

Observations on a juvenile female square-lipped or white rhinoceros (*Ceratotherium simum simum* (Burch.)) in the National Zoological Gardens of South Africa. By R. BIGALKE, Director of the National Zoological Gardens, T. STEYN, Assistant Director of the National Zoological Gardens, D. DE VOS, Radiologist of the Veterinary Research Station at Onderstepoort, and K. DE WAARD, Keeper of the Ungulates in the National Zoological Gardens.

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(With Plates I-III.)

The acquisition of a baby female Square-lipped Rhinoceros (*C. simum simum*) by the National Zoological Gardens in Pretoria on July 29, 1946, was an event of great importance for two reasons. In the first place this was the first time in the history of mankind that a specimen of *C. simum simum* had found its way to a zoological garden, and secondly the animal's age was known to within a day (Bigalke, 1947). For the first time, therefore, the opportunity has been afforded of making observations on *C. simum simum* in captivity. This account is the result of those observations over a period of eighteen months.

FEEDING AND TREATMENT.

After her arrival in the National Zoological Gardens "Zuluana" was provided with a native attendant who remained with her in the enclosure every day from about 8 a.m. until about 4.30 p.m., when she was locked up in her sleeping quarters. This arrangement, which continued until Zuluana was about a year old, was deemed necessary not only on account of the great value of the animal, but also in order to provide her with a companion.

Zuluana spent the night in a spacious brick room 13 by 13 ft. well provided with grass bedding. But soon after her arrival it was found that she was rubbing and skinning her lips against the walls. A wooden cell was thereupon built in about two-thirds of the night-house and the boards were padded on the inside with grass underneath bags. This proved effective.

As Zuluana is the first baby White Rhinoceros kept in a zoological garden, it is desirable to furnish information about her feeding during the first few months.

After her arrival on July 29, 1946, she was fed as follows:—

(a) July 29 to August 13, 1946.—The following were given *three times* per day:—Two bottles of unboiled cow's milk, with one pound of thickly cooked maize meal porridge stirred into the milk to make a thin gruel.

In the case of one of the three feeds one-half bottle lime water and a raw egg were stirred into the milk.

To keep the bowels open, one tablespoonful of milk of magnesia was added to one of the bottles of milk when necessary.

Note.—An improvised teat was first used and attached to each bottle in turn, but this was soon replaced by a rubber teat of a type commonly used for calves. The aperture of the teat had to be enlarged somewhat to let the gruel through easily.

(b) August 14 to 23, 1946.—Eight bottles of unboiled cow's milk, four pounds of maize meal porridge and two raw eggs, *per day*. One bottle lime water as above.

Measurements and Weights of Female Square-lipped Rhinoceros, Zuluana, up to the age of eighteen months.

Born on 23rd July, 1946.

Date.	Anterior horn.	Posterior horn.	Height at withers.	Height of left fore-limb measured along the median outer surface from the middle point of the humeral fold to the board on which the animal stood.	Length of tail measured on the underside in the median line from the root to the tip excluding the hair-tuft.	Distance between right and left squamosal knob.	Weight.
August 7, 1946	Rounded boss about 2.5 cm. at the highest point	Absent	59.3 cm. (N.B. The height of 60 cm. on August 1, 1946 (Bigalke, 1947, p. 55) should have read 58.8 cm.)	33.7 cm.	26.1 cm. (In this single instance the measurement was made with dividers).	16.3 cm.	105 $\frac{1}{4}$ lb.
August 20, 1946	—	Absent	59.3 cm.	34.3 cm.	26 cm.	16.5 cm.	107 lb.
September 23, 1946	—	Absent	59.8 cm.	35 cm.	26.1 cm.	16.5 cm.	118 $\frac{1}{2}$ lb.
October 23, 1946 (Three months old)	—	Slight protuberance	59.8 cm.	35 cm.	26.8 cm.	17 cm.	138 $\frac{1}{2}$ lb.
November 23, 1946	—	—	—	—	—	—	161 lb.
December 24, 1946	2.4 cm. (measured with dividers in the posterior median line)	Slight protuberance	—	—	—	—	200 $\frac{3}{4}$ lb.
January 23, 1947. (Six months old)	2.8 cm. (measured with dividers in the posterior median line)	Slight protuberance	71.8 cm.	39 cm.	29 cm.	19.2 cm.	241 lb.
February 24, 1947	—	—	—	—	—	—	268 lb.

