

A NEW ANTIGEN *Kr 5* IN THE BLOOD GROUP SYSTEM *B* IN CATTLE¹

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Summary. In 1963 a test serum, identifying a blood group antigen in cattle, unknown until now, was obtained by isoimmunization and was designated with a symbol *Kr5*.

In 1964 the next isoimmunization by the cow blood containing the antigen *Kr5* was made, which resulted in a serum with the anti-*Kr5* antibodies.

During the years 1963 - 1972 about 16,500 head of cattle of various breeds were examined by these sera. It was found that the antigen *Kr5* belongs to the *B* blood group system and displays a relation to the antigen *Y'*, its frequency being about 0.15%.

Despite the identification of 12 blood group systems in cattle and about 100 antigens of which over 50 belong to the *B*-system (Busch, 1965, Dorynek, 1971), there exists a possibility of finding new antigens unknown hitherto. The antigen composition of the red blood cells is identified using monovalent sera obtained by iso- or heteroimmunization and subsequent absorptions. That is why the production of test sera is a basic activity in all blood group testing laboratories.

Among the cows immunized in 1963 there was a Lowland-Red-and-White cow from stable No. 588 immunized with the blood of a cow from stable No. 788 belonging to the same breed. Considering the antigen composition of the selected cows the following antibodies were expected: anti-*H'*, anti-*O₃* and anti-*K'*.

Stable No. 788 (donor) — $O_3 Y_2 K' Y' C_2 R_2 X_2 F H' S'$.

Stable No. 588 (recipient) — $A Q G' T^1 Y_2 B' Y' G'' C_2 R_2 X_2 W L' F J_2 S'$.

The cow from stable No. 588 did not produce the expected antibodies but she did produce the antibodies which hemolyzed the blood corpuscles of the donor as well as those containing the antigen *U*. After the absorption of the *U*-antibodies, the antibodies of one kind which did not correspond to any antibody in the then

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available test sera remained in the serum. Assuming that it contained a new, unknown hitherto antibody, it was designated with a symbol *Kr5*.

In 1964 a Polish Red cow from stable No. 2 was immunized with the blood of a cow from stable No. 3, which had the antigen *Kr5* in its antigen composition. The antigen compositions of the donor and recipient were as follows:

Cow from stable No. 3 — $A O_3 Y_2 A' E_2 O' Y' Kr5 C_2 W X_2 F L H' Z$

Cow from stable No. 2 — $A B O_1 Y_2 B' E_2 D' O' C_1 W X_2 F L H' Z$.

Following the immunization the serum of the cow from stable No. 2 was found to react with the blood corpuscles of the donor as well as with those of the individuals having the *U'*-antigen. After the absorption of the anti-*U'* antibodies a monovalent serum was obtained which reacted identically as did the *Kr5* serum obtained in 1963.

Since then, for testing blood samples of all the investigated cattle in researches and serviceable-scientific work both sera — *Kr5* of 1963 and *Kr5* of 1964 — have been used.

In the years 1964 - 1972 a total of about 16,500 head of cattle of either sex, bred in Poland, were tested of such a large number hardly 25 head of cattle reacted to the anti-*Kr5* serum. That figure included:

- 6 Lowland Black-and-White head of cattle,
- 15 Polish Red head of cattle,
- 2 Lowland Red-and-White head of cattle,
- 2 Simental head of cattle.

Therefore the frequency of the antigen *Kr5* incidence is low, amounting to 0.15% for the total of the material under study.

The *Kr5* sera were also used to test the blood corpuscles reported to the international comparison test which is organized each second year by the ESABR. The *Kr5* serum was officially recognized as an experimental one in 1968 when out of 40 blood samples one (No. 26) was found to give a positive reaction to the *Kr5* serum. An identically reacting serum designated with a symbol *Ba5* was in the possession of the Blood Group Laboratory of the Zootechnical Institute in Balice (10).

In the years 1966, 1970 and 1972 no positive reaction was found in the comparison test despite the fact that the blood samples originated from various breeds of cows reared in the world.

The results of the blood group investigations in all animals with the *Kr5* antigen are presented below, the blood group system being restricted here to the *B*-system, since the genetic analysis showed the assignment of the trait *Kr5* to the same system.

