ACTA PHYSIOLOGICA POLONICA
1961, XII, 6, 859

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REGULATION OF BLOOD PRESSURE IN THE EUROPEAN BISON, *BISON BONASUS* (L.)

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The chloralhydrate narcosis of the European Bison was investigated by *Jaczewski, Świeżyński* (1955), and by *Piwowarczyk* (1958). This problem however can not be regarded as solved yet.

So far, no investigations of blood pressure regulation in the European Bison have been made. There are, however, papers concerning this problem in other wild ruminants, viz. — Red deer (*Jaczewski, Gill* 1958), Manesheep (*Gill*, 1960).

An experiment was made on an European Bison bull, „Plato" (575), born on June 1st, 1941 at the Pszczyna Reservation. This animal was eliminated from breeding an account of its age, an injured eye, and some deformity of its forelegs. Therefore „Plato" was used for physiological experiments.

COURSE OF THE EXPERIMENT

On September 29th. 1958. at about 5.00 P. M., the bull was closed in a cage and put on a lorry. The trasport from Białowieża to the Zoological Garden in Warsaw lasted from 18 : 10 till 2 : 10 the next day. The animal's weight on that day was about 750 kilograms. „Plato" was set free in a small enclosure on September 30th, about 8 : 50. Thus it remained in the cage for 17 hours, and 35 minutes, standing all the time. On September 30th it was fed on hay only. Next day he was given ground oats, and hay. All this time it was given no water.

On October 2nd it was given no food. At 11 : 35 the animal was given 125 grams of chloralhydrate in 12 litres of water. „Plato" drank it very

slowly and with distaste. The solution was then diluted by adding 7 litres more of water. „Plato" began to drink a little better, but with intervals. At 13 : 00 25 grams of chloralhydrate were added to the solution. Further 80 grams of chloralhydrate in 6 litres of water were added to the original solution. „Plato" drank very slowly making frequent intervals, splashing a great deal. The animal began to stagger. At 14 : 48 250 millilitres of 96% alcohol were added to the solution. Then the animal sniffed, went away, and stopped drinking altogether.

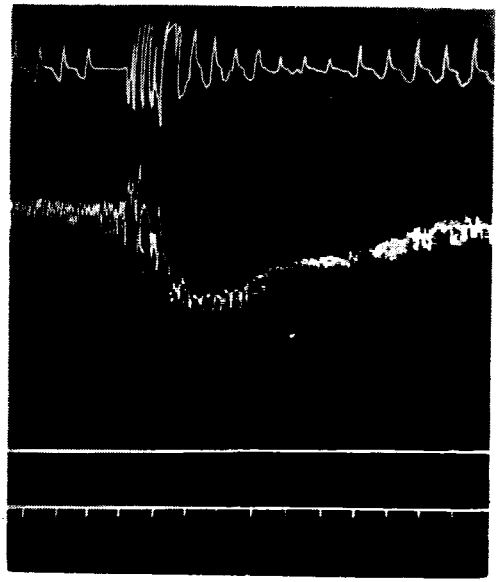

Fig. 1. Effect of manipulation with the left truncus vagosympathicus (interval of time signal — 10 seconds).

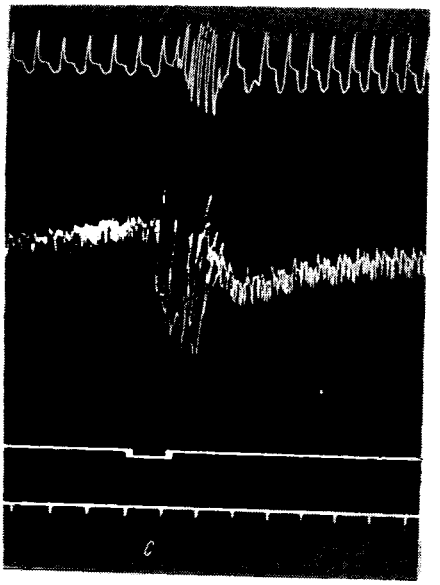

Fig. 2. Effect of stimulation of the left truncus vagosympathicus (the secondary coil shifted 15 centimetres from the primary coil), (time — 10 seconds).

