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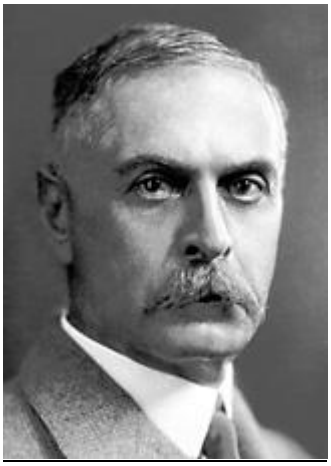
Nobel Prize in Medicines 1930



Karl Landsteiner

The Nobel Prize in Physiology or Medicine 1930 was awarded to Karl Landsteiner"for his discovery of human blood groups".

Thirty years ago, in 1900, in the course of his serological studies Landsteiner observed that when, under normal physiological conditions, blood serum of a human was added to normal blood of another human the red corpuscles in some cases coalesced into larger or smaller clusters. This observation of Landsteiner was the starting-point of his discovery of the human blood groups. In the following year, i.e. 1901, Landsteiner published hidiscovery that in man, blood types could be classified into three groups according to their different agglutinating properties. These agglutinating properties were identified more closely by two specific blood-cell structures, which can occur either singly or simultaneously in the same individual. A year later von Decastello and Sturli showed that there was yet another blood group. The number of blood groups in man is therefore four.

Landsteiner's discovery of the blood groups was immediately confirmed but it was a long time before anyone began to realize the great importance of the discovery. The first

incentive to pay greater attention to this discovery was provided by von Dungern and Hirszfeld when in 1910 they published their investigations into the hereditary transmission of blood groups. Thereafter the blood groups became the subject of exhaustive studies, on a scale increasing year by year, in more or less all civilized countries. In order to avoid, in the publication of research on this subject, detailed descriptions which would otherwise be necessary - of the four blood groups and their appropriate cell structures, certain short designations for the blood groups and corresponding specific cell structures have been introduced. Thus, one of the two specific cell structures, characterizing the agglutinating properties of human blood is designated by the letter A and another by B, and accordingly we speak of «blood group A» and «blood group B». These two cell structures can also occur simultaneously in the same individual, and this structure as well as the corresponding blood group is described as AB. The fourth blood-cell structure and the corresponding blood group is known as O, which is intended to indicate that people belonging to this group lack the specific blood characteristics typical of each of the other blood groups. Landsteiner had shown that under normal physiological conditions the blood serum will not agglutinate the erythrocytes of the same individual or those of other individuals with the same structure. Thus, the blood serum of people whose erythrocytes have group structure A will not agglutinate erythrocytes of this structure but it will agglutinate those of group structure B, and where the erythrocytes have group structure B the corresponding serum does not agglutinate these erythrocytes but it does agglutinate those with group structure A. Blood serum of persons whose erythrocytes have structures A as well as B, i.e. who have structure AB, does not agglutinate erythrocytes having structures A, B, or AB. Blood serum of persons belonging to blood group O agglutinates erythrocytes of persons belonging to any of the groups A, B, or AB, but erythrocytes of persons belonging to blood group O are not agglutinated by normal human blood serum. These facts constitute the actual basic principles of Landsteiner's discovery of the blood groups of mankind.

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When the scientific importance of the discovery of the blood groups had been recognized - thanks to the investigations by von Dungern end Hirszfeld - research in connection with the blood groups was directed first to studies of the hereditary transmission of blood groups and also of the relative occurrence of the individual blood group in different countries and among different peoples and races. The group characteristics are handed down in accordance with Mendel's laws. The characteristics of blood groups A, B, and AB are dominant, and opposing these dominant characteristics are the recessive ones which characterize blood group O. An individual cannot belong to blood group A, B, or AB, unless the specific characteristics of these groups are present in the parents, whereas the recessive characteristics of blood group O can occur if the parents belong to any one of the four groups. If both parents belong to group O, then the children never have the characteristics of A, B, or AB. The children must then likewise belong to blood group O. If one of the parents belongs to group A and the other to group B, then the child may belong to group A or B or it may possess both characteristics and therefore belong to group AB. If one of the parents belongs to group AB and the other to group O, then in accordance with Mendel's law of segregation the AB characteristic can be segregated and the components can occur as separate characteristics in the children. If a child has the A-group structure (either A or AB), then the A-group characteristic must be present in at least one of the parents, i.e. one of them must belong to group A or AB. If the child belongs to group AB, then one of the parents must belong to group A and the other to group B, or one of the parents must belong to group AB and the other to group A or B, or else both parents must belong to group AB. Application of the discovery of blood groups in questions relating to the establishing of paternity is based on these principles governing the hereditary transmission of blood groups.