March 25, 1947	—	—	—	—	—	—	270 lb. (The animal had stomach trouble for about two weeks).
April 23, 1947 (Nine months old)	4.7 cm. (measured with dividers in the posterior median line)	Slight protuberance, but more obvious than previously	75.8 cm.	41.7 cm.	31.8 cm.	20.1 cm.	300 lb.
May 23, 1947	—	—	—	—	—	—	345 lb.
June 23, 1947	—	—	—	—	—	—	415 lb.
July 23, 1947 (One year old)	5.6 cm. (measured with dividers in the posterior median line)	Slight protuberance with the horn fibres visible	82.3 cm.	43 cm.	33.3 cm.	22.5 cm.	482 lb.
August 23, 1947	—	—	—	—	—	—	550 lb.
September 23, 1947	—	—	—	—	—	—	628 lb.
October 23, 1947. Fifteen months old)	7.7 cm. (measured with dividers in the posterior median line)	Slight protuberance with the horn fibres visible	94.8 cm.	46.5 cm.	37.3 cm.	24.2 cm.	713 lb.
November 24, 1947	—	—	—	—	—	—	812 lb.
December 23, 1947	—	—	—	—	—	—	930 lb.
January 23, 1948. (Eighteen months old)	8.2 cm. (measured with dividers in the posterior median line)	A small knob about 5 mm. high in the centre and about 2.5 cm. in diameter at the base.	98.8 cm.	51.7 cm.	42.5 cm.	26.3 cm.	1013 lb.

NOTES.—(a) The height of the withers was measured with an anthropometer and the distance between the two squamosal knobs was measured by means of circular calipers.

(b) The height of the left fore-limb was measured with dividers and the length of the tail with a steel tape. Owing to the difficulty of measuring the same points on each occasion, these measurements are not as accurate as the others.

(c) August 24 to September 23, 1946.—Nine bottles of unboiled cow's milk, five pounds of maize meal porridge and three raw eggs, *per day*. One bottle lime water as above.

(d) September 24 to October 23, 1946.—Nine and a half bottles unboiled cow's milk, five pounds of maize meal porridge and four raw eggs, *per day*. One bottle lime water as above.

(e) October 24 to November 23, 1946.—Ten bottles of unboiled cow's milk, six pounds of maize meal porridge and five raw eggs, *per day*. One bottle lime water as above. If an aperient was necessary, three tablespoons of milk of magnesia were added to one of the bottles of milk.

From November 24 onwards the daily feeding remained as under (e), except that six raw eggs were used per day.

In addition to the milk gruel, efforts were made from November 5, 1946, onwards, to give Zuluana about $\frac{1}{4}$ pound of bran once a day from the keeper's or the native attendant's hand. By this time she had erupted six lower and four upper premolars as indicated later. On November 14, 1946, it was observed that Zuluana tried to masticate the bran offered out of the keeper's hand, but much of it remained in the pocket of the lower lip and probably most of it fell out of the mouth. It seemed as if she were not interested in this food.

By November 29, 1946, Zuluana was beginning to take the bran (now consisting of about $\frac{1}{2}$ lb. bran with a little salt) properly from the native's hand. There was much chewing, but swallowing appeared to be a slow process since much of the bran fell out of her mouth during the act of mastication. But the native gathered this up again and again from the stone on which it was lying and offered it to her.

On December 17, the quantity of solid food was increased to $\frac{1}{2}$ lb. bran mixed with $\frac{1}{2}$ lb. rolled oats and a little salt, and this was further increased to 1 lb. bran and $1\frac{1}{2}$ lb. rolled oats on February 23, 1947. From March 1, 1947, onwards a further mixture of $\frac{1}{2}$ lb. bran and $\frac{1}{2}$ lb. rolled oats was placed in a trough inside her night-quarters, and she consumed this during the night. Gradually more solid food was given to the animal and the feeding of the milk gruel ceased on November 28, 1947.

SKIN AND SKIN FOLDS.

When Zuluana reached the National Zoological Gardens on July 29, 1946, at the age of six days (Bigalke, 1947), her skin was rather wrinkled and loose in appearance. The following skin folds could then be distinguished:—a transverse nuchal fold immediately behind the base of the ears (visible when the head was held in a raised position), a transverse gular fold (visible when the head was lowered), a humeral fold across the upper arm just above the elbow, a scapular fold, an anterior costal fold immediately behind the scapular fold, a well-developed pelvic fold in front of the thigh (Pl. I, fig. 1), an inconspicuous posterior thigh fold running down the posterior surface of the thigh and passing into a hardly recognizable transverse tibial fold on the outer surface of the tibia (as the animal grew this fold became clearer), and a vulvar fold on each side between the vulva and the posterior thigh fold (when Zuluana was three years old the thigh and vulvar folds were well developed). On the left side of the body a well developed posterior costal fold was present a short distance in front of the pelvic fold (Pl. I, fig. 1), and on the right side there were two posterior costal folds in front of the pelvic fold.

