THE CHEMICAL CAPTURE OF ANIMALS

A Guide to the Chemical Restraint of Wild and Captive Animals

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dangerous situation arises that may readily result in the death of the animal. This is particularly true of rapidly metabolized compounds such as succinylcholine, where a part of the injected drug is already metabolized by the time peak absorption takes place. The small amount injected into a vein, will therefore constitute an effectively larger and therefore possibly lethal dose. A similar effect may also be produced with morphinomimetic substances, which, when injected quickly intravenously may cause bradycardia and hypotension, together with apnoea that may rapidly be fatal.

UNSUITABLE INJECTION ROUTES

Intravenous

This route is used for injection by hand in virtually all animals receiving antidote. The exceptions are lightly narcotized standing elephant and animals recovering rapidly, which are given intramuscular injections.

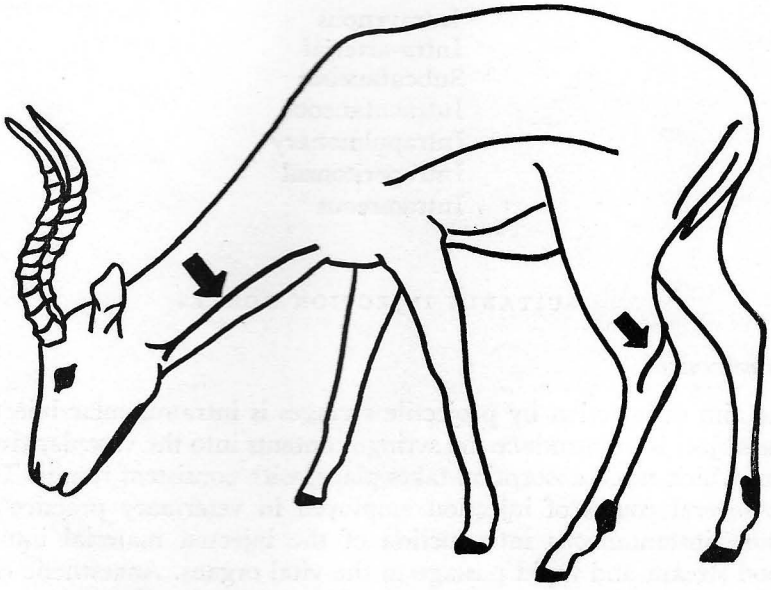

Fig. 1 Superficial veins of the antelope suitable for injection and blood sampling (jugular and recurrent tarsal).

Most antelope and giraffe are injected into the jugular vein, or the recurrent tarsal vein running laterally over the hock (see Fig. 1). Zebra have a number of superficial veins on the hind legs which are conveniently used (see Fig. 2). Elephant and rhinoceros have well-developed

Fig. 2 Course of saphenous vein in equidae.

ear veins (see Figs 3(a) and 3(b)), and elephants also have superficial veins in the hind limbs which may be used when standing. Hippopotamus appear to have no superficial veins on the body surface. Veins available under the tongue are not commonly used for injection. The recurrent tarsal vein is used in preference to the jugular vein in heavy necked animals such as buffalo, or animals with thick coats such as waterbuck and sable antelope. Some species of antelope, such as blesbok are most conveniently injected in the prominent radial vein just above the carpus in the front leg, while the vein is raised by gripping the upper leg or by a twist of rubber tubing easily released by the operator without assistance. The felidae are injected in the radial, recurrent tarsal, or the tail vein (see Figs 4 and 5).

Inadvertent intravenous injection does not occur frequently. When it does occur it has always been observed to follow remote injection into the jugular furrow area of the neck. Since using centrally-acting compounds, deaths from this cause, as far as could definitely be ascertained, have occurred only in rhinoceros.

Intra-arterial

Injections by the intra-arterial route are very much less likely to occur than by the intravenous route. The principal danger of giving

