Acta Theriologica 45 (3): 431–432, 2000.

Physiology of the European bison

Zarys fizjologii żubra [An outline of the physiology of the European bison]. J. Gill. Severus, Warsaw, 1999, 176 pp. ISBN 83-901505-8-1 [In Polish with English summaries of chapters. Available from Białowieża National Park, 17-230 Białowieża, Poland]

This book is the result of 45 years of research performed on the physiology of the European bison, mainly by Professor J. Gill and his co-workers. The author was inspired by former Director of the Warsaw Zoological Garden, Dr Jan Żabiński (1897–1974), and started his research on the physiology of digestion and on the regulation of blood pressure and respiration. The next stage of bison physiology studies was possible when more animals were made available. Then many haematological, biochemical and hormonal data were collected.

The first, introductory chapter is concerned mainly with the evolution and history of European bison. J. Gill is not a specialist in this field. His data are based on the papers by Z. Pucek, but unfortunately references to those are not given (eg Pucek 1991). It is a pity that J. Gill did not use "Bibliography of the genus Bison" by Z. Jaczewski and A. Korona (1994). The literature about fossil bison is rather large and the important papers should be included (eg Żabiński 1960, Kowalski 1967, Krysiak 1967, Pucek 1986). The second chapter describes the behaviour of European bison, which differs considerably between animals in enclosures, and those in free ranging herds. In captivity European bison becomes aggressive towards man. The very important sense is olfaction. European bison's daily activity rhythm is different in summer and in winter. Bulls accompany female groups only during the mating season. The third chapter deals the strong inbreeding of the European bison population, which consequently is highly homozygotic. According to the author some diseases of genital organs in bulls (not defined yet) could be the result of increased homozygosity. The next, extensive, chapter "Feeding and digestion" lies in the field of J. Gill's interest. The results of many studies of European bison food preferences, the amount of food consumed, the list of plants eaten are referred to, as well as are some data on the anatomy of the digestive tract.

The 5th chapter concerns reproduction. The duration of pregnancy is about 265 days. Before extermination in the wild, the mating season was in the autumn and the calving period in spring, mainly in May. After World War I, this seasonality in captive animals became extended and calving occurred in different months. Reintroduction of European bison into the natural environment (first done in Białowieża Primeval Forest) restored reproductive seasonality. Information about blood level of testosterone, oestradiol and progesterone is given. Some pathological changes in genital organs of European bison males are described. According to J. Gill they could be the result of inbreeding. In the 6th chapter data are presented concerning the number and size of red blood cells, sedimentation rate and number of white blood cells. Investigations on the biochemical indices of blood are fairly numerous. Chapter 7 concerns blood circulation. At the beginning the methods of narcosis application are described. Arterial blood pressure and respiration were registered for 22 European bisons. The systolic blood pressure was 132.40 ± 12.58 mmHg and the diastolic 116.80 ± 7.31 mmHg. The European bison was very tolerant of chloralhydrate narcosis and very sensitive to injections of acetylcholine and adrenaline. At the end of the experiment the animals were bled from the carotid artery. Depending on animal size from 4.30 to 24 liters of blood were collected, ie 1.98 to 4.47% of body weight. Chapter 8 describes respiration. Direct counting of the respiratory movements in quiet European bison indicates about 10–18 per minute. In deep narcosis this rate was from 8 to 20 per minute. The European bison reacts by acceleration of breathing during manipulation. The respiratory rate increases then to over 100 per minute. Postmortem pathological changes were often found in lungs.

The 9th chapter describes metabolism. The following constituents and enzymes in blood of European bison were measured at different seasons: glucose, pyruvic acid, lactic acid, alkaline reserve, pH values, bicarbonate levels, CO_2 pressure, O_2 pressure, aldolase, acid phosphatase, alkaline phosphatase, albumins and globulins. Nearly all constituents and enzymes showed seasonal cyclicity. The 10th chapter describes immunology of European bison. According to J. Gill, the European bison evolved in big forests and was therefore isolated from pathogens. In the forest environment there are

plants producing bacteriocidal compounds (phitoncids) making the big forests nearly sterile. This resulted in the poorly developed immunological system of European bison.