On both sides of the barrel there were also more or less clearly marked rib furrows like those of *Diceros bicornis* (Pl. I, fig. 1) (Roosevelt and Heller, 1915, p. 667). The posterior costal folds mentioned in the previous paragraph are clearly demarcated by rib furrows. Rib furrows were much less in evidence

in a bull *C. simum simum* who was believed to be about 12 months old when he reached Pretoria on January 16, 1949. He had no posterior costal folds, and in his case the scapular, anterior costal and pelvic folds were not nearly as well developed as those of the female. The development of costal folds appears to be liable to a good deal of variation. A case has recently come to our notice in which a bull in the Umfolosi Game Reserve has three well-developed posterior costal folds on the left side of the barrel, and in which the anterior rib furrows in front of the three folds show up clearly.

As Zuluana grew, a second short gular fold developed and was obvious when the animal lowered the head to the ground.

On September 7, 1946, when Zuluana was 1½ months old, it was observed that the stratum corneum of the epidermis was beginning to flake off, especially on the limbs and sides of the body. A week later the peeling had spread to other parts of the body. As the new skin was distinctly whitish in colour, the animal presented a piebald appearance (see Pl. I, fig. 3). By November 29, 1946, the shedding of the outermost layer of the skin was more or less complete except on the back, the top of the head and the upper sides of the body, where the old skin was still adhering in crusts, probably because the animal could not easily rub these places.

Although the skin of the body appears to be naked except for the ear-fringe and the tail-tuft, it is not entirely devoid of hair. On November 12, 1946, it could still be observed that when the skin was viewed at an angle in full sunlight there was sparse short black hair on practically the whole of the body. At the base of the toes and on the lower front side of the limbs the hair was thicker and could be plainly seen even when the sunlight did not fall directly on to the limbs. On October 16, 1947, the hair could still be seen on the back and sides of the body if viewed at an angle in the sunlight.

About the beginning of May of the year 1947 another skin moult was observed. It was obvious on the left thigh, where the skin was coming off in small pieces of irregular shape. It seems as if ecdysis of the stratum corneum takes place more or less regularly, but it was most obvious in the first moult owing to the contrast in colour between the new and the old skin.

NUCHAL HUMP.

In a previous communication (Bigalke, 1947) attention was drawn to the presence of three nuchal callosities on Zuluana's neck behind the ears. As the animal grew these nuchal callosities became larger and thicker until they fused into a nuchal hump. The large central callosity and the small posterior callosity fused at the age of about four months. When Zuluana was about six months old, the three callosities had all fused, but the position of the anterior one was marked by a shallow transverse groove. The nuchal hump continues to grow becoming both wider and higher, until it forms a well-marked hump when the animal stands with the head raised (Pl. III, figs. 10 and 12); the upper part of this hump is hard to the touch. Its trilobed origin is revealed by the presence of a shallow anterior and a shallow posterior transverse groove. In the adult bull the nuchal hump is a larger structure than in the cow of *C. simum simum*.

Heller (1913) states that one of the peculiarities of *C. simum cottoni* is "the prominent, rounded, fleshy hump upon the nape of the neck just forward of the withers. This hump is purely a muscular structure and receives no support from the dorsal processes of the cervical vertebrae". We have already pointed out that in *C. simum simum* the nuchal hump arises as three thickenings of the skin. That it is closely associated with the skin is not only shown by its origin, but also by the fact that when the animal lowers its head to the ground the hump lengthens with the stretching of the skin and becomes less prominent; the hard part can then be easily moved from side to side with one's

hand, showing that it is part of the skin. This was also found to be the case in the male specimen of *C. simum simum* received at a later date. While the exact nature of the hump of *C. simum simum* remains to be determined by anatomical dissection, there is little doubt that it is not entirely a muscular structure.

ANTERIOR AND POSTERIOR HORN.

Anterior Horn.

At the age of six days, and hence almost certainly at birth, the anterior horn is a rounded boss with a shield-like outline when viewed from above; it is covered with a shiny black horn membrane (Bigalke, 1947). The latter probably serves to protect the genital organs of the cow against injury during the birth of the calf. (See Pl. I, figs. 1 and 4.)