The four blood groups have been demonstrated in the populations of all countries where tests have been made. These cover the greater part of the world. It is clearly a constant physiological characteristic of man that every individual belongs to a particular blood group. However, the percentage distribution of the four blood groups varies within

different populations and races. In the population of Europe, for instance, a larger proportion of individuals belongs to group A than in other parts of the Old World, and in the northern and western parts of Europe a larger proportion of individuals belongs to blood group A than in the southern and eastern parts. The varying frequency of the individual blood groups in different races points to essential constitutional differences. Here Landsteiner's discovery opened up new fields for research on the determination of the racial purity of a people. Blood group determinations have shown that if an alien race is present within a population this race retains its specific blood group characteristics, even if it has lived away from its main and original homeland for centuries. In the field of genetics the discovery of the blood groups has also proved to be of importance from the point of view of methodology in the study of the hereditary transmission of other characteristics. Landsteiner's discovery of the blood groups also prompted research on the question - important for the study of constitution - whether other body cells in addition to erythrocytes, and in particular the germinal cells, can be differentiated according to specific groups.

However, the discovery of the blood groups has also brought with it important scientific advances in the purely practical field - first and foremost in connection with blood-transfusion therapy, identification of blood, and establishing of paternity.

The transfer of blood from one person to another for therapeutic purposes began to be practised on a considerable scale during the 17th century. It was found, however, that such blood transfusion involved serious risks and not infrequently resulted in the death of the patient. Therapeutic application of the blood transfusion had therefore been almost entirely given up by the time of Landsteiner's discovery. As a result of the discovery of the blood groups it was now possible, at least in the majority of cases, to explain the cause of the dangers linked with this therapeutic measure as previous experience had shown, and at the same time to avoid them. A person from whom blood is taken must in fact belong to the same blood group as the patient. Thanks to Landsteiner's discovery of the blood groups, blood transfusions have come back into use and have saved a great many lives.

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Already at the time of publishing his discovery of the blood groups in 1901, Landsteiner pointed out that the blood-group reaction could be used for investigating the origin of a blood sample, for instance of a blood stain. However, it is not possible to prove by determining the blood group that a blood sample comes from a particular individual, but it is possible to prove that it is not from a particular individual. If, for instance, the blood of a blood stain is from an individual belonging to blood group A, then it cannot be from an individual who is found to belong to group B, but a blood-group determination will not tell us from which person of blood group A the blood came.

The establishing of paternity for legal purposes has in all ages presented the legislator with insurmountable difficulties owing to the fact that paternity cannot be proved objectively. In this sphere, therefore, the legislator has had to content himself with possibilities or, at best, greater or lesser probabilities. In view of this situation with regard to proof in cases of disputed paternity it is only natural that the possibility of using the determination of blood group in such cases should have aroused general interest, from both the theoretical and the practical point of view. The use of blood-group determination in paternity actions also constitutes a significant advance in this field, even though the proof is of a negative character. A blood-group determination can, in fact, never establish paternity, but can exclude the possibility of it. However, a blood-group determination does not give results suitable for use as evidence under all circumstances. If the child in question belongs to blood group O, then a determination of the group gives no proof, because the recessive blood group in the child provides no basis for any conclusions regarding the parents, who in this case can belong to any one of the four blood groups. Only in those cases where the child belongs to a dominant blood group, i.e. A, B, or AB, and the specific blood structure of the group is not present in the mother, are the results of any value. A group structure which is present in the child but absent in the mother must have been inherited by the child from its father. If the man who is claimed to be the father belongs to a blood group different from that of the child in question, then the child cannot have

inherited its blood-group characteristic from this man, and the possibility of his paternity must therefore be ruled out.

Landsteiner's discovery of the blood groups - as will be clear from what has been said - has opened up new avenues for research in several branches of science and has brought with it important advances in the purely practical field. However, it is only recently that the scientific importance of Landsteiner's discovery has been fully realized. In view of all the circumstances outlined above, the Staff of Professors of the Caroline Institute has decided to award the Nobel Prize for Physiology or Medicine, 1930, to Professor Karl Landsteiner for his discovery of the human blood groups.

Professor Karl Landsteiner. Proffering you its felicitations to the discovery of the human blood groups, which discovery has been of such great importance for many branches of medical science, the Royal Caroline Medical Institute now invites you to receive from the hands of His Majesty the King the Nobel Prize in Physiology or Medicine.

For more details please visit:

http://www.nobelprize.org/nobel_prizes/medicine/laureates/1930/press.html