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**Current Status of Studies on the European Bison
Blood Properties****Bisoniana XX**

Studies on the blood properties of the European bison (or wisent) are reviewed. Investigations has been concerned with: (1) The polymorphism of the red-cell antigenic factors, (2) The serologic specificity of European bison normal sera, (3) The serologic properties of the serum globulins, and (4) The polymorphism of haemoglobins and transferrins. Comparison studies on the blood properties of wisent, domestic cattle, and their hybrids were also conducted. Tested wisents appear to be homozygous on the relation to particular blood properties.

European bisons of wisents, *Bison bonasus* (Linnaeus, 1758) reared in Poland form today a relatively small, strongly inbred relict population. Research on the wisent blood properties was first suggested in Poland by the late Professor Mieczysław Czaja. It was hoped that results of this study might form a biological basis for constructive breeding of this species of animals.

Heretofore, for several years investigations on the blood properties of wisents has been concerned with: (1) The polymorphism of the red-cell antigenic factors (Czaja & Gasparski, 1960; Gasparski & Dubiski, 1962; Gasparski & Gerner-Nowakowa, 1963; Gasparski *et al.*, 1963; Gasparski, 1964a, b; Gasparski, 1965). (2) The serologic specificity of wisent normal sera with reference to red-cell antigenic factors in human and in several species of animals (Gasparski *et al.*, 1966). (3) The serologic properties of the serum globulins (Gasparski & Dubiski, 1963). (4) The polymorphism of haemoglobins and transferrins (Braend & Gasparski, 1966). The studies on the wisent blood properties were conducted in the direct form as well as in comparison with the blood properties of domestic cattle and their hybrids.

1. The polymorphism of red-cell antigenic factors. The results of the investigation on the wisent red-cell antigens showed

that a series of antigenic factors are common for both wisents and domestic cattle as well as for the American bison. From among the antigens occurring in the wisents several proved to be similar to some of red-cell antigens of domestic cattle. Furthermore, in wisents several antigens were found probably specific only for this species of animals. Of these antigens which were compared to large number of blood samples of domestic cattle and were tested with blood samples of the different wisents, two were identified as specific only for wisents. These antigenic factors were denoted as Bi_1 and Bi_2 .

Particular investigations of the FV system showed: (a) The occurrence in the red cells of wisents of the V antigenic factor may be determined by the allele in pair with the allele determining the lack of an antigenic factor or in pair with the allele determining some specific antigenic factor which could not be stated with the means at our disposal. (b) In studying the effects of immunizing different animal species with wisent red cells, in one rabbit antiwisent immune serum an antibody was isolated which reacted only with cattle cells containing simultaneously both F and V antigens. The FV_{Bi} serum containing antibodies probably for heterozygous antigenic substances is the only known example of such an element in domestic cattle blood group studies. In this case one may suggest that the gene $F^F Bi$ must have been fairly similar to the gene F^F cattle since its simultaneous action with the gene F^V caused the formation of a specific FV »hybrid substance«. (c) Using the wisent blood red cells to the absorption of the F cattle blood-typing reagent a serum was obtained which contained antibodies for homozygous form of F antigenic factors. (d) In wisent V antigen, there is probably present in the form of V_3 subtype which occurs also in cattle. However, in cattle this subtype in the unrelated form with V_1 and V_2 or with V_2 subtype occurs very seldom. It is probable that the other wisent red-cell antigenic factors for example J , L and Z are present likewise as subtypes J_2 , L_2 and Z_2 , of course not in every case as a single but together with J_1 , L_1 and Z_1 subtypes.

The investigations on the wisent red-cell antigenic factors contain also the investigations on the antigenic factors of hybrids (wisent \times cattle). Having a rather large number offspring of the wisent »Pokorny« it was proved that in a few systems the red-cell antigenic factors or their complexes in wisent »Pokorny« are present in a homozygous form.

2. The serologic specificity of wisent normal sera. The investigations on the wisent normal sera in comparison with cattle and their hybrids were carried out in view of their eventual usefulness for identification of red-cell antigenic factors in human beings or in several species of animals, in this case in cattle, chickens, coypus, sheep and rabbits.

From among the tested sera, the specific antibodies were observed in some of them for human antigenic factors — for A_1 and B factors; as well as for chickens — for factors of the A system and for coypus — for factors Co_1 and Co_2 .

