Fy(a−)	
		No.	%	No.	%
Korean by Lee,					
Previous series	48	44	91.67	4	8.33
Present series	45	45	100.00	0	0
Combined series	93	89	95.70	4	4.30
Japanese by Lewis et al. (1957)	145	144	99.31	1	0.69
English by Race et al. (1954)	1,035	680	65.70	355	34.30

Table 6 includes these data as well as data on other races as observed by others. While the positivity of the Duffy factor in the English is approximately two-thirds, extremely high incidences are reported in Mongoloids. Lewis (1951) reported a positivity of 99.31% in Japanese and Miller (1951) reported 100% in Chinese. Though the positivity of Koreans is not 100%, it is still a very high incidence and it appears that the Duffy factor is quite prevalent among all Mongolians. Our calculated gene frequency for Fy^a is 0.7926 and for Fy^b is 0.2074.

MNSs System: In our previous series we reported the distribution of MN types in Koreans based on the data of 105 blood samples. In the present series we tested an additional group of 223 bloods with anti-M and anti-N sera and the results were compared with our previous series as well as the data on other Mongolian groups.

As shown in Table 7, our two series are very well in agreement. The calculated positivities based on our combined series would be 31.2% for M, 30.6% for N and 38.5% for MN type. M type is a little predominant over N type in Korean as in Chinese and in Japanese. The comparatively low incidence of MN type in Koreans is difficult to interpret but this is our constant experience. Our calculated gene frequencies are 0.5031 for *m* and 0.4946 for *n*.

Table 7. Phenotype frequencies of MN system

	Number tested	M	MN	N
		%	%	%
Korean by Lee,				
Previous series	105	29.82	39.42	30.77
Present series	223	31.8	37.7	30.5
Combined series	328	31.2	38.5	30.6
Chinese by Wiener et al. (1944)		31.9	46.4	21.7
Japanese by Lewis et al. (1957)		26.21	51.72	22.07

In 1947 Sanger found a new factor called "S" which was proven to be related with the MN system, and with the use of anti-S, the MN system was further divided into six different types.

We tested 68 Korean bloods with anti-S as well as anti-M and anti-N. The distribution as to these six types is tabulated in Table 8. Data on other race groups reported by others were also included.

In general there are similarities among three Mongolian groups which are quite different from the English. When Sanger (1947) found S factor, it seemed to be more frequently associated with M factor rather than with N factor, but it was their impression based on the data of Caucasian bloods. Later Lewis (1957) pointed out that from his data on Japanese bloods, the S factor was more associated with the N factor rather than with the M factor.

As seen in Table 8, our result on M type bloods reveals that MS type is only 1.5% while

Table 8. MNSs system defined by Anti-M, Anti-N and Anti-S

	Number tested	M S	Ms	MNS	MNs	NS	Ns
Korean		%	%	%	%	%	%
by Lee, Present study	68	1.5	20.0	10.0	40.0	15.0	11.5
Chinese by Miller (1951)		4.0	35.0	5.0	37.0	1.0	17.0
Japanese by Lewis et al. (1957)		2.0	24.0	10.0	42.0	5.0	17.0
English by Sanger et al.(1947)		19.0	7.4	30.0	20.0	8.0	15.8

Ms type is 20%. This data gives a support to Lewis' view in this regard. Miller's data on Chinese bloods (1951) shows also in the same tendency.

It can be seen from the table that the over all S-positivity of Korean bloods is 26.5% while that of Chinese bloods is 10% and that of Japanese bloods is 17%. Whether the relatively high positivity in Koreans over the Chinese and Japanese would be of any significance is in question but at any rate, Mongolian groups reveal much lower positivities of S factor than in the English. The over all positivity of the S factor in the English is 57% by Sanger (1947).

Since the discovery of anti-s serum in 1951, S-positive bloods can be further divided into two subdivisions, s-positives and s-negatives. We studied 66 Korean bloods with both anti-S and anti-s sera and the results are shown in Table 9. Data on whites and Negroes by Levine (1951-a) are also included.

