GENETICS

Blood Groups of the Chinese in Calcutta

THE purpose of this investigation was to record the distribution of A_1A_2BO, MN, Rh, Kell and Duffy blood groups and of ABH secretor factor and haemoglobin variants, if any, of the Chinese in Calcutta, most of whom are reported to have migrated from Canton about two or three generations ago. They live in groups and do not seem to intermingle with Indians.

The gene frequencies for D and d among 474 Chinese in Calcutta are 95·4 per cent and 4·6 per cent respectively, giving 99·8 per cent Rh-positive and 0·2 per cent Rh-negative individuals. In the detailed analysis of Rh groups, the chromosome frequencies are in general agreement with those previously reported[2,4–6]. The Chinees differ from the Indians in having a higher frequency of *CDe* and *cDE* and a lower frequency of *cde* chromosomes.

The Duffy positive is almost universal in Chinese as observed by Miller *et al.*[5] and Layrisse and Arends[9], while 96 per cent among 127 individuals in the present survey are

Table 1. DISTRIBUTION OF ABO, A_1A_2BO, MN, Rh, DUFFY AND KELL BLOOD GROUPS AND SECRETOR FACTOR AMONG THE CHINESE IN CALCUTTA

ABO system: Phenotypes (number and per cent)					ABO system: Genes (per cent)			A_1A_2BO system*: Phenotypes (number and per cent)						
O	A	B	AB	Total	p	q	r	O	A_1	A_2	B	A_1B	A_2B	Total
252	170	113	31	566				252	142	12	113	20	4	543
44·52	30·04	19·96	5·48	100·00	19·69	13·65	66·66	46·41	26·15	2·21	20·81	3·68	0·74	100·00
(44·44)	(30·13)	(20·06)	(5·37)	(100·00)	±1·25	±1·06	±1·49	(46·33)	(25·66)	(2·21)	(20·79)	(4·57)	(0·44)	(100·00)

A_1A_2BO system*: Genes (per cent)				MN system: Phenotypes (number and per cent)				MN system: Genes (per cent)		Rh system (tested with anti-D only): Phenotypes (number and per cent)			Rh system (tested with anti-D only): Genes (per cent)	
p_1	p_2	q	r	M	MN	N	Total	M	N	Rh(D)	Rh(d)	Total	D	d
				68	89	52	209			473	1	474		
16·47	1·60	13·86	68·07	32·54	42·58	24·88	100·00	53·83	46·17	99·79	0·21	100·00	95·42	4·58
				(28·98)	(49·71)	(21·32)	(100·00)							

Rh system (Tested with anti-C, -c,-D, -E and -e only): Phenotypes (number and per cent)										Chromosomes (per cent)				
CDe	cDE	CcDe	cDEe	CcDEe	cDe	CDEe	cde	CcDE	Total	*CDE*	*CDe*	*cDE*	*cDe*	*cde*
82	10	12	4	48	3	1	1	0	161					
50·93	6·21	7·45	2·49	29·82	1·86	0·62	0·62	0·00	100·00	0·43	70·05	22·25	3·63	3·64
(49·07)	(4·95)	(10·19)	(3·24)	(31·23)	(0·40)	(0·60)	(0·13)	(0·19)	(100·00)					

Duffy system: Phenotypes (number and per cent)			Duffy system: Genes (per cent)		Kell system: Phenotypes (number and per cent)			Kell system: Genes (per cent)		ABH secretion: Phenotypes (number and per cent)			ABH secretion: Genes (per cent)	
Fy(a+)	Fy(a−)	Total	*Fy*^{a}	*Fy*^{b}	Kell+	Kell−	Total	*K*	*k*	Secretor	Non-secretor	Total	*Se*	*se*
122	5	127			1	131	132			406	149	555		
96·06	3·94	100·00	80·16	19·84	0·76	99·24	100·00	0·38	99·62	73·15	26·85	100·00	48·19	51·81

Figures in parentheses represent expected percentage.
* Obtained from ABO data.

During June–December, 1965, blood specimens were collected mainly from students and teachers of three Chinese schools in Calcutta and were tested for blood group antigens like A, A_1, A_2, B, M, N, C, c, D, E, e, Kell (K) and Duffy (Fy^a), but because of non-availability of antisera all the specimens could not be tested for every antigen. All the antisera with the exception of anti-A and anti-B were received from 'DADE' in U.S.A. Kell and Duffy antigens were determined by Coombs test, while other antigens were determined by standard methods. The specimens of saliva were examined by the method of Race and Sanger[1] for ABH secretor factor. Paper electrophoresis technique was used for the detection of haemoglobin variants. All the results have been summarized in Table 1.

In a sample of 566 individuals, 44·5 per cent belong to group O, 30·0 per cent to group A, 20·0 per cent to group B and 5·5 per cent to group AB. The maximum likelihood estimates of p, q and r for three allelomorphic genes A, B and O are 19·7, 13·6 and 66·7 per cent respectively. The incidence of B gene in China is less than 20 per cent and that of A gene is more than 20 per cent, in contrast to India and South Eastern Asia were B is generally in excess of A (ref. 2). The incidence of B in China, however, is greater than is found in Europe. It has been noted[3–7] that the Chinese are characterized by complete absence of A_2 gene, but as in the present investigation, occurrence of A_2 gene at a low frequency has also been reported[8,9].

Among the Chinese the incidence of M gene is greater than that of N and it varies from 50·5 per cent to 63·0 per cent against 60 per cent to 70 per cent in India. The frequency of M gene obtained in the present investigation is 53·8 per cent while its mean value calculated by pooling the results of all workers[3–6,8–11] including ours is 56·9 per cent.

found to be Duffy positive giving approximately 80 per cent of Fy^a genes. One of 132 individuals examined was found to be Kell positive. Earlier Miller *et al.*[5] and Sussman[6] reported complete absence of Kell antigen in the blood of the Chinese.

In the present survey of 555 individuals, 73 per cent were secretors and 27 per cent non-secretors; the gene frequencies for secretors and non-secretors were 48·2 per cent and 51·8 per cent respectively. As far as we know, this is the first report of the distribution of secretor factor among the Chinese. No abnormal haemoglobin was detected.

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[1] Race, R. R., and Sanger, R., *Blood Groups in Man*, fourth ed. (Blackwell Scientific Publications, Oxford, 1962).
[2] Mourant, A. E., *The Distribution of the Human Blood Groups* (Blackwell Scientific Publications, Oxford, 1954).
[3] Wiener, A. S., Sonn, E. B., and Yi, C. L., *Amer. J. Phys. Anthropol.*, **2**, 267 (1944).
[4] Simmons, R. T., Graydon, J. J., Semple, N. M., and Green, R., *Med. J. Austral.*, **2**, 917 (1950).
[5] Miller, E. B., Rosenfield, R. E., and Vogel, P., *Amer. J. Phys. Anthropol.*, **9**, 115 (1951).
[6] Sussman, L. N., *Amer. J. Clin. Pathol.*, **26**, 471 (1956).
[7] Miller, E. B., Tannor, H. D., and Hsu, C., *J. Lab. Clin. Med.*, **36**, 230 (1950).
[8] Levine, P., and Wong, H., *Amer. J. Obst. Gynec.*, **45**, 832 (1943).
[9] Layrisse, M., and Arends, T., *Nature*, **177**, 1083 (1956).
[10] Ride, L., *Caduceus*, **14**, 277 (1935).
[11] Alley, O. E., and Boyd, W. C., *Amer. J. Phys. Anthropol.*, **1**, 301 (1943).