Chapter 11 describes the influence of environmental factors on the rectal and skin temperatures in European bison. The data were obtained immediately after the animal was shot. For 209 European bison the mean rectal temperature ranged from 38.1°C to 38.4°C. The mean upper foreleg skin temperature was 21.2°C in young males and 23.0°C in mature bulls. The mean abdominal temperature was 20.0°C in young males and 22.8°C in mature bulls. Thyroid hormone levels are also presented for 201 European bison. Chapter 12 describes stress. Cortisol level in European bison blood was rather low. Analysed by the radioimmunoassay method it was from 5.98 ng/ml in cows to 13.10 ng/ml in mature bulls. The males with some genital pathology had lower cortisol levels than did healthy ones. Chapter 13 summarizes results. The current European bison population derives from just 5 individuals, leading to very high homozygosity. This caused some genetic disorders now expressed as pathological changes in the preputial area. The last chapter is written in remembrance of the people working for the breeding and the protection of European bison. Professor Gill recollects not only scientists and important directors but also gamekeepers, whose work is extremely important.

The book is premised on the ecological and evolutionary approach to physiological problems. The low immunocapacity of European bison as result of living in the forest could be compared with North American bison living in prairies. Many data are referred to as original and presented in tables and figures. Only some of them have been published before in scientific journals and are critically revised in this book. So the text has a value of first-hand information on the physiology of European bison. Unfortunately the text was poorly proofed and some mistakes appear, eg p. 13; the last auroch was killed in 1627 not in 1657, p. 171; I was born in 1928 not 1927, p. 169; J. Żabiński did not work simultaneously with J. Sztolcman (1854–1928) because Sztolcman was 43 years older. When Sztolcman (1925) presented his paper "Le Bison d'Europe" in Paris J. Żabiński was still a student. The intensive activity of Żabiński with European bison started in 1929 when he became the Director of the Warsaw Zoological Garden. However, these mistakes are of minor importance and do not diminish the value of this unique and pioneering book. Although it has been published in Polish, it contains a great deal of original data, worthy of presentation also in an English edition. I hope that Professor Gill's followers will continue his work on physiology of European bison in the future.

References

Kowalski K. 1967. The evolution and fossil remains of the European bison. Acta Theriologica 12: 335–338.

Krysiak K. 1967. The history of the European bison in the Białowieża Forest and the results of its protection. Acta Theriologica 12: 323–331.

Jaczewski Z. and Korona A. 1994. Bibiography of the Genus *Bison* (H. Smith, 1827) (until 1950). Oficyna Wydawnicza 'Volumen', Warszawa: 1–120.

Pucek Z. 1986. *Bison bonasus* (Linnaeus, 1758) – Wisent. [In: Handbuch der Säugetiere Europas. Vol. 2/II. J. Niethamer and F. Krapp, eds]. Aula – Verlag, Wiesbaden: 278–315.

Pucek Z. 1991. History of the European bison and problems of its protection and management. [In: Global trends in wildlife management. B. Bobek, K. Perzanowski and W. Regelin, eds]. Transactions of 18th IUGB Congress, Kraków 1987. Świat Press, Kraków – Warszawa: 19–39.

Sztolcman J. 1925. Le Bison d'Europe. Premier Congres International pour la Protection de la Nature.Faune et Flore, Paris: 87–92.

Żabiński J. 1960. The European bison (*Bison bonasus*). State Council for Conservation of Nature, Poland, Warsaw, Kraków: 1–26.

Zbigniew JACZEWSKI, Research Station of Ecological Agriculture and Breeding of Endangered Animals, Polish Academy of Sciences, Popielno, 12–222 Wejsuny, Poland.