Blood Groups in the Philippines*†

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During 1960 blood samples were obtained from 413 adult Philipinos living in Manila but originating from all parts of the island (Motulsky, Stransky, and Fraser, 1964). The main object of this study was to determine the incidence of abnormal haemoglobins and G6PD deficiency but the opportunity was also taken to characterize the blood and serum group frequencies of this population.

Blood Groups

ABO System. Blood groups following ABO system are set out in Table I.

TABLE I

ABO System	Numbers	Frequency
O	183	0.454
A	104	0.258
B	92	0.228
AB	24	0.060
	403	

The gene frequencies were determined by the method of Race and Sanger (1962): A = 0.17; B = 0.15; O = 0.58.

The value of χ^2 for one degree of freedom, based on the differences between the observed and expected numbers of AB, is 0.39, showing an extremely good fit.

These gene frequencies are in good agreement with the very large sample of Atienza (1955): A = 0.168; B = 0.160; O = 0.672.

MNSs System. (Table II). Anti-M, anti-N, and anti-s sera were used.

TABLE II

Genotypes	Number Observed	Number Expected
MMSS	3	4.3
MMSS, MMss	119	129.4
MNSS	7	5.2
MNSS, MNss	213	191.7
NNSS	1	1.5
NNss, NNss	60	70.9

The chromosome frequencies were calculated according to the methods of Moutant (1954) as: MS = 0.103; Ms = 0.473; NS = 0.062; Ns = 0.362.

The fit is not very good, reflecting the heterogeneous origin of the sample. The χ^2 value for one degree of freedom for the MN frequencies alone is 5.5 and for the above table, including Ss, is 6.1 for two degrees of freedom ($0.05 > p > 0.01$ in both cases). These frequencies are somewhat similar to those for Chinese (Miller, Rosenfield, and Vogel, 1951).

Rhesus System. Anti-D, anti-C, anti-E, and anti-c sera were used and tests were done with anti-D^u on all those persons negative with anti-D (Table III).

Gene frequencies were estimated by a suitable modification of the methods of Moutant (1954): $R_1 + R_1^u$ (CDe + CD^{ue}) = 0.810; R_2 (cDE) = 0.092; R_z (CDE) = 0.065; r (cde) = 0.033.

These figures agree reasonably well with those of Simmons and Graydon (1945). These authors, however, did not use anti-c and were therefore unable to identify the R_z chromosome.

The frequency of R_1^u or CD^{ue} may be estimated as 1/18 of the frequency of $R_1 + R_1^u$ (= 0.045), since one case with the genotype CD^{ue}/cde and 17 with CDe/cde were found. This would give a frequency of R_1 of 0.765.

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TABLE III

Number Observed	Phenotype				Genotypes	Number Expected
	Anti-C	c	D or D ^u	E		
263	+	—	+	—	CDe/CDe	259.8
18	+	+	+	—	CDe/cde	21.2
10	—	+	+	+	cDE/cde, cDE/cDE	5.8
61	+	+	+	+	CDe/cDE, CDE/cde, CDE/cDE	65.4
44	+	—	+	+	CDE/CDe, CDE/CDe	43.4
0	—	+	—	—	cde/cde	0.4
396						396

The fit between expected and observed in these phenotypic classes is extremely good ($\chi^2 = 4.38$). No positive reactions were noted in 297 tests with anti-V serum. The V or ce^s complex has been found thus far only in Negroes to any extent (Giblett, Chase, and Motulsky, 1957). These authors found positive reactions to be very rare amongst Whites, Asiatics, and American Indians.

Kell System. Only anti-K serum was used, and 7 of 403 samples tested were positive. Assuming these are all heterozygotes Kk, an estimate of the frequency of the K gene as approximately 0.09 may be made. The K gene also is rare or non-existent in the Chinese (Miller *et al.*, 1951), the Marshallese (Simmons, Graydon, Semple, Birdsell, Milbourne, and Lee, 1952), and the Malaysians (Polunin and Sneath, 1953).

Duffy System. Anti-Fy^a was used, and 373 of 399 were positive. This gives a frequency of the Fy^a gene of approximately 0.750. This is lower than that among Chinese in New York City (Miller *et al.*, 1951) and similar to levels in India (Cutbush and Mollison, 1950).

Diego System. 14 of 403 persons tested were positive with anti-Di^a. This gives a frequency of the Di^a gene of approximately 0.018. This is similar to the frequency in Chinese (Layrisse and Arends, 1956).

Sutter System (Giblett, 1958). No positive reactions were found in 297 tests with anti-Js^a. This confirms the findings of Giblett and Chase (1959) who found no positive reactions in blood samples of 500 non-Negroes, including 53 Asiatics.

Serum Groups

Haptoglobins. (Table IV).

The gene frequencies were as follows: Hp 1 = 0.394; Hp 2 = 0.606.

TABLE IV

Genotype	No.
Hp 1-1	67
Hp 2-1	182
Hp 2-2	152
Ahaptoglobinaemia	2
Total	403

χ^2 for 1 degree of freedom = 0.99.

Neither of the two persons with ahaptoglobinaemia was identified as having thalassaemia or G6PD deficiency.

Transferrins. Eight persons were identified as having the transferrin genotype CD₁, though the possibility cannot be excluded that the D₁ transferrin was, in fact, D_{Chi} (Parker and Bearn, 1961). This would give a gene frequency for the D₁ transferrin of 1%. Again, none of these 8 persons was identified as having thalassaemia or G6PD deficiency.

Summary

413 students living in Manila and originating from many areas of the Philippine islands were studied for a variety of genetic markers. ABO, Rh, MNS, Kell, Duffy, Diego, and Sutter blood groups were determined and gene frequencies calculated. Haptoglobin and transferrin groups were also studied. Ahaptoglobulinaemia was found twice and D₁ transferrin (D_{Chi}) in approximately 2% of the population.

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