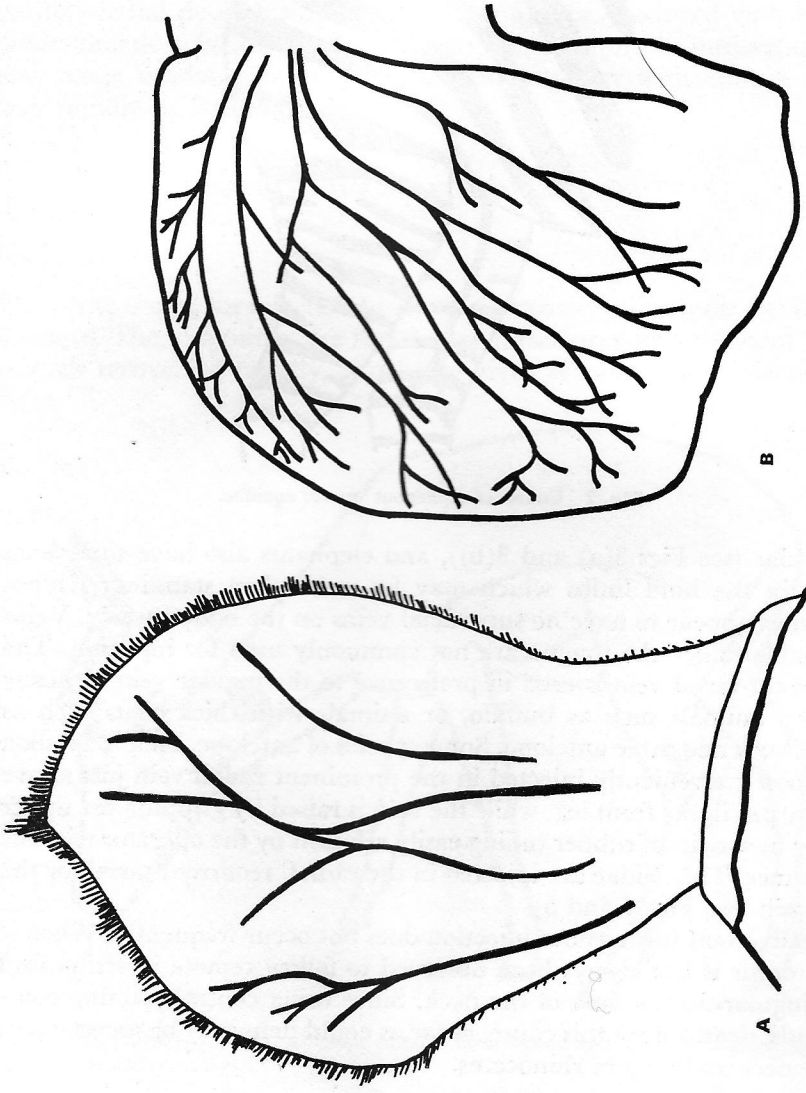

Fig. 3 Veins of the ear: (a) rhinoceros, (b) elephant.

To induce the effects needed for animal capture a combination of actions is employed namely, tranquillization, sedation, narcosis, analgesia, resulting in a state of so-called areflexia or mineralization. In addition there is also the condition of so-called dissociative anaesthesia (see below).

Tranquillizing effects

The tranquillizing effect is on the personality of the animal, inducing a state of behavioural change, loss of aggression, indifference to surroundings, and a degree of loss of sensation. A sedative effect which arises during the immobilization procedure from a combination of tranquillization, narcosis, and analgesia, induces depression of activity and sleep. Narcosis in man is usually defined as a state of deep sleep from which the subject is not readily aroused. It is used here in a slightly different context of a condition of stupor in which the animal exhibits markedly reduced reactions to stimuli, but is not asleep or necessarily recumbent. At the same time a state of analgesia obtains so that the reaction to bodily stimuli is reduced. Optimally, the activity is reduced, although this is not necessary for capture. The condition of so-called immobilization by centrally-acting compounds, has been referred to as areflexia, although in fact the normal body reflexes are functional, or mineralization although the animal may be ambulant.

Dissociative anaesthesia

The term dissociative anaesthesia has been used for the effects of phencyclidine and ketamine, where the animal retains many of its normal reactions; it is not necessarily unconscious, and is largely indifferent to stimuli. This condition has been widely employed for the capture of carnivores. In this condition the animal is incapable of walking, may be unconscious, will relapse into sleep if not stimulated and is generally unaggressive.

Analgesics and narcotics

The state of the hoofed-animal under the effect of etorphine-, fentanyl-, or diethylthiambutene-tranquillizer mixtures is different in that they are often able to stand and walk, or even run. Many basic body actions and reflexes are modified; the gait is abnormal and stilted, fear is largely lost. Aggression is in abeyance depending on the dose, but not always absent (see Plate 10). The senses of sight, smell, and to a lesser extent hearing, are dulled. Here again the animals seem unaware of their surroundings so that normally aggressive animals such as rhinoceros may

be handled while standing (see Plate 11). They are not unconscious of their surroundings, however, and evince a lively curiosity (see Plates 4 and 8). Animals that approach cars or people standing still, while lightly narcotized is an interesting and frequently observed phenomenon, which may be duplicated under laboratory conditions in timid domestic animals such as sheep (Harthoorn 1965). In other cases the animal's entire attention appears to be taken up with a particular impulsive action such as eating.