Then the solution was taken away and the floor of the enclosure was sprinkled with 8 kilograms of NaCl. From that day on the animal was fed with salted ground oats, salted fresh grass and was given nó water. „Plato" was getting thinner and distinct obstruction was apparent (dry feces and in very small quantities).

On October 5th, 1958, at 8 : 08, „Plato" was given 100 grams of chloralhydrate in 10 litres of water. The animal began to drink immediately. Till 8 : 20 it drank half of the total quantity given, with one interval only. At 8 : 23 50 grams of chloralhydrate in 5 litres of water were added to the solution. At 8 : 24 the animal's movements began to be staggering. „Plato" continued to drink with short intervals. At 8 : 50 25 grams of

chloralhydrate in 2,5 litres of water were added. At 9 : 03 25 grams of chloralhydrate in 2,5 litres of water were added again. The animal continued to drink with short intervals. At 9 : 15 almost all the solution was drunk. The movements became more and more staggering. „Plato" put his head against the wall of the enclosure. At 9 : 16 the bull slipped and fell down. Its hind legs were normally under its trunk, as usually in a laying position, its forelegs were stratched out. Plato's eyes were almost completely closed, but it reacted distinctly, when touched. The animal's head was tied to a beam of the enclosure, and the legs were tied together. The animal was laying on its right side. In the places of prospective injections and operation the skin was not shaved, so that the animal's skin could not be injured. At 10 : 10 injections to the vena jugularis and vena saphena were tried but without a succes (owing to the thickness of the animal's coat). At 10 : 40 „Plato" was given 45 grams of chloralhydrate in 700 millilitres of water *per rectum*. Afterwards the head was better tied and fixed and the legs were tied, lifted up and fastened with a rope to the beam over the enclosure. At 11 : 58 25 grams of chloralhydrate in 250 millilitres of water were added *per rectum*. Nevertheless the animal manifested a strong reaction to an incision on the skin. Therefore at 12 : 37 50 grams of chloralhydrate in 500 millilitres of water were added *per rectum* again. The operation was then started. The left jugular vein was dissected and at 13 : 20 20 grams of chloralhydrate in 200 millilitres of water were administered intravenously. A glass cannula was inserted into the left carotid artery and connected with a mercury manometer. Into the tied end of the left carotid artery 20 000 u. i. of heparin were injected. A tracheal tube was connected with a membrane manometer. At 15 : 00 the recording of both respiration and arterial pressure was started.

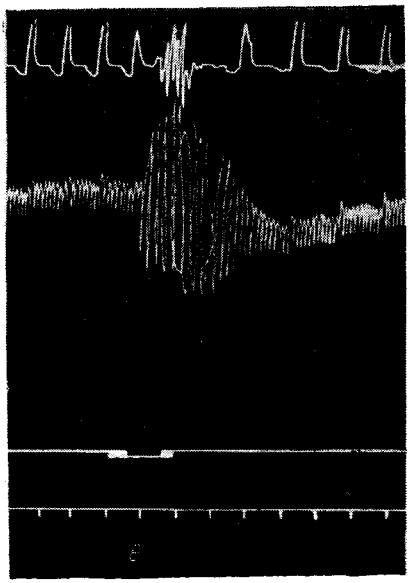

Fig. 3. Effect of stimulation of the left truncus vagosympathicus (the secondary coil shifted 8 centimetres from the primary), (time — 10 seconds).

Truncus vagosympathicus on the left side was separated and stimulating electrodes were places under it. This manipulation caused a decrease of blood pressure and an acceleration of the respiration rate (fig. 1). At 15 : 10 truncus vagosympathicus was stimulated with an induced current

(the secondary coil shifted 15 centimetres from the primary coil), (fig. 2). At 15 : 22 15 grams of chloralhydrate in 150 millilitres of water were administered intravenously, but this was without effect on the blood pressure or respiration. Subsequently truncus vagosympathicus was stimulated with an induced current (the secondary coil shifted 8 centimetres from the primary), (fig. 3).