Not a single instance was observed of the presence of the specific antibodies, in the tested sera, for wisent, cattle and their hybrid red cell antigens; the same applied to sheep and rabbits.

3. The serologic properties of serum globulins. Basing on the general principle that serum proteins of any animal species possess a so-called serologic specificity a series of tests was performed for determining the differences or similarities between the serologic properties. In this case the study was performed on cross-reaction between anti-cattle-globulin immune sera with globulins of wisent sera and also, for comparison, the sera of several other animals (red deer, sheep, horse, pig and wild boar).

The results indicated that cattle sera completely neutralizes antibodies against cattle globulins and, in consequence, inhibits entirely the agglutination of sensitized red cells of sheep. The neutralizing power of wisent sera was a little lesser. Red deer serum exercises some slight neutralizing effect, while no such effect appears in the sera of sheep, horses, wild boar and pigs.

These differences are the measure of serologic differences between the serum globulins of the several tested species of animals. The differences between the wisent and domestic cattle serum globulins were very insignificant and hence one can postulate that between the wisents and domestic cattle exists a rather close serological relationship.

4. The polymorphism of haemoglobins and transferrins. In the studies on the polymorphism of haemoglobins (*Hb*) and transferrins (*Tf*) in wisent, cattle and their hybrids the technique employed was starch gel electrophoresis.

All tested wisents showed two *Hb* bands of which the faster was the stronger and the slower with the same rate of migration as *Hb A* of cattle. The F_1 hybrids showed three *Hb* components. The two fastest match those of bison and cattle but the slowest of these two was, however, considerably stronger than the faster. In addition, in the F_1 hybrid there was a third *Hb* band which was weaker than the two other *Hb* bands of the hybrids.

It was, however, not possible with the employed technique to distinguish clearly between the migration rates of the two bands of cattle, wisent fast and wisent slow *Hb* respectively. Although it was not possible to demonstrate clear differences between wisents and cattle polypeptide chains in acidic starch gels the wisent cattle hybrid may still be doubly heterozygous for structural *Hb* genes and the extra *Hb* component a result from a similar operating mechanism during synthesis of *Hb* as in man (Itano & Robinson, 1959). Other explanations may, however, also be possible.

In the studies on the wisent transferrins (*Tf*) all samples from 14 wisents were examined. No differences between their *Tf* patterns could be seen. In comparison with cattle all were more greatly similar to the type *AA* transferrin of domestic cattle. This type has bands of which the fastest one is very weak. The three other bands are very close to those of wisent in rate of migration, but the slowest band of cattle *AA* is slightly slower than the slowest wisent *Tf* band. The second slowest band of wisent is slightly broader than the second slowest band of cattle *AA* and the third slowest band of cattle is slightly faster than the third slowest band of wisent. In this case it was possible to find distinct differences in the degree of migration of particular bands.

The transferrin patterns of the hybrids appeared as combinations of the transferrin phenotypes of the two parent species. The same occurred for the hybrid between the wisent and a *Tf D₂E* cow. No extra *Tf* components could be detected in the hybrid samples by use of starch gel electrophoresis technique or by the use of *F⁵⁹* autoradiographs.

All above mentioned studies will be continued and extended for the familiarization with the many other traits of the blood of wisents. The problem should be considered important from a theoretical point of view as well as for the confirming of more precise picture of the blood properties of this species of animals.

The results of investigations point out to the fact that the tested wisents appear to be homozygous on the relation to particular blood properties. This suggests that a whole population of the wisents reared in Poland should be tested for determination of the degree of the homozygosity of blood properties, found in various chromosomes, and this can be an indication of the degree of homozygosity of other traits than blood traits.

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STAN BADAŃ NAD WŁAŚCIWOŚCIAMI KRWI ŻUBRA

Streszczenie

Dokonano przeglądu badań nad fizjologicznymi właściwościami krwi żubra i stwierdzono, że dotyczyły one: 1) polimorfizmu czynników antygenowych, 2) serologicznej specyficzności surowic żubrów, 3) serologicznych właściwości globulin surowicy oraz 4) polimorfizmu hemoglobin i transferin. Prowadzono też porównawcze badania nad właściwościami krwi żubrów, bydła domowego i hybrydów tych dwu gatunków. Badane żubry okazały się zwierzętami homozygotycznymi.