Animals in this condition of so-called narcosis are usually easily handled. They frequently are stopped by some minor object which they would normally brush aside, walk through, or avoid (see Plate 7). Rhinoceros are frequently stopped by placing a rope on a hind leg by hand, giraffe similarly (if sufficient persons are not available to stop him in the recommended way) (see p. 208 and Plate 5), but with a rope on a pole (Harthoorn, 1970). Antelope and giraffe are captured easily and safely by walking them into a rope. Animals are easily restrained from walking away by holding the head or horns (see Plate 12).

ADVANTAGES OF CENTRALLY-ACTING COMPOUNDS

The advantages of immobilization with centrally-acting compounds may be listed as follows:

(i) Wide safety margin.
(ii) Low or zero mortality.
(iii) The sparing action on the basic physiological mechanisms of the body.
(iv) Retention of righting reflexes and postural reflexes.
(v) Ease of handling of the immobilized animal.
(vi) The possibility of effective reversal of drug effect.
(vii) The possibility of graded reversal to render the animal ambulant but still tractable.
(viii) Minimal infliction of fear, distress and pain.

Safety margin

This has already been mentioned earlier (p. 51). The term itself is misleading as the margin stretches either side of the optimal dose, and could better be called effective margin. A wide effective margin enables animals that are underdosed, to be captured, as animals become sufficiently affected with half or less of the optimal dosage rate. This results in a considerable saving of syringes, drug dosages and time, as well as the animals themselves, which have been noticed to become sufficiently incapacitated (or perhaps just singled out by predators) to jeopardize their survival.

The dosage rate of 100 white rhinoceros captured successfully with a thiambutene mixture was later shown to vary eight-fold per unit of estimated body weight. None of the animals failed to recover from the drug dose although inevitably mortality occurred from accidents particularly during crating and deaths from disease during the acclimatization period in the holding enclosures.

Low or zero mortality

This is essential for exercises involving the capture of rare or diminishing species or dealing with zoo animals. Many of the exercises for the capture of rare animals are now only undertaken because it is reasonably certain that the casualty rate will be very low. Furthermore the casualty rate from accidents and other causes associated with taming and artificial feed, are largely predictable. More animals are being captured in this way, now that the mortality rates are not only very low (see Chapters 8 and 9), but that these are plainly recorded and as a result authorities are becoming confident of immobilizing methods in the hands of trained operators; also now that the appalling death rates are known which occur when professional animal dealers purchase immature specimens of rare and delicate animals previously ordered from native hunters, a mortality which does not take into account the young that have already died before they could be carried to the dealer, or the mothers that are customarily shot to facilitate capture of the babies. A mortality rate exceeding 90 per cent has been observed among young elephants captured by trappers. The main reason for this high mortality is that young are taken when they are still being suckled.

Using small doses of centrally-acting drugs injected without alarming the herd, the elder of two youngsters from one female is easily captured as he drops behind after injection. Such youngsters are weaned and take readily to cut or artificial foods, tame rapidly and generally survive. The mortality that results from transport and taming of various animals such as the rhinoceros mentioned above, is a factor that is likely to improve with experience, better accommodation and transport, increased knowledge of food preferences and treatment of disease. Mortality resulting from the use of unsuitable, outmoded or improperly administered drugs is less easily condoned, and not so amenable to correction, except by using tried and tested compounds.

Physiological mechanisms

The maintenance of normal body functions is highly important especially for the capture of the larger animals. Rhinoceros and giraffe and to a lesser extent hippopotamus and elephant are very delicate

Plate 3 Typical high-stepping in animals injected with morphinomimetic compounds; etorphine-hyoscine narcosis.

Plate 4 The eye is fixed and staring as a narcotized rhinoceros approaches the Landrover.