On August 16, 1946, the black horn membrane had two small lacerations resulting from a small injury received a few days previously. There was a space below the membrane, and if one exerted pressure with the fingers a little pus escaped from one laceration. On the following day, a crescentic slit was present in the horn membrane towards the posterior margin of the horn boss (Pl. II, fig. 5). This slit increased in extent until the central portion of the horn membrane fell off on September 2, 1946, exposing the boss of the anterior horn. A narrow strip of the horn membrane adhered to the horn boss along the periphery. In the middle of the horn there was a more or less rounded area of soft white (epidermal?) tissue (Pl. II, fig. 6) which increased in size until, on October 15, 1946, it filled the whole of the area from which the horn membrane had been shed. The soft tissue was covered by a thin horny covering. On the posterior side, where the horn boss is highest, remnants of the black horn membrane could be seen, but it was clear that they were either wearing off or being broken up by the tips of the growing horn fibres to which they adhered.

Unfortunately it is not possible to state whether the shedding of the horn membrane on September 2, 1946, in the manner described was a normal process or not. It would seem to be a case of injury to the horn and regeneration of the underlying horn tissue as the result of the injury. It is clear, however, that the black horn membrane would in any event have been pushed off or would have disintegrated as the horn fibres grew in length. On November 20, 1946, the regenerated middle portion of the anterior horn was still whitish in colour, but it had become hard like the rest of the horn. On December 7, 1946, a slight but distinct elevation could be seen in the centre of the surface of the regenerated part of the horn. But there was a much more distinct elevation on the posterior margin, this being the growing tip of the horn. By January 23, 1947, that is at the age of six months, the growing portion of the anterior horn was oval in shape when viewed from above with the remaining part of the horn boss forming a basal collar (Pl. II, fig. 8). By March 21, 1947, the anterior horn had grown appreciably but was still compressed from side to side (Pl. III, fig. 9).

Posterior Horn.

At the age of 15 days (Pl. I, fig. 4) Zuluana had a flat forehead with the skin stretched tightly over it. Just behind the anterior horn boss there were two crescentic depressions. At this stage there was no trace of the posterior horn; it was first observed on October 23, 1946, as a very slight protuberance in the median line of the forehead between the two crescentic depressions. The posterior horn grows much more slowly than the anterior one. At the age of 18 months, when the anterior horn stood 8.2 cms. high (see table of measurements), the posterior horn formed a small knob about 5 mm. high in the centre, and about 2.5 cms. in diameter at the base. (Pl. III, fig. 10.)

DECIDUOUS DENTITION.

The dental formula of the permanent dentition of *C. simum simum* is as follows: $\frac{0, 0, 4, 3}{0, 0, 4, 3}$ Pm $\frac{1}{1}$ are small and are not replaced when they have fallen out (Gray, 1867; Heller, 1913; Selater, 1900; Weber, 1928).

When Zuluana reached the National Zoological Gardens on July 29, 1946, she had no teeth in the mouth, and since the date of her birth is known (Bigalke, 1947), the sequence of eruption of the deciduous teeth was studied. Although the animal has a wide mouth, the gape is rather small, and as she could often not be induced to hold the mouth open for sufficiently long, the sequence of eruption had largely to be ascertained by frequent feeling with the hand. These observations were, however, checked by means of a few X-ray photographs taken by one of the authors, D. de Vos, in the laboratory at Onderstepoort.

The sequence of eruption of Zuluana's deciduous premolars is as follows:—

Date of Birth, July 23, 1946.

A. Upper Jaw.

Left Side.

Right Side.

Tooth.	Order of appearance.	Date of eruption.	Tooth.	Order of appearance.	Date of eruption.
dpm. 1	Seventh	16 July, 1947	dpm. 1	Ninth	6 September, 1947
dpm. 2	Fifth	21 October, 1946	dpm. 2	Fifth	21 October, 1946
dpm. 3	Second	9 October, 1946	dpm. 3	Second	9 October, 1946
dpm. 4	Sixth	10 December, 1946?	dpm. 4	Sixth	10 December, 1946 ?

B. Lower Jaw.

Left Side.

Right Side.

Tooth.	Order of appearance.	Date of eruption.	Tooth.	Order of appearance.	Date of eruption.
dpm. 1	Eighth	16 August, 1947 (Possibly 15 Aug.)	dpm. 1	Eighth	16 August, 1947 (Possibly 15 Aug.)
dpm. 2	Fourth	19 October, 1946	dpm. 2	Fourth	19 October, 1946
dpm. 3	First	8 October, 1946	dpm. 3	First	8 October, 1946
dpm. 4	Third	14 October, 1946	dpm. 4	Third	14 October, 1946

In one X-ray plate taken on November 4, 1946, the lower dpm.1 is clearly a much smaller tooth than the other deciduous premolars of the lower jaw. It seems peculiar that in both jaws dpm.1. is the last to erupt.

No incisors or canines erupted.

ATTRITION AND GROWTH OF NEW HOOFS.