Lowland Black-and-White breed

1. Stable No. 788 (dam)

$O_x Y_2 K' Y' Kr5$

2. Cattle No. 788 (son)

$O_x Y_2 K' Y' Kr5/-$

3 - 5. of 8 head of cattle of the studied progeny of a bull from cattle No. 788 three inherited the allele $O_x Y_2 K' Y' Kr5$.

6. R-6705 (dam)	$O_2Y_1K'Kr5/O_xO'$
R-6704 (daughter)	$O_xO'/Y_2D'G'I'$
Red Polish breed	
152 <i>K</i> (sire)	BO_1/O_1
7. <i>L</i> -1020 (dam)	$O_xY_2K'Y'Kr5/O'$
8. <i>L</i> -995 (daughter)	$O_xY_2K'Y'Kr5/O_1$
9. <i>L</i> -996 (son)	$O_xY_2K'Y'Kr5/O_1$
<i>L</i> -1127 (sire)	$I'/-$
10. <i>L</i> -1126 (dam)	$O_xY_2B'G'Y'Kr5/BO_1$
11. <i>L</i> -1125 (son)	$O_xY_2B'G'Y'Kr5/-$
1427 <i>G</i> (sire)	$G_2I_1/O_xB'E'_2O'$
12. <i>R</i> -846 (dam)	$O_xY_2K'Y'Kr5/G'G'' . . .$
13. <i>R</i> -845 (daughter)	$O_xY_2K'Y'Kr5/G_2I_1$
1266 <i>K</i> (sire)	$O_xB'E'_2O'/Y_2Y'$
13. <i>R</i> -845 (dam)	$O_xY_2K'Y'Kr5/G_2I_1$
14. <i>R</i> -1731 (son)	$O_xY_2K'Y'Kr5/O_xB'E'_2O'$
2402 <i>K</i> (sire)	$G_2E'_2O'G''/E'_2O'$
15. <i>Kr</i> -2277 (dam)	$O_xY_2I'Y'Kr5/T_1B'$
16. <i>Kr</i> -3339 (daughter)	$O_xY_2I'Y'Kr5/G_2E'_2O'G''$
692 <i>K</i> (sire)	$G_2E'_2O'G''/O_3A'$
17. <i>Kr</i> -2065 (dam)	$O_xY_2I'Y'Kr5/I_1E'_3G'G''$
18. <i>Kr</i> -1907 (son)	$O_xY_2I'Y'Kr5/G_2E'_2O'G''$
0240 <i>G</i> (sire)	$I_1E'_3G'G''/I_2D'E'_2G''$
17. <i>Kr</i> -2065 (dam)	$O_xY_2I'Y'Kr5/I_1E'_3G'G''$
19. <i>Kr</i> -4417 (son)	$O_xY_2I'Y'Kr5/I_2D'E'_2G''$
20. <i>Kr</i> -2354 (cow)	$O_xY_2K'Y'Kr5/I_1G''$
21. <i>Kr</i> -1157 (cow)	$O_xY_2K'Y'Kr5/O_1I'$
Lowland Red-and-White breed	
031 <i>G</i> (sire)	BO_1Y_2D'/I'
22. <i>W</i> -1579 (dam)	$O_xY_2K'Y'Kr5/G'' . . .$
23. <i>W</i> -1578 (daughter)	$O_xY_2K'Y'Kr5/BO_1Y_2D'$
Simental breed	
61 <i>G</i> (sire)	$G_1O_xA'/-$
24. <i>R</i> -8988 (dam)	$O_xY_1A'I'Y'Kr5/O_1 . . .$
25. <i>R</i> -8987 (daughter)	$O_xY_1A'I'Y'Kr5/-$

The fact of knowing the *B*-genotypes of parents made it possible to ascertain a hereditary character of the antigen *Kr5* and to establish *B*-alleles in which this trait occurs. These alleles are:

1. $O_xY_2K'Y'Kr5$
2. $O_2Y_1K'Y'Kr5$
3. $O_xY_2B'G'Y'Kr5$
4. $O_xY_2I'Y'Kr5$
5. $O_xY_1A'I'Y'Kr5$