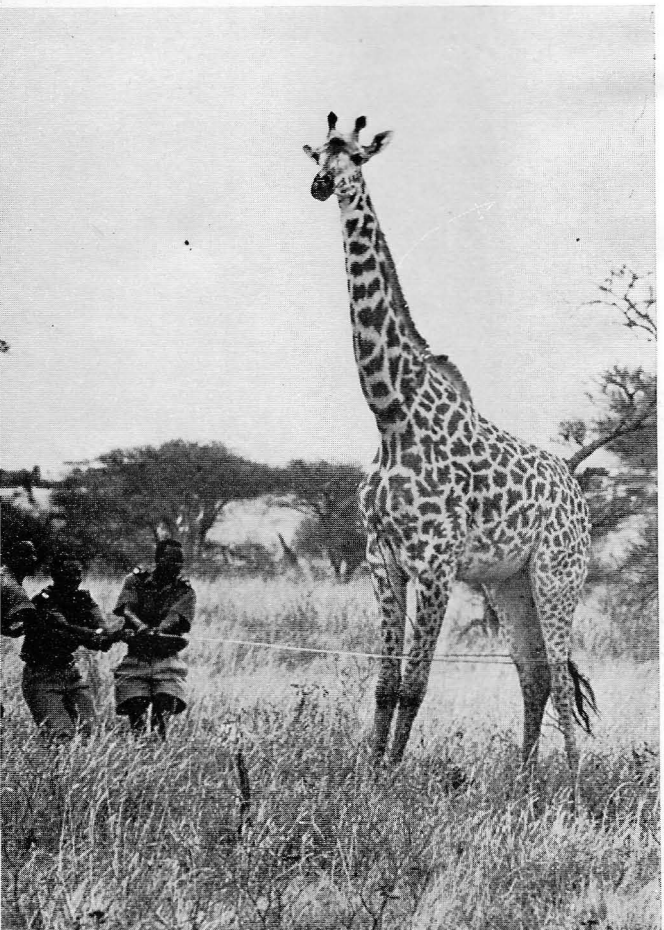

Plate 5 Adult giraffe captured with a rope while ambulant (note poacher's snare round neck), Tsavo National Park; etorphine-azaperone-acetyl-promazine.

Plate 8 Syringes placed correctly in two rhinoceros: both approach Landrover while under etorphine-hyoscine.

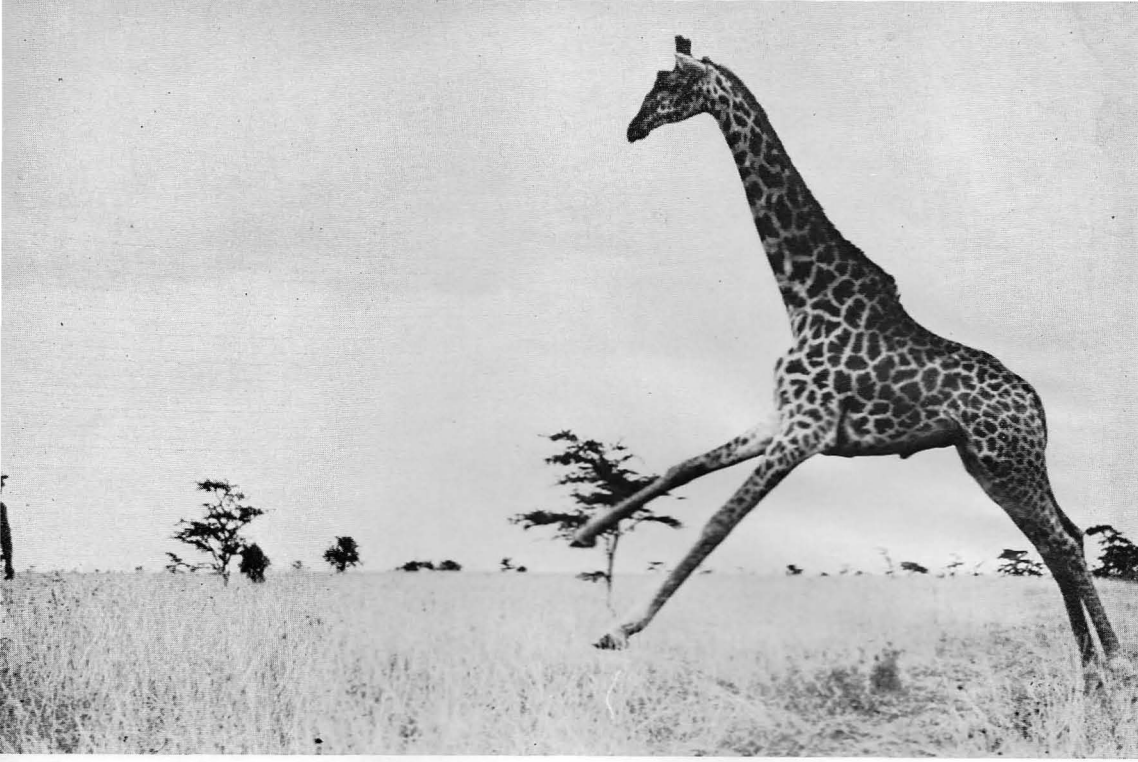

Plate 10 Adult male resents approach: later led to enclosure for relocation to national park; *Themalon*-chlorpromazine.