At the age of six days (Bigalke, 1947) Zuluana had large toes with a wide, thick, black, hoof-like nail on each of the three toes of the fore and hind-limb, the middle hoof being the largest. As the free end of each hoof wore down by attrition, the new keratin grew from the base, and as it was of a greyish colour similar to that of the adjacent skin, there was a clear demarcation between the new horny substance and the black portion of the hoof representing the hoof present at birth. In fact the black baby hoof formed a kind of cap at the free end of the hoof (see Pl. III, fig. 11). During the course of growth the new hoof substance developed black transverse bands and eventually it became completely black.

The following table shows the time required for the complete attrition of the baby hoofs of Zuluana :—

Date of Birth, July 23, 1946.

	Date of completion of attrition of baby hoof.	Number of days.
Left fore-limb.		
Outer toe	3 June, 1947 (?)	315 (?)
Middle toe	30 April, 1947	281
*Inner toe	27 October, 1947	461
Right fore-limb.		
Outer toe	17 May, 1947	298
Middle toe	1 May, 1947	282
*Inner toe	?	?
Left hind-limb.		
Outer toe	3 June, 1947	315
Middle toe	16 July, 1947	358
*Inner toe	9 August, 1947 ?	382 (?)
Right hind-limb		
Outer toe	?	?
Middle toe	29 July, 1947	371
*Inner toe	30 September, 1947	434

In the case of the toes marked with an asterisk, the new hoofs were growing somewhat abnormally, that is to say with a concavity on the dorsal surface. This undoubtedly accounts for the longer period required for their complete attrition.

From the above table it is clear that in the case of the two fore-limbs the time required for the complete attrition of the large middle hoof was 281 and 282 days, whereas in the case of the hind-limb the periods for the middle hoof were 358 and 371 days respectively. The longer periods in the case of the hind-limbs may be due to the fact that more weight is carried by the fore-limbs, but it may also be partly due to the manner in which the fore and hind-limbs are placed on the ground. When the animal stands still, the fore-limb is practically vertical, but in the case of the hind-limb the pes (metatarsus) forms an angle with the crus (Pl. I, figs. 1 and 2). The latter position probably results in a slower rate of attrition of the middle hoof.

As Zuluana grew in size, the hoofs became thicker and more hoof-like (Bigalke, 1947, p. 52). On account of the greater weight on the hoofs as the animal grows, the attrition is correspondingly greater and the hoofs become much shorter (Pl. I, fig. 2).

URINATION AND DEFAECATION.

In the act of urination Zuluana straddles the hind-limbs and depresses the posterior part of the body. The tail is curved upwards to form an almost complete circle, and urination then takes place.

Previously it has been stated "that in the complete act of defaecation soil is scraped over the excrement by means of alternate backward movements of the two hind-limbs" (Bigalke, 1947). But when Zuluana was eating more solid food, it became clear that the object of the scraping movements of the hind-limbs was not to cover the excrement with soil (this was in any case precluded by the large heap of faeces voided at a time as the animal grew), but to disturb the heap of manure. It must be emphasized, however, that scraping with the hind-limbs was usually done in a rather indifferent manner. The act can certainly not be described as a scattering of the manure, since a few furrows in the heap were generally all that resulted. Although defaecation frequently took place in a corner of the enclosure on stone paving, the alternate scraping movements of the hind-limbs never seemed to be omitted.

Sometimes they were commenced even before the act of defaecation was complete, and sometimes the scraping hind-limbs hardly touched the heap of faeces.

Scattering of the manure by means of the anterior horn has not been observed, neither in the case of Zuluana nor in the case of a young bull White Rhinoceros received at a later date.

In the case of Zuluana defaecation generally seems to take place three times per day. In the act the tail is curled up and the hind-limbs straddled as in urination.

COPROPHAGY.

On October 15, 1946, that is to say at the age of 84 days, Zuluana's upper lip was seen to have excrement on it. The keeper stated that he had observed this previously on a number of occasions, and that he had also found excrement inside Zuluana's mouth. On December 8, 1946, the keeper actually saw Zuluana in the act of eating her droppings. It was clear, therefore, that the animal was eating her faeces, but principally at night-time. It is not known for what period this continued, but the habit seems to have ceased as the animal began to eat larger quantities of solid food.

Schneider (1936) has recorded coprophagy in another perissodactylous mammal, the Malay Tapir (*Rhinochoerus indicus*), but in this case it was associated with the sexual excitement of a pair of adult Malay Tapirs.

DRINKING.

Zuluana was first seen to drink water on December 4, 1946, when she was 134 days old. It cannot be asserted, however, that she had not drunk water previous to that date, though this seems probable in view of the large quantity of milk she was getting. In the act of drinking the lips are kept immersed in the water as in the case of the horse.

