

THE NEW Rh CONSTITUENT OF HUMAN BLOOD

BY

S. D. S. GREVAL

(Imperial Serologist's Laboratory, School of Tropical Medicine, Calcutta)

(For blood groups see this *Journal*, 1940, 9, No. 11. In the present communication technical terms are explained in square brackets when not explained in the text.)

WHAT IT IS

RECENT work in America has brought to light yet another constituent (in addition to A & B, and M & N) of the human red blood cells, hereafter called r.b.c.: it is the Rh substance (immunologically the *antigen*, genetically the *character* and loosely, unfortunately, the *factor*). It is called Rh because it occurs normally in the r.b.c. of *Macacus rhesus* [the common brown monkey of India]. It has also been found in America in about 85 per cent. of the human beings tested.

HOW HUMAN BEINGS ARE TESTED

Rhesus monkey's washed r.b.c. are injected into a rabbit or guinea-pig. After a suitable course of injections the *serum* [the watery part of the clotted blood] of the animal begins to *agglutinate* [clump] the monkey's r.b.c. when brought into contact with them in a test tube or on a slide. When the action is strong the r.b.c. are *lysed* [broken up]. This is brought about by an anti-Rh hæmagglutinin [a substance clumping r.b.c.: such anti-substances formed as a result of injections are called *antibodies* in a general way: when the r.b.c. are lysed the substance is *lysin*: the animal has been *immunised* against the monkey's r.b.c.]. The serum, in suitable dilutions, also agglutinates the r.b.c. of 85 per cent. of human beings. These human beings are Rh⁺: the other 15 per cent. are Rh⁻.

IMPORTANCE IN MEDICINE

An Rh⁺ father's child conceived by an Rh⁻ mother may come to grief. The foetus [developing child in the womb] has in his veins his father's blood which acts on the mother as the injected blood acts on the animal. The mother is *iso-immunised* [iso because of the same species] and the anti-bodies act deleteriously on the blood of the foetus causing its death and expulsion or such a damage to its r.b.c. that on birth the child suffers from jaundice and anæmia and more often than not dies.

Ordinarily the foetal r.b.c. and the maternal r.b.c. do not mix: a membrane keeps them apart. The membrane, apparently, at times leaks. The antibodies in the mother's blood, on the other hand, being in solution pass freely into the foetal blood at all times.

Fortunately all Rh⁻ mothers of Rh⁺ foetuses do not act in this infanticidal manner, at least not in the first pregnancy. The reason is constitutional. Either the leak in the membrane separating the two circulations does not develop or their systems do not react with full vigour.

Further, not all Rh⁺ fathers beget Rh⁺ children from Rh⁻ mothers. The reason is genetical. The character Rh(=Rh⁺) is dominant to the character rh(=Rh⁻). A homozygous father (genotype RhRh) must beget

Rh⁺ children while a heterozygous father (genotype Rhrh) may or may not.

It may be asked why a foetus whose blood group is incompatible with his mother's does not suffer the same fate for similar reasons. The foetus A of a mother B will also *iso-immunise* the mother who will discharge into the foetal circulation antibodies against the substance A. The reason so far available is that the group specific substances A and B occur well distributed throughout tissues and fluids of the body, while the Rh substance occurs only in the r.b.c. which, thus, are exposed to the full effect of the mother's antibodies.

The Rh⁻ mother having formed in her blood the antibody against Rh⁺ blood also comes to grief when she is given a transfusion of an otherwise compatible but Rh⁺ blood. This risk makes the direct matching of the bloods of the donor and the recipient doubly important when the recipient is an expectant mother or a mother in or after labour.

HUMAN BLOOD IS ALSO USED IN TESTING
HUMAN BEINGS

When it is known that a mother has given birth to a baby which is suffering from damage to its r.b.c., the mother's blood is taken and serum obtained from it. This serum will also agglutinate the r.b.c. of Rh⁺ human beings. Not all such sera are satisfactory. The subject is being studied and points to a rather complex structure of the Rh antigen.

IMPORTANCE IN SOCIOLOGY

A well-known worker on the subject has already suggested artificial insemination, from extraneous compatible sources, of Rh⁻ females incompatibly mated with Rh⁺ males. A consideration of compatibility before marriage is more natural and will probably be demanded. Most people would be compatible. Others could wait for compatible partners.

IMPORTANCE IN FORENSIC MEDICINE

When the technique of the test has been standardised and further observations on the inheritance of the character Rh made, one more aid to the determination of paternity and maternity of children will be provided. Going by what has been said above of an Rh⁺ father, some Rh⁺ couples (genotype Rhrh) can have a Rh⁻ child but Rh⁻ couples cannot have a Rh⁺ child.

IMPORTANCE IN ANTHROPOLOGY

The serologists have given to the anthropologists yet another means of differentiating between races of humanity.

Levire, P., *New York State Journal of Medicine*, 1942, 42, No. 20, 1928. 2. Boorman, K. E., Dodd, F. E., and Mollison, P. L., *British Medical Journal*, November 1942, 7, p. 535. 3. Gallagher, F. W., and Jones, L. R., *The Journal of Immunology*, 1943, 46, No. 1, 9.