Truncus vagosympathicus was tied once (fig. 4 — first signal) and a second time nearer to the heart (fig. 4 — second signal). Afterwards it was cut between tied places (fig. 4 — third signal). At 15 : 42 and

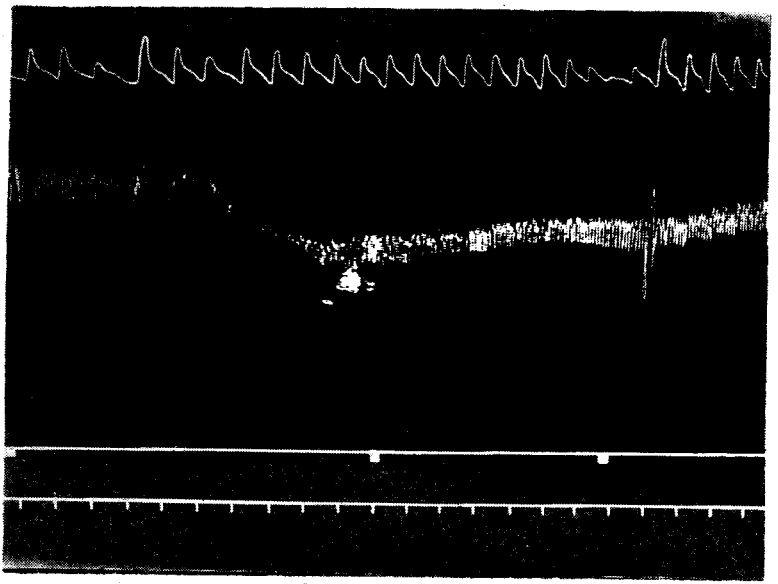

Fig. 4. Effect of tying of the left truncus vagosymphaticus — first signal, tying once more nearer the heart — second signal, cutting the truncus vagosympathicus — third signal (time — 10 seconds).

15 : 45 peripheric end of truncus vagosympathicus was stimulated with induced current (the secondary coil shifted 8 centimetres from the primary). At 15 : 50 the same was done (the secondary coil shifted 6 centimetres from the primary), (fig. 5). At 15 : 55 the centripetal end of truncus vagosympathicus was stimulated with induced current (the secondary coil shifted 12 centimetres from the primary), this caused a typical vagus effect (fig. 6d). At 15 : 58 the same was repeated (the secondary coil shifted 8 centimetres from the primary), this caused slight sympathicus effect (fig. 6e). At 16 : 00 the same was repeated (the secondary coil shifted 6 centimetres from the primary), this caused a distinct sympathicus effect.

At 16 : 05 0,4 grams of acetylocholine was given intravenously, this produced a decrease of systolic blood pressure from 180 mm Hg to 80 mm Hg (fig. 7). At 16 : 20 0,6 grams of acetylocholine was administered intravenously again, the effect in this case was distinctly prolonged and lasted nearly 10 minutes (fig. 8).

At 16 : 30 0,004 grams of adrenaline was given intevenously. The reaction was so strong, that the registration had to be stopped. This effect lasted nearly 10 minutes. After this injection the difference between the systolic and diastolic blood pressures was very prominent — about 40 mm Hg, while before the injection it was about 16 mm Hg only. At 16 : 46 0,002 grams of adrenaline was given intevenously again. This

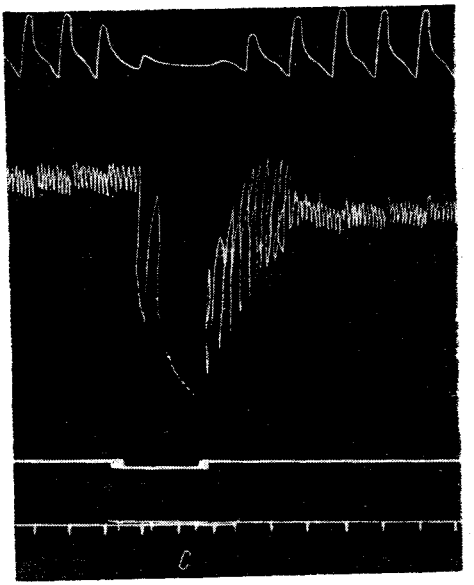

Fig. 5. Effect of stimulation of the peripheric end of the left truncus vagosymphaticus (the secondary coil shifted 6 centimetres from the primary), (time — 10 seconds).