TOSSING INSTINCT.

A few days after Zuluana's receipt on July 29, 1946, it was observed that she sometimes made tossing movements with the head although the anterior horn was a mere boss at this stage. As tossing with the head is the means of defence of rhinoceroses, there can be no doubt that the tossing instinct is present at birth. At the age of 84 days Zuluana was inclined to toss the head upwards when handled for some time, when there was delay in giving her the bottle, and also when the native attendant ran straight towards her from the front.

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EXPLANATION OF THE PLATES.

PLATE I.

- Fig. 1. Zuluana at the age of six days (July 29, 1946). The dry vestige of the umbilical cord fell off on July 31, 1946.
2. Zuluana at the age of three years (July 23, 1949), showing the nuchal hump and the skin folds on the right side of the body.
3. Zuluana at the age of 58 days (September 19, 1946), showing the shedding of the stratum corneum.
4. Zuluana at the age of 15 days (August 7, 1946), showing the shield-shaped boss of the anterior horn.

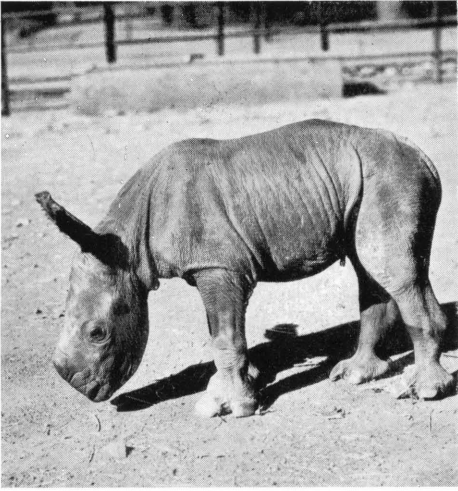
PLATE II.

- Fig. 5. Dorsal view of Zuluana's anterior horn showing the crescentic slit in the horn membrane (August 17, 1946).
6. Dorsal view of Zuluana's anterior horn showing the regenerated white tissue in the centre surrounded by horn fibres (September 14, 1946).
7. Left side view of Zuluana's head showing the anterior horn. Patches of old skin are adhering to parts of the head (December 21, 1946).
8. Dorsal view of Zuluana's anterior horn showing its oval shape and the basal collar at the age of six months (January 23, 1947).

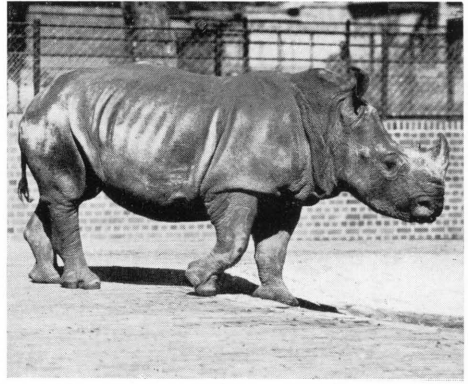
PLATE III.

- Fig. 9. View of Zuluana's anterior horn from the left side (March 21, 1947).
10. View of Zuluana's head from the left side showing the tiny knob of the posterior horn at 18 months (January 23, 1948).
11. Left fore-limb of Zuluana to show attrition of the baby hoofs and the growth of new hoof tissue (October 24, 1946).
12. Front view of Zuluana at the age of three years (July 23, 1949) showing the head, ears, nuchal hump and anterior horn.

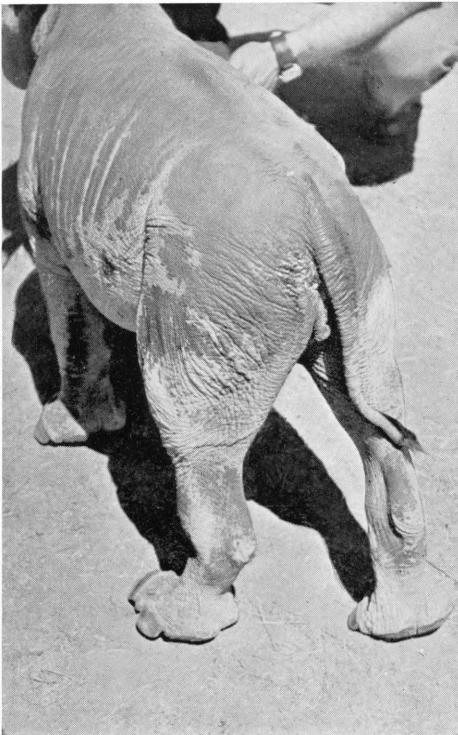
(Photographs of figures 1, 2, 4 and 12 by D. Wolff; figures 5-11 by R. Bigalke; figure 3 by W. Schack).