Maybe, the first allele corresponds to the second one and the fourth allele to the fifth one. It is possible too that the first alleles possess a trait A' since at the earlier period the following test sera belonging to the B -system were available: $B G_2 K I_1 I_2 I_2^0 O_1 O_x P Q T_1 Y_2 B'D' E_2' I'GJ'K'O'P'Y'$ and G'' and only in the later period $Y_1 O_2$ and A' were additionally used. The antigen Y' occurs in all the alleles with the antigen $Kr5$. Although the frequency of this trait is also low in all the breeds investigated hitherto in Poland (2, 3, 4, 5, 7, 8, 9), it is found to occur in a greater number of alleles than the trait $Kr5$. Hence, one can infer that the antigen $Kr5$ is a supergroup for the antigen Y' and their relationship is similar to that of G_1 and G_2 or Y'_1 and Y'_2 .

It seems, therefore, that the serum symbol Y' might be changed for Y'_2 and that of $Kr5$ for Y'_1 .

REFERENCES

1. Busch B. (1965). Tierzucht. 627-629.
2. Dola L. (1965). Acta Agraria et Silvestria. 3-12.
3. Dola L., Pawłowski K., Kaszycka H., Ormian M. (1968). The Frequency of B -alleles in the Polish Red Cattle from south region of Poland. XI-th Europ. Conf. Blood Group. Warszawa. 163-169.
4. Dola L., Pawłowski K., Kijowska-Petryk T. (1968). Blood Group Studies on the B -alleles of Red-and-White Lowland Cattle. XI-th Europ. Conf. Blood Group. Warszawa. 157-162.
5. Dola L. Charakterystyka składu antygenowego czerwonych ciałek krwi stada bydła rasy nizinnej czarno-białej w Z. D. Pawłowice (in press).
6. Dorynek Z., Kaczmarek A., Świtek M. (1971). Genetica Polonica 469.
7. Kaszycka H. Wpływ buhajów PZUZ na częstotliwość występowania B -alleli u bydła rasy nizinnej czarno-białej woj. krakowskiego (maszynopis).
8. Rapacz J., Dola L., Jakóbiec J. (1964). Blood Group Studies on B -groups in Polish Red Cattle. IX-th Europ. Conf. Blood Group. Praga. 39-42.
9. Słota E., Rapacz J., Barinow A. (1968). Blood Group Studies in Simental Cattle in Poland. XI-th Europ. Conf. Blood Group. Warszawa. 151-156.
10. Comparison Test (1968).

NOWY ANTYPEN $Kr5$ Z UKŁADU GRUPOWEGO KRWI B U BYDŁA

Streszczenie

W roku 1963 otrzymano na drodze izoimmunizacji surowicę testową, identyfikującą nieznaną dotąd antygen grupowy krwi u bydła, który oznaczono symbolem $Kr5$.

W roku 1964 dokonano następnej izoimmunizacji krwią krowy z antygenem $Kr5$, w wyniku czego otrzymano surowicę z przeciwciałami anty- $Kr5$.

W latach 1963 - 1972 przebadano tymi surowicami około 16,5 tys. sztuk bydła różnych ras. Stwierdzono, że antygen $Kr5$ należy do układu grupowego krwi B i wykazuje spokrewnienie z antygenem Y' , a jego częstotliwość wynosi około 0,15%.

НОВЫЙ АНТИГЕН *Kr5* ИЗ ГРУППОВОЙ СИСТЕМЫ КРОВИ *B* У СКОТА

Резюме

В 1963 году путем изоиммунизации была получена тестовая сыворотка, определяющая неизвестный до сих пор антиген крови скота, который обозначили символом *Kr5*.

В 1964 году была проведена следующая изоиммунизация кровью коровы с антигеном *Kr 5*, в результате чего получено сыворотку с антителами анти-*Kr5*.

В 1963 - 1972 годах этими сыворотками было исследовано 16,5 тыс. голов скота разных пород. Обнаружено, что антиген *Kr 5* принадлежит к групповой системе крови *B* и проявляет родственные признаки с антигеном *Y'*, а его частота составляет около 0,15%.

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