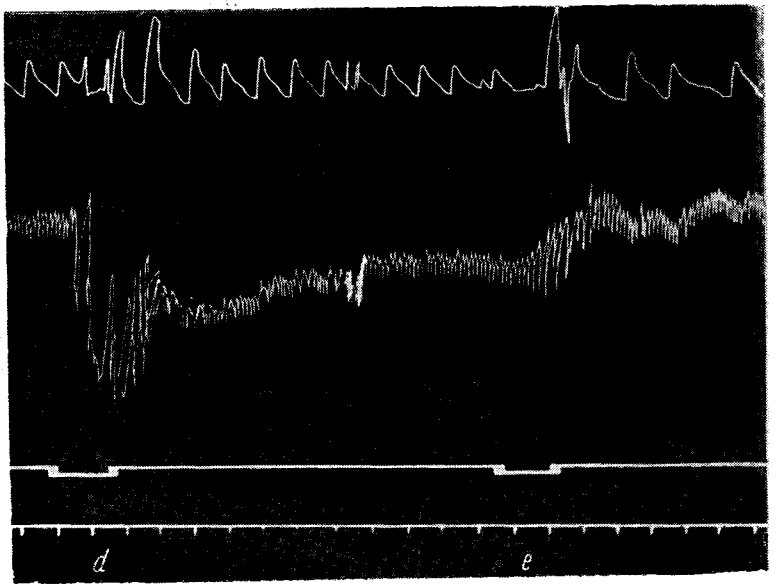

Fig. 6. — d. Effect of stimulation of the centripetal end of the left truncus vagosympathicus (the secondary coil shifted 12 centimetres from the primary); e — the same (the secondary coil shifted 8 centimetres from the primary), (time — 10 seconds).

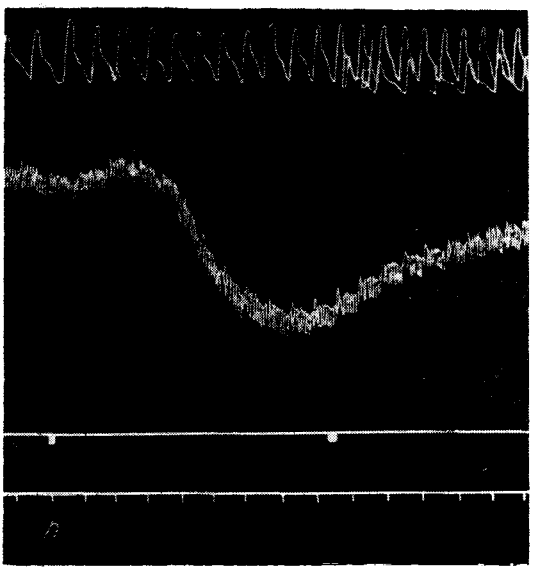

Fig. 7. Effect of acetylocholine administration (0,4 grams), (time — 10 sec.).

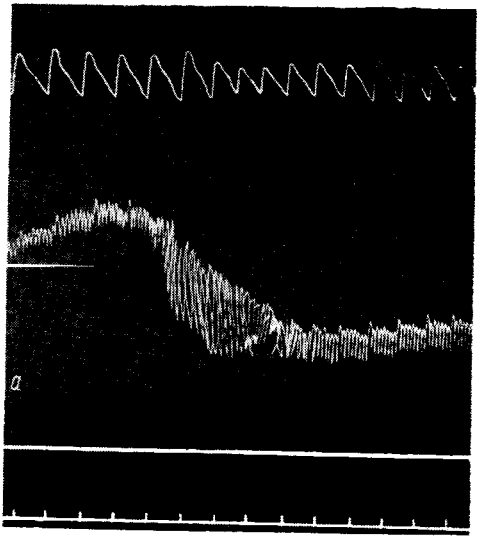

Fig. 8. Effect of acetylocholine administration (0,6 grams), (time — 10 seconds).