Plate 11 The standing posture is advantageous for measuring: ranger with white rhinoceros.

greatly facilitated by administering 20 g of chloral hydrate nightly in food. Other compounds such as diazepam may be given in the same way in food, or some compounds, after a period of deprivation, in water. Large apes have been handled successfully after the oral administration of droperidol (see p. 234), and carnivores are readily sedated to the point of anaesthesia, by feeding meat which has been previously injected with phencyclidine.

After suitable sedation, the intravenous route is available in many animals, and intramuscular injections may be given by hand or even by extension syringe with considerably greater accuracy than is possible by remote injection.

The possibility of premedication

As mentioned above, premedication may be carried out by administering tranquillizers in food and water, if necessary over periods of days or longer. It may also be effected through multiple injections (see above) when tranquillizers or sedatives may be given some time before the immobilizing dose. This modifies the reaction to immobilization and is often effective in reducing the amount of immobilizing compounds and anaesthetic needed.

The availability of apparatus

Captive animals are more readily resuscitated than animals under field conditions on account of the apparatus available. Positive pressure respiratory apparatus is used when a large animal stops breathing, such as a polar bear immobilized with curare (*Flexibil*, Boehringer) (Heck Jr. 1965), and other aids may be used such as the walk-in refrigerator in which a cheetah was cooled on exhibiting a steep temperature rise after phencyclidine-promazine anaesthesia (to 42·2°C) accompanied by convulsions (Seal & Erickson 1969). During deep anaesthesia and extensive operation in the field, (Harthoorn et al. 1971) a number of problems are apt to arise from lack of trained help to maintain anaesthesia and also from a shortage of instruments.

Aftercare

Aftercare is particularly difficult in the field and wild animals usually have to be released immediately after the particular interference is completed. When animals can be taken to enclosures, the stress of unaccustomed captivity tends to retard healing and recovery. Exceptions are rhinoceroses which take more readily to captivity than most other animals, and Plate 14 shows a black rhinoceros captured to treat a severe spear wound in the shoulder, which healed successfully before

release. Other rhinoceros have been similarly treated for other conditions mainly for removal of, and treatment of wounds caused by poachers' snares, and one large abscess formation of the sheath supposedly caused by a horn wound. Attempts to keep lions in captivity after operations were only partially successful owing to the restlessness induced in this way. One lion restricted to a wire mesh enclosure after intramedullary fixation of the humerus, jumped from the roof of a Land-Rover within a few days after the operation and the bone, whether for this or other reasons, eventually had to be plated. Other animals such as the giraffe, depicted in Plate 5 which had a deeply embedded poachers' snare round the neck, was released immediately as it would have been quite impossible to procure a crate and enclosure for an adult giraffe in the available time. She survived at least for 10 days, when she was observed while still easily recognizable by the bright yellow iodoform ointment which covered the snare wound.

Captivity may be a disadvantage in that resistance of animals is usually lower under artificial conditions than in the wild, at least while the forage is good. Careful documentation during capture of white rhinoceros in Natal indicated that intractable abscess formations at the injection site of the 15 ml or so of the compounds used at the time (diethylthiambutene, hyoscine and chlorpromazine), were frequent in animals removed to holding enclosures, but were not seen in any of the rhinoceroses captured for marking purposes only. Antibiotic treatment and regular spraying of the surface of the needle wound makes a simple infection from the conditions in the enclosures unlikely, and therefore the abscess formation is more likely to be due to lowered resistance.

Partial immobilization and extension syringes

Full immobilization is seldom necessary under captive conditions. Most of the procedures for which restraint is required are effected quickly with little disturbance to the animal. In this way the chemical restraint of 480 hoofed stock injected with xylazine was described with a mortality of 4 of which one was purposely destroyed. Besides these there were 5 elephant, and 2 rhinoceros. Many of these were injected to move them from one paddock (10 to 80 acres) to another. A total of 570 lions were also immobilized in this way with no mortality attributable to the use of drugs (York & Quinn 1973). Similar results were obtained in 150 cases of 17 different species of wild ruminants injected for capture, transport and shipment of shy and aggressive animals, handling of injured animals, therapeutic treatment and obstetric assistance (Gauckler & Kraus 1970).

The first injection is usually given with a projectile syringe fired from

Plate 13 Tonic convulsions in leopard immobilized with phencyclidine: later these were controlled with barbiturates.

Plate 14 Black rhinoceros convalescing from spear wound in shoulder: shortly before release.