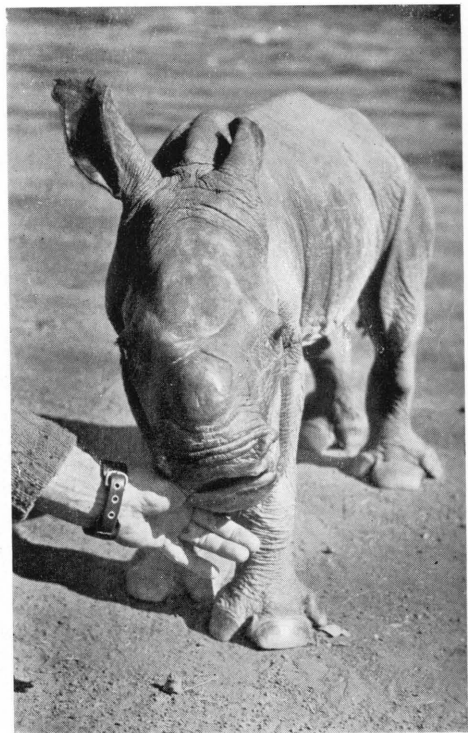
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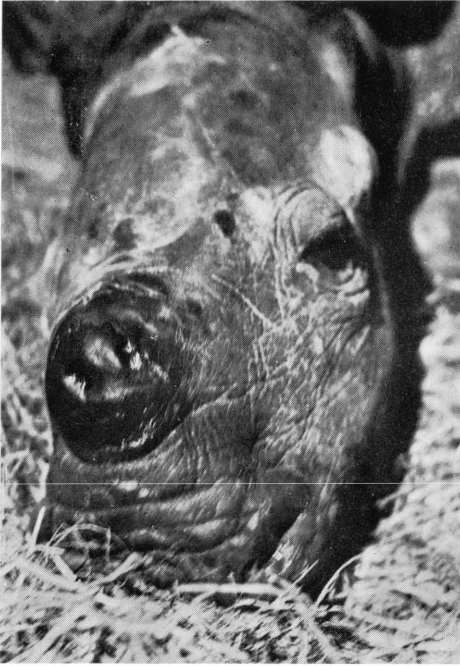
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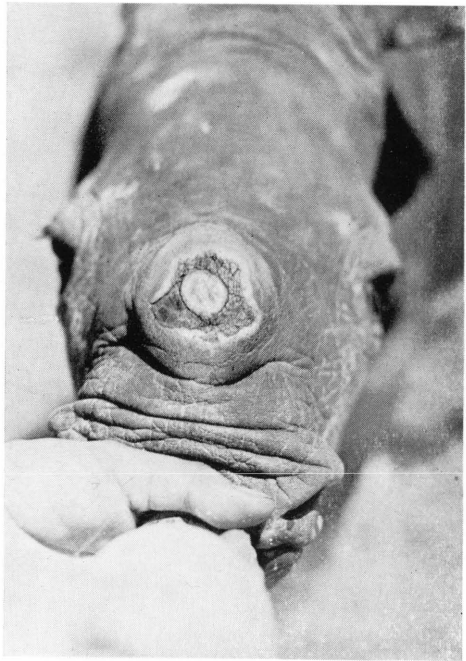
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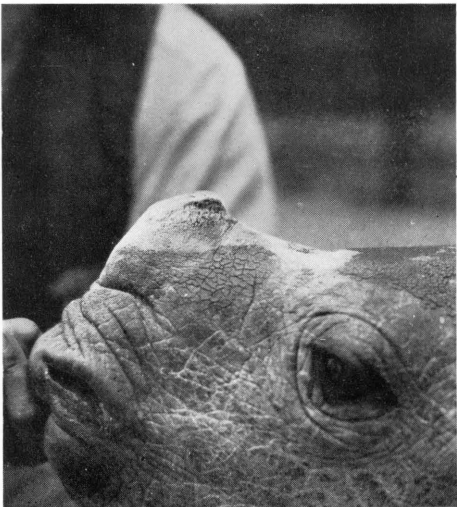
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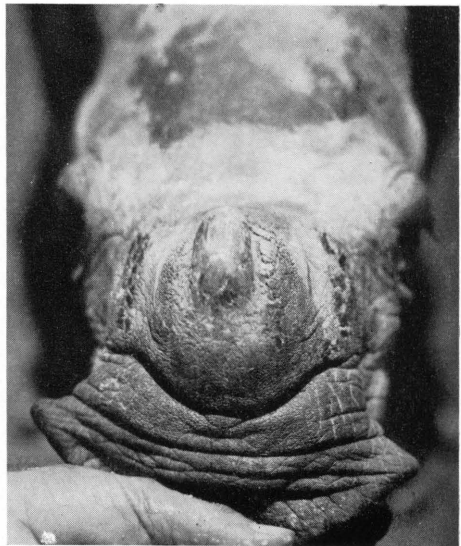