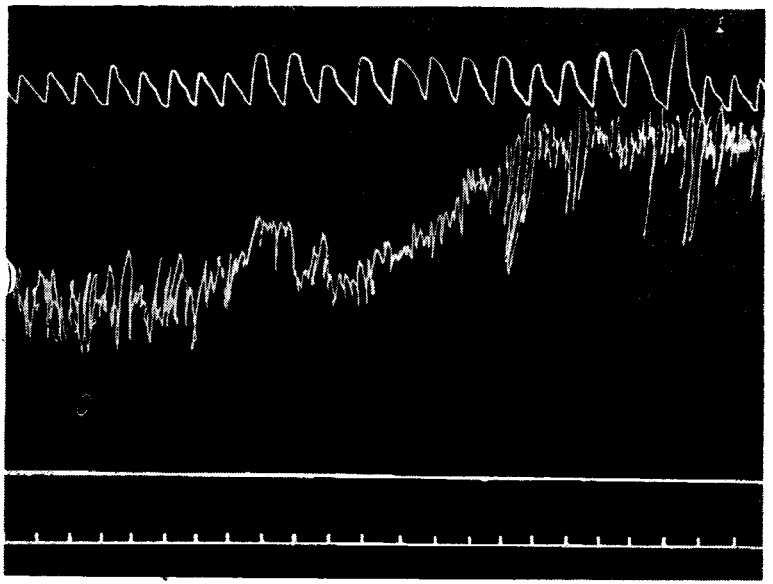

Fig. 9. Effect of adrenaline administration (0,002 grams), (time — 10 seconds).

produced an increase of systolic blood pressure from 130 mm Hg to 236 mm Hg (fig. 9). In this case the effect of adrenaline action also lasted nearly 10 minutes.

At 17 : 05 intravenous infusion of 10% chloralhydrate solution was started. At this moment the systolic blood pressure was about 170 mm Hg (fig. 10a). At 17 : 30 the infusion was finished, up to that moment 770 millilitres of the solution were given, and at that time the systolic blood pressure decreased to 84 mm Hg (fig. 10b). In spite of the infusion the blood pressure and respiration were regular, but systolic-diastolic oscillations were distinctly diminished.

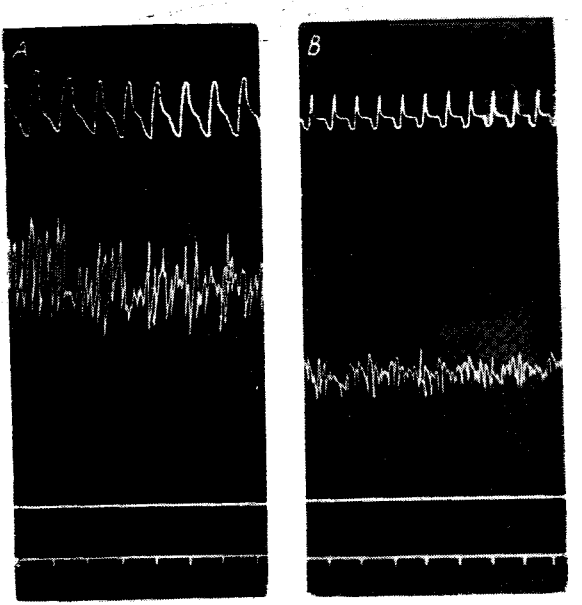

Fig. 10. a — Beginning of the intravenous infusion of 770 ml of 10% chloralhydrate solution; b — Finishing of the intravenous infusion of 770 ml of 10% chloralhydrate solution (time — 10 seconds).

Subsequently the bison was bled, as much as possible, from the left carotid artery. 16,5 litres of blood were collected before the animal died. During the operation the animal lost probably about 0,5 liter of blood. Hence the total quantity of blood lost was 17 litres. The animal's death followed without any symptoms of asphyxia.