Among the 17 S-positive Korean bloods there was only one s-negative blood and all the rest were s-positive. This means homozygous S/S bloods are rare in Koreans and the majority of S-positive bloods must be heterozygous S/s bloods.

All 49 S-negative bloods were positive with anti-s serum. The distribution of Korean bloods as to these three S-s genotypes is somewhat close to the data on Negroes and it is quite different from the data on whites as shown in Table 9.

Table 9. Genotype frequencies of S-s system defined by Anti-S and Anti-s sera

	Number tasted	S/S		S/s		s/s	
Korean		No.	%	No.	%	No.	%
by Lee, Present series	66	1	1.5	16	24.0	49	73.5
Whites by Levine et al. (1951)			12.2		46.5		41.4
Negroes by Levine et al. (1951)			2.8		29.0		68.3

Subgroups of A and AB: In our previous series, we found one A_2 blood among 115 Korean A bloods and the rarity of A_2 and A_2B cells was pointed out. The present series confirm this view once again. No A_2 or A_2B cells were found this time. The frequency of the A_2 cell would become 0.4% and A_2B cell 0% when our two series are combined. As shown in Table 10 the homogeneity of the A and AB subgroup is also observed in the Japanese and Chinese by others.

P System: P-factor was discovered in 1927 when MN system was first found but since the anti-P was considered rarely a matter in blood

Table 10. Subgroups of A and AB

	A_1		A_2		A_1B		A_2B	
Korean	No.	%	No.	%	No.	%	No.	%
by Lee. Previous series	114	99.1	1	0.9	22	100.0	0	0.5
Present series	150	100.0	0	0	37	100.0	0	0
Combined series	264	99.6	1	0.4	59	100.0	0	0
Chi nese by Simons et al. (1950)		100.0		0		100.0		0
Japanese by Lewis et al. (1957)		100.0		0		95.0		5.0

transfusion practice, little attention was paid to this factor. However, in recent years there has been reported a considerable number of anti-P of human origin, some of which were apparently responsible for post transfusion reactions. Therefore a survey of P-factor on Korean blood seemed to be of practical importance and we tested 106 random blood samples with anti-P serum.

The results were tabulated in Table 11 and compared with the data of several other race groups as observed by others. Since the discovery of Jay factor (Tj^a) by Levine et al. (1951-b) coupled with the recognition by Sanger (1955) that this factor was in fact a part of the P system, a new notation is in use. But we stuck to the original notation and our anti-P implies anti-P_1 in the new notation. Our P+ implies P_1 and P— implies P_2 in the new notation.

As shown in Table 11 the distribution of the P factor is quite different from each other. Koreans have 52.8% positivity which is much lower than that of whites or negroes and higher than that of Chinese or Japanese. The calculated gene frequency of P+ was 0.3132 and of P— was 0.6868.

Table 11. Phenotype frequencies of P-system

	Total number tested	P+		P—	
		No.	%	No.	%
Korean					
by Lee, Present series	106	56	52.8	50	47.2
Chinese					
by Miller (1951)	103	28	27.2	75	77.8
Japanese					
by Lewis et al. (1957)	145	59	40.7	86	59.3
Whites					
by Henningsen (1949)	2,345	1,849	78.9	496	21.2
Negroes					
by Miller (1951)	200	190	95.0	10	5.0

Diego System: Diego factor has not been found in pure Caucasian and is known to be present exclusively among American Indians and Mongolians. Regarding Mongolian bloods Layrisse and Arends (1956) tested 100 Chinese bloods dwelling in Venezuela against anti-Di^a and found 5 positive individuals. They tested 65 Japanese bloods from the same area and found 8 positive ones or a positivity of 12.31%. Since then, the frequency of the Diego factor in the Japanese has been studied by Lewis (1956, 1958) and many other Japanese workers and their data ranges between 3.20% to 12.31%.

