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HAEMOGLOBINS IN WILD ANIMALS

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SUMMARY

Haemoglobins of lion, impala, black rhinoceros, zebra, buffalo, elephant and wildebeest were investigated and their migration pattern in starch gel electrophoresis established.

INTRODUCTION

The haemoglobins of vertebrates display a similarity of composition and structure which bears witness to their possible common evolutionary origin[1]. The haemoglobin molecule is of tetrameric structure, composed of two pairs of identical polypeptide chains. The presence of more than one normal haemoglobin is common in domestic animals[2-5]. In each, the variant can be traced to one or other of the polypeptide chains; in every case where the analysis has been carried out, it has been found that the variant chain differs from its normal counterpart by the substitution of only one or two amino acid residues[6]. Many studies have been performed on domestic animals[7], and questions of linkage and natural selection have also been discussed in other species. A series of abnormal haemoglobins has been found in man, but in animals none of the known variants is apparently associated with a pathological condition.

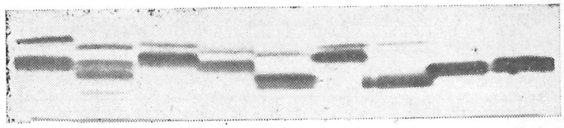
MATERIAL AND METHOD

In a survey performed on stored blood samples of wild animals in the Kruger National Park, the following specimens were included: 19 lions, 101 impalas, one black rhinoceros, 33 zebras, 27 buffaloes, 109 elephants and 12 head of wildebeest. The samples were very often haemolysed before treatment, hence the faint bands in samples A, B, E, F and G (Fig. 1), which are actually serum proteins.

The original technique of starch gel electrophoresis[8] but with a few modifications[9] was applied.

RESULTS AND DISCUSSION

The migration rates of the haemoglobins of different species are depicted in figure 1, where sheep haemoglobin type BB (H) and cattle haemoglobin type AC (1) are included for comparison.



RATE OF MIGRATION OF DIFFERENT HAEMOGLOBINS

A—Lion, B—Impala type AB, C—Black Rhino, D—Zebra, E—Buffalo, F—Elephant, G—Wildebeest, H—Sheep type BB and I—Cattle type AC.

The results obtained can be summarized as follows:

Lion (A): All 19 samples investigated showed only one band, and no variation was found. *Impala* (B): It was established that there are three haemoglobin alleles responsible for the different phenotypes found in the following frequencies: 8 AA, 49 BB, 2 CC, 29 AB, 11 BC and 2 AC, giving the following gene frequencies Hb^A=0,233; Hb^B= 0,683 and Hb^C=0,084. In figure 1 the haemoglobin sample B represents the haemoglobin AB. The faint bands behind and in front of the haemoglobins originate from the serum proteins.

Black Rhinoceros (C): Only one sample was included in this comparison which, in figure 1, appears as one thick band (sample C). From earlier investigations it was established that the black rhinoceros possesses two types of haemoglobin, which present themselves as two bands migrating very closely together[10]. The white rhinoceros, however, possesses only one type of haemoglobin, identified by a single band.

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Zebra (D): Two types of zebra haemoglobin were identified, one type showing a single line and the other type possessing two lines. Of the 33 samples investigated 32 belonged to the double band type, the one (D) in figure 1 being haemoglobin of the animal with the single band. The frequency of the different types in zebra haemoglobins is in agreement with an earlier investigation[4].

Buffalo (E): One type of haemoglobin was found in the 27 samples; it was represented by a double band. The bands were very close together and the front band always appeared to be darker than the slower migrating one. In figure 1, sample E, the two bands can be clearly seen. Again this is in agreement with an earlier investigation on 178 samples of buffalo where, in all cases, the typical double band pattern was obtained[11].

Elephant (F): Haemoglobin typing was performed on 109 blood samples, but all samples exhibited only one migration line, and no variation was found[12]. From figure 1, sample F, it is obvious that the elephant haemoglobins migrate faster than all the other haemoglobins investigated.

Wildebeest (G): Only one type was found in the 12 samples investigated, expressed by a single band in the electrophoretogram.

The chemical nature of the haemoglobins of wild animals is not known, but it is obvious from figure 1 that distinct differences in migration rates exist. The elephant haemoglobins migrated the fastest, followed by that of black rhinoceros, with lion, impala and zebra haemoglobins migration almost the same rate; buffalo and wildebeest haemoglobins exhibit the slowest migration rate.

This study has to be regarded as a preliminary one, and should be followed up with chemical studies of the nature of the haemoglobins; this could lead to interesting phylogenetic conclusions.

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