

Observations on the Racial Distribution of Variants of Blood Type rh'.

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Following the demonstration of the existence of 3 major varieties of Rh factors, determining 8 types of human blood, it was found that the incidence of the Rh types differed in different races.¹ It was also found that bloods existed which failed to give a clear-cut positive or negative reaction with one or more of the 3 reagents, anti-Rh₀, anti-rh', or anti-rh'', indicating the existence of variants of each of the Rh factors.^{2,3} In the earlier work these aberrant bloods were designated as belonging to "intermediate" types in order to indicate that the reactions obtained with the reagents were weak or intermediate in intensity. It was observed that the so-called "intermediate" types were particularly frequent among Negroids.⁴ The purpose of the present communication is to present the results of a study of so-called "intermediate" types on a larger series of cases, and to discuss the general significance of the findings.

The donors who provided the blood for the present study were individuals who presented themselves at the Blood Bank of the New York University-Bellevue Medical Center of which one of us (L. J. U.) is the Director. They therefore represent a random group who presented themselves consecutively. The tests were carried out in the usual manner, using potent specific reagents of the tube agglutinating variety. For the sake of simplicity, the present paper will be limited only to the results of tests for the rare blood type rh' and its variants.

In Table I is shown the relative incidence

of blood type rh' among Negroids and Caucasoids. Whereas only 2.7% of the donors who presented themselves belonged to the Negroid race, among those individuals belonging to type rh' fully 13.9% were Negroids. This indicates that the type rh' is about 4 to 5 times as frequent among Negroids as among Caucasoids.

As indicated above, some type rh' bloods gave weak or indefinite reactions when tested with anti-rh' serum. In Table II is shown the relative incidence of such weakly reacting or "intermediate" bloods among Negroids and among Caucasoids. It will be seen that while only 5% of type rh' bloods among Caucasoids gave weak reactions with anti-rh' serum, 27.6% among Negroids gave weak reactions. Therefore, these results on a larger series of cases confirm the previous report concerning the more frequent occurrence of bloods of "intermediate" types among Negroids.⁴

Comment. With regard to the significance of the so-called "intermediate" types, this is best explained by drawing an analogy with the variants of group A. When earlier workers observed that group A bloods fall into two natural subdivisions, namely, those giving strong reactions and those giving weak reactions, they explained these observations on a quantitative basis, believing that weakly reacting bloods contained less agglutinin A than strongly reacting bloods. From the work of Landsteiner,^{5,6} we know the difference in intensity of the reactions of group A bloods does not represent a quantitative difference but instead a qualitative difference. Antibodies and antigens behave in reactions like locks and keys. A key designed for lock X may also open lock Y, but usually not quite

¹ Wiener, A. S., Sonn, E. B., and Belkin, R. B., *Proc. Soc. Exp. Biol. and Med.*, 1943, **54**, 238.

² Wiener, A. S., *Science*, 1944, **100**, 595.

³ Wiener, A. S., Davidsohn, I., and Potter, E. L., *J. Exp. Med.*, 1945, **81**, 67.

⁴ Wiener, A. S., Unger, L. J., and Sonn, E. B., *Proc. Soc. Exp. Biol. and Med.*, 1945, **58**, 89.

⁵ Landsteiner, K., and Witt, D. H., *J. Immunol.*, 1926, **11**, 203.

⁶ Landsteiner, K., and Levine, P., *J. Immunol.*, 1926, **12**, 441.

TABLE I.
Relative Incidence of the Blood Type rh' Among Negroids and Caucasoids in New York City.

Types of donors	No. of consecutive donors	Caucasoid (%)	Negroid (%)
All Rh types	98,529	97.3	2.7
Type rh' only	705	86.1	13.9

TABLE II.
Relative Incidence of Weak and Strong Reactions Among Type rh' Bloods.

Race	No. consecutive type rh' donors	Strong reactions (%)	Weak reactions (%)
Negroid	98	72.4	27.6
Caucasoid	607	95.0	5.0

as smoothly as in the lock for which it was designed. On the other hand, keys could be designed for lock Y which may or may not open lock X. Similarly, the common anti-A agglutinin clumps A_1 cells somewhat more strongly than A_2 cells, presumably because the configuration of the antibody molecule more closely conforms with A_1 than with A_2 . On the other hand, A_2 blood contains other structures which are lacking or different from those present in A_1 blood, as shown by its reactions with anti-O serum. In the same way the existence of type rh' bloods giving weak or "intermediate" reactions does not necessarily mean that the quantity of rh' factor in such bloods is smaller than in typical type rh' bloods, but rather that the rh' factor is qualitatively different. In support of this interpretation may be cited the observation that among Caucasoids some type Rh_1 bloods which react weakly with anti-rh' serum are strongly clumped by anti-rh" (C") serum.⁷ It may be of interest to mention that despite the relatively high incidence of weak rh' bloods among Negroids, thus far we have failed to demonstrate the presence of rh" factor in any blood of Negroid origin in tests on a random series of 105 individuals. No doubt with more intensive and prolonged study, antisera will be found or produced which strongly clump other "intermediate" rh' bloods such as described here, while giving weak or no reactions with "typical" rh'

bloods. This same principle would also apply to bloods giving "intermediate" reactions with anti- Rh_0 , anti-rh", anti-hr', and anti-hr" sera.

It must be emphasized that one is not justified in giving a specific name to an "intermediate" blood except when a specific anti-serum has been found, as in the case of Rh_1 bloods which contain the special factor rh". In the present stage of our knowledge concerning the "intermediate" Rh_0 factors, the name D" is misleading and possibly incorrect, so long as no specific factor or factors corresponding to D" have been isolated.⁸

Summary. Observations on a large series of blood donors indicate that the rare type rh' is about 4 to 5 times as frequent among Negroids as among Caucasoids. Moreover, it is found that type rh' bloods giving weak or "intermediate" reactions are about 5 to 6 times as common among Negroids as among Caucasoids, confirming previous observations on a shorter series of cases. It is pointed out that the existence of bloods giving weak reactions with anti-rh' serum is more reasonably explained by postulating the existence of qualitative variants of the rh' factor such as rh", than by attributing the weak reactions to the presence of a smaller quantity of the factor rh' in the blood. A similar explanation would apply to certain bloods giving "intermediate" reactions with sera anti- Rh_0 , anti-rh", anti-hr', and anti-hr".

⁷ Wiener, A. S., and Gordon, E. B., in preparation.

⁸ Race, R. R., Sanger, R., and Lawler, S. D., *Annals Eug.*, 1948, **14**, 171.