14. On the Heredity of Anti-Q Agglutinin.

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(Comm. by T. FURUHATA M.J.A., Feb. 12, 1949.)

Anti-Q agglutinin was discovered by IMAMURA in No. 225 pig serum in May, 1935, was afterwards clarified to exist in normal serum of rabbits, fowls, goats and cows and further made clear to exist also in human serum and colostrum by J. SUZUKI's extensive studies.

According to SUZUKI (1937) the anti-Q agglutinin is said to be found in each type of serum at a rate of about 3%. (Refer to Table 1)

Table 1. (J. SUZUKI 1937).

Blood type	Number of persons examined	Persons possessing anti-Q agglutinin	
O	418	12	2.9%
A	520	16	3.1%
B	310	9	2.9%
AB	143	5	3.5%
Total	1,391	42	3.0%

FURUHATA and S. ARAI (1943) learned by examining 756 inhabitants of Tokyo Metropolis that 3.7% of them possessed the anti-Q agglutinin. (Refer to Table 2.)

Table 2. Frequency of Anti-Q Agglutinin in Tokyo-To.

Blood type	Number of persons examined	Persons possessing anti-Q agglutinin	
O	216	2	0.9%
A	286	14	4.9%
B	182	10	5.5%
AB	72	2	2.8%
Total	756	88	3.7%

This Table shows that the percentage of those possessing anti-Q agglutinin is small for O and AB types and great for A and B types. But if a greater number of persons are examined, it is believed that the percentage of those possessing anti-Q agglutinin may go up for O and AB types.

As in Utsunomiya, Tochigi Prefecture, sera were obtained from 62 persons of A type and 47 persons of B type, altogether 109, for getting test sera to be

used for blood transfusion, the percentage of the existence of the anti-Q agglutinin was examined with the following results. (Refer to Table 3.)

Table 3. Frequency of Anti-Q Agglutinin in Tochigi Prefecture.

Blood type	Number of persons examined	Persons possessing anti-Q agglutinin	
A	62	3	4.8%
B	47	3	6.4%
Total	109	6	5.5%

Fumio FUJINUMA (1948) examined the frequency of irregular agglutinins by sera of 1358 persons in FURUHATA's laboratory with the following results. The greater part thereof are regarded as the anti-Q agglutinin.

Table 4. Frequency of Irregular Agglutinin in Human Normal Sera.

Blood type	Number of persons examined	Persons possessing irregular agglutinin	
O	437	12	2.8%
A	461	12	2.6%
B	323	14	4.3%
AB	137	5	3.7%
Total	1,358	43	3.2%

These results of FUJINUMA's are very near those of SUZUKI's.

On the Heredity of the Anti-Q Agglutinin.

It is SUZUKI that firmly established the proof that the anti-Q agglutinin is inherited. Every time he met with persons possessing anti-Q agglutinin, he would examine their nearest relatives to see if there were any among them who possessed anti-Q agglutinin in their sera. In this way he examined 216 persons and, it is said, found 56 persons (25.9%) who possessed the anti-Q agglutinin. (Refer to Table 5).

Table 5. Frequency of Anti-Q Agglutinin (SUZUKI 1937).

Blood type	Number of persons examined	Persons possessing anti-Q agglutinin	
O	54	21	38.8%
A	91	15	16.4%
B	39	8	20.4%
AB	12	12	37.5%
Total	216	56	25.9%

The general frequency of the anti-Q agglutinin is about 3%, in consideration of which Table 5 makes inference possible that the anti-Q agglutinin is inheritable. Consequently SUZUKI examined 122 children of 47 families to ascertain the heredity relation of the anti-Q agglutinin with the following results. (Refer to Table 6.)

Table 6. Heredity of Anti-Q Agglutinin in 47 Families.

Union of parents	Number of families	Children					
		R		r		Total	
1) $r \times r$	3			6	100%	6	100%
2) $R \times r$	20	32	66.7%	16	33.3%	48	100%
3) $R \times R$	24	60	88.2%	8	11.8%	68	100%
Total	47	92		30		122	100%

Indicating those possessing the anti-Q agglutinin by r, and those possessing no anti-Q agglutinin by R, the general frequency of heredity is shown by the following Table. (Refer to Table 7.)

Table 7. Heredity of Anti-Q Agglutinin.

$$k = \sqrt{r} = \sqrt{30.0} = 0.5477.$$

Union of Parents	Frequency of Children	
	R	r
$R \times R$	$\frac{1+2k}{(1+k)^2}$	$\frac{k^2}{(1+k)^2}$
$R \times r$	$\frac{1}{1+k}$	$\frac{k}{1+k}$
$r \times r$	—	1

According to SUZUKI the anti-Q agglutinin is inherited as a recessive factor.

In the area of a Toyama Prefecture we examined the heredity relation of the anti-Q agglutinin by 133 children of 43 families with the following results. (Refer to Table 8.)

Refer to the Pedigree chart in the previous paper.

Table 8. Heredity of Anti-Q Agglutinin in 43 Families
(FURUHATA and IMAMURA 1948).

Union of Parents	Number of Families	Children					
			R		r		Total
			Number	Percent	Number	Percent	Number Percent
R×R	23	observed	62	81.58%	14	18.42%	76 100.0%
		calculated		87.4 %		12.6 %	
R×r	18	observed	31	62.0 %	19	38.0 %	50 100.0%
		calculated		64.6 %		35.4 %	
r×r	2	observed	0		7	100.0%	7 100.0%
		calculated				100.0%	100.0%
Sum	43		93	69.91%	40	30.09%	133 100.0%

1) There were 2 unions in which both parents possessed the anti-Q agglutinin. 7 children born of these parents all possessed the anti-Q agglutinin, that is 100%.

2) There were 18 families in which one of the parents of each union had the anti-Q agglutinin. 31 children (62%) out of 50 of these parents did not possess the anti-Q agglutinin and the remaining 19 children. (38%) possessed the anti-Q agglutinin.

3) There were 43 families in which both parents of each union did not possess the anti-Q agglutinin. 60 children (81.58%) out of 76 of these parents did not possess the anti-Q agglutinin and the remaining 14 (18.42%) possessed the anti-Q agglutinin.

These results of ours are nearly the same as those of SUZUKI's namely the anti-Q agglutinin is of recessive heredity.

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