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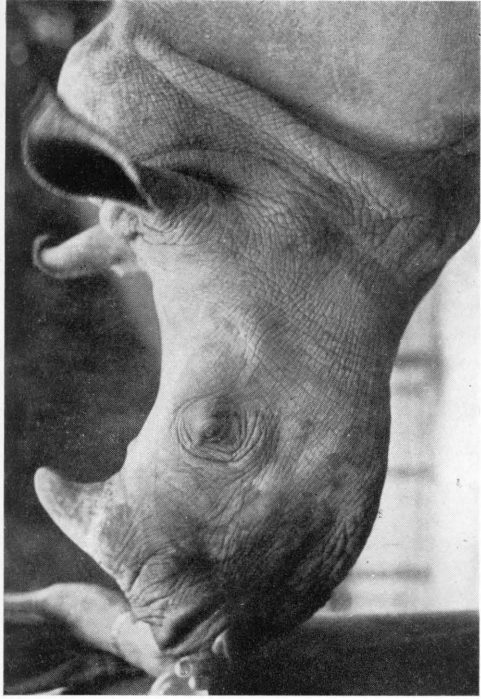
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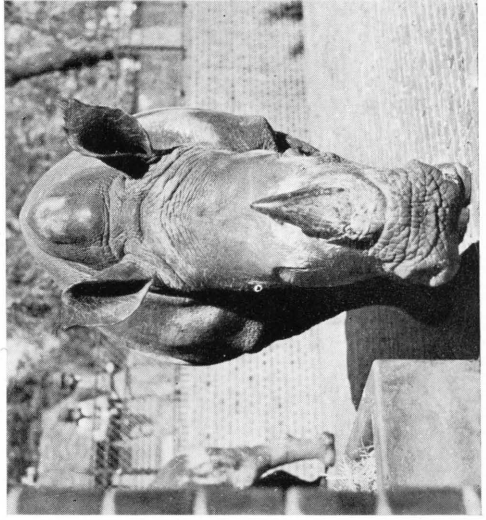
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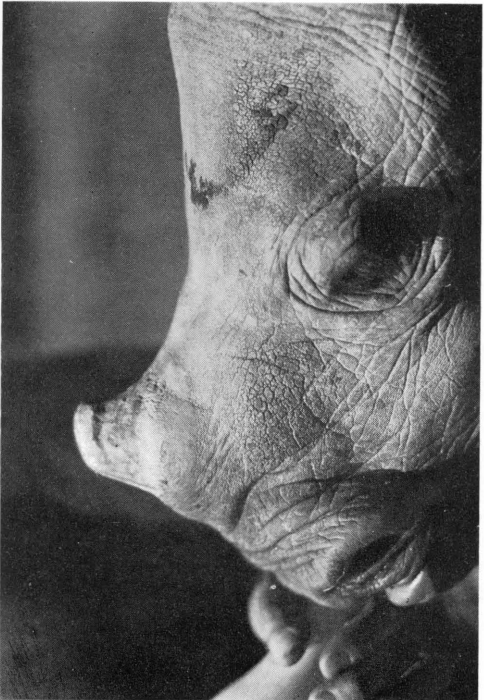
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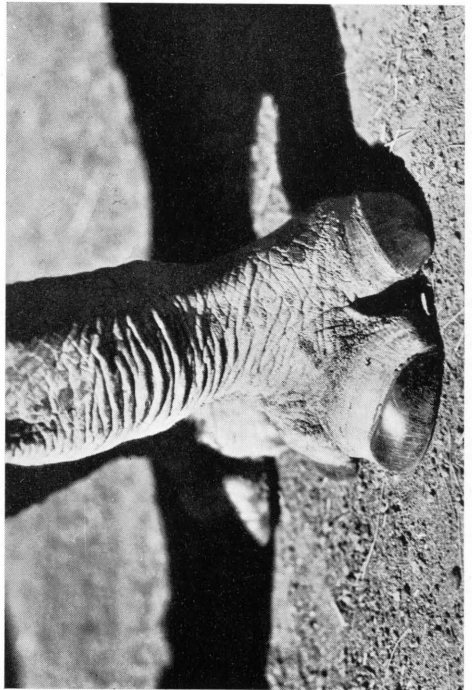
10



12



9



11