Some of these data and our data on Korean bloods are listed in Table 12. We studied 117 random Korean bloods and found 17 positive ones or a positivity of 14.5%. It was our experience that the agglutination with anti-Di^a was rather weak, at most a one plus reading, and the wide ranges of Japanese positivities might be due to different strength of antisera. Whether our higher incidence compared of the Japanese data has any statistical significance is in doubt but at least this data tells us that Koreans have the Diego factor no less frequently than the Japanese do.

Table 12. Frequency of Diego factor in Mongoloids

	Total number tested	Dia+	
		No.	%
Korean			
by Lee, Present series	117	17	14.5
Chinese			
by Layrisse and Arends, (1956)	100	5	5.0
Japanese			
by Layrisse and Arends, (1956)	65	8	12.31
by Lewis et al., (1956)	77	6	7.79
by Ueno and Murakata, (1957)	153	12	7.84
by Lewis et al., (1958)	145	10	6.89
by Iseki et al., (1958)	500	16	3.20

Lutheran System: Though it was in 1946 when Callender and Race first identified a new antibody called anti-Lu^a, it was 10 years later when the first example of anti-Lu^b was found by Cutbush and Chanarin (1956). Thus anthropological studies with these antisera show little accumulated data up to the present.

As shown in Table 13, Callender and Race (1946) reported the positivity of Lu^a antigen in the English to be 7.9%. Barnicot and Lawler (1953) found that West Africans of Lagos had a positivity of 7%, which was similar to the English incidence. A higher incidence of this

Table 13. Frequency of Lutheran factor

	Total number tested	Lu(a+) No.	%
Korean			
by Lee, Present series	95	0	0
English			
by Callender and Race (1946)	582	46	7.9
West Africans of Lagos			
by Barnicot and Lawler (1953)	114	8	7
Brazilian Indians			
by Pantin and Junquira (1952)	73	12	16
Australian aborigines			
by Sanger, Walsh and Kay(1951)	178	0	0
New Guinea natives			
by Sanger, Walsh and Key(1951)	141	0	0

antigen was found in Brazilian Indians by Pantin and Junqueira (1952) who found a positivity of 16% in this race group. A lower incidence of this antigen was reported by Sanger, Walsh and Kay (1951) who studied 178 Australian aborigines and 141 New Guinea natives and found not a single Lu(a+) blood.

In the present study we tested 95 Korean bloods with anti-Lu^a and found no Lu(a+). The reactivity of anti-Lu^a was ascertained by positive control cells. Though the group is still too small to draw any conclusion it must be true that Koreans rarely have antigen Lu^a like Australian aborigens and New Guinea natives.

Due to the limited amount of anti-Lu^b serum only 20 bloods were tested with this serum but it should be worth while to mention that every one of these samples revealed positive readings and no Lu(a—b—) cell was found.

Lewis System: As shown in Table 14, it has been known that the positivities of Le(a+) in whites and negroes are about the same range of 22 to 24%. Miller et al. (1951) reported a positivity of 24.7% on Chinese bloods, which is very similar to the range of whites and negroes. Simmons (1950) reported a little lower positivity of 15.5% on Chinese bloods.

In the present study, we tested 75 Korean bloods with anti-Le^a and found 22 Le(a+) bloods or a positivity of 29.3%. This is a little higher incidence than the other data on Mongolian

Table 14. Frequency of Lewis factor

	Total number tested	Le(a+) No.	%
Korean			
by Lee, Present series	75	22	29.3
Chinese			
by Miller (1951)	85	21	24.7
by Simmons et al. (1950)	71	11	15.5
Negroes			
by Miller (1951)	200	48	24.0
English			
by Race et al. (1954)	1,796	402	22.4

bloods but if one combines our data with the other two series on Chinese bloods, the over all positivity of Mongolian bloods would become about 23%, which is the positivity of whites and negroes.

Theories and interpretations on Lewis antigens have not been settled and it is interesting to find that Le(a+) cells are found with the same frequency no matter whether in whites, negroes or in Mongolians.

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