DISCUSSION OF RESULTS

From this single experiment it would appear, that the European bison is very tolerant to chloralhydrate narcosis. The bison „Plato" received 200 grams of chloralhydrate per os, 120 grams per rectum, and that amount sufficed to produce the narcosis necessary for operating. During the operation the bison received also 35 grams of chloralhydrate intra-

venously, which was necessary to keep up the narcosis at the required level.

After nearly nine hours from the moment the animal began to drink chloralhydrate, the bison was given an additional 77 grams of chloralhydrate intravenously — in order to investigate its tolerance to that drug. The total amount of chloralhydrate given was 432 grams.

The reaction of blood pressure to vagus stimulation was typical, but the usual simultaneous increase of the respiratory movements did not occur. Instead, quite exceptionally, the respiratory movements stopped and there was no compensatory increase in these movements afterwards (fig. 5).

The animal was very sensitive to the injections of both adrenaline and acetylocholine. The dose twice as small as the dose given to the Red deer (*Jaczewski, Gill*, 1958) produced nearly the same effect.

The small bleeding volume (2,27% of the body weight) can not be regarded as a typical one, because of the fact, that the animal was deprived of water, received large quantities of salt and, probably, the animal's age and poor condition were not without effect either.

CONCLUSIONS

1. The investigated European bison was very tolerant to chloralhydrate narcosis.
2. The reaction of blood pressure to stimulation of the peripheric end of the truncus vagosympathicus was typical, though there was no increase of respirations.
3. The bison was very sensitive to the injections of both adrenaline and acetylocholine.

J. Gill, Z. Jaczewski

REGULACJA CIŚNIENIA KRWI U ŻUBRA *BISON BONASUS* (L.)

Streszczenie

Do doświadczenia użyto żubra „Plato" (575), ur. 1. 6. 1941 r. w Rezerwacie w Pszczynie. W dniu 30. 9. 1958 został on przewieziony z Rezerwatu w Białowieży do Ogrodu Zoologicznego w Warszawie. Ważył wtedy 750 kg. Dnia 2. 10. 58 podano mu do picia w kilku porcjach 230 g wodzianu chloralu w 25 litrach wody. Żubr pił roztwór ok. 3 godz. Nie uzyskano jednak narkozy. Przez następne trzy dni podawano mu solone pokarmy bez wody. 5. 10. podano do picia łącznie 200 g wodzianu chloralu w 20 l wody. Żubr pił 67 min. Nastąpił sen, lecz do rozpoczęcia operacji trzeba było jeszcze dodać 120 g wodzianu *per rectum*.

Rejestrację ciśnienia krwi przeprowadzano z lewej tętnicy szyjnej wspólnej, oddechu — z tchawicy. Drażniono lewy pień błędno-współczulny. Reakcje przedstawione są na krzywych. Podczas doświadczenia konieczne było dodanie jeszcze 35 g wodzianu dożylnie, w 10% roztworze.

Po ok. 9 godzinach od chwili rozpoczęcia picia narkotyku przez żubra wprowadzono szybko dożylnie 77 g wodzianu. Spowodowało to spadek ciśnienia tętniczego ze 170 do 84 mm Hg, bez wystąpienia innych zmian. W sumie zostało podane 432 g wodzianu chloralu.

Żubr został wykrwawiony z lewej tętnicy szyjnej. Uzyskane 17 l krwi stanowią 2,27% ciężaru ciała.

Badany żubr wykazał wielką tolerancję na wodzian chloralu. Reakcja ciśnienia krwi na drażnienie obwodowego końca n. błędnego była typowa, ale zamiast zwykłego przyspieszenia ruchów oddechowych, zostały one zahamowane i nie nastąpiło wyrównawcze przyspieszenie ich po zakończeniu drażnienia. Żubr był bardzo czuły na dożylne wprowadzanie małych dawek adrenaliny i acetylocholiny.

LITERATURE

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Otrzymano: 16. 6. 1961.

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