CHEETAH CAPTURE AND IMMOBILISATION HANDBOOK

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CHEETAH CONSERVATION FUND, OTJIWARONGO, NAMIBIA

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Introduction

The cheetah (*Acinonyx jubatus)* is a highly specialised and effective hunter, and, as recently as 1900, had a vast geographic range that spanned Africa, the Middle East and across Asia into the Indian subcontinent. During the past century, however, cheetahs have suffered a dramatic decline in both range and numbers, and while the African cheetah still numbers approximately 15 000 individuals, the Asiatic cheetah (*Acinonyx jubatus venaticus*) has been pushed to the very brink of extinction. This subspecies is now thought only to exist in Asia, with a small, fragmented population of perhaps 50 animals remaining in Iran.

Faced with such rapid decline over the past century, it is vital for conservationists across the globe to work together to formulate effective conservation strategies for the cheetah. Training future researchers is a critical part of this endeavour, and particular emphasis should be placed on capacity-building and training within cheetah range countries, so that local scientists are as well-equipped as possible to conduct necessary research and make the best-informed decisions for future conservation work. Some of this research is likely to involve invasive handling of cheetahs, whether to collect biomedical samples, radio-collar animals for future tracking, or to remove cheetahs from conflict situations. This handbook covers some of the basic techniques used at CCF for such procedures, and this information can be a useful tool for training new scientists. Through such education and training, we hope that the most effective strategies can be put in place to attempt to halt the cheetah's rapid population decline, and to conserve a population that is viable in the longer term.

Section 1 – Background

(1.1) Cheetah subspeciation

Although seven subspecies have been identified, five subspecies are considered valid by most taxonomists (Smithers 1975), namely:

(a) Acinonyx jubatus venaticus (Griffith, 1821) – the North African/Asiatic cheetah
Characteristics: Smaller than the East African cheetah, with shorter legs, no mane on nape of neck or belly, small widely spaced spots.

(b) Acinonyx jubatus hecki (Hilzheimer 1913) – the West African cheetah
Characteristics: Small body size (dainty), pale coat colour.

(c) Acinonyx jubatus soemmeringii (Fitzinger 1855) – the Central African cheetah
Characteristics: Smaller spots, widely separated, hind feet spotted, pale coat colour.

(d) Acinonyx jubatus raineyii (Heller 1913) – the East African cheetah
Characteristics: Longer hair similar to *A. j. velox* (extinct), but shorter, still has neck and belly hair, coat colour is paler, fewer spots on back.

(e) Acinonyx jubatus jubatus (Schreber 1776) – the Southern African cheetah.
Characteristics: Smaller body size, small, well-separated spots

Some taxonomists argue that sub-populations are markedly different and have thus become isolated from other populations with which they are grouped (Nowell & Jackson 1996), but the validity of the existence of sub-species is questionable due to genetic research which has shown the genetic distance between two subspecies *A. j. jubatus* and *A. j. raineyi*, is trivial, 10 to 100 times less, for example, than the genetic distance between human racial groups (O'Brien, et al. 1987). At present though, the genetics of the central African, North African, West African and Asiatic cheetahs are yet to be investigated.

<u>(1.2) Current cheetah distribution worldwide</u>

The population of cheetah has declined by nearly 90% since the turn of the century (Marker 1998) at which time the population was estimated at 100,000 individuals found throughout Asia, India, Africa and the Middle East (Myers 1975). Despite widespread distribution, cheetah populations have been greatly reduced. Over the past 50 years cheetah have become extinct in over 13 countries.

Historically, the Asiatic cheetah (*A. j. venaticus*) was widely distributed throughout Asia. Today this subspecies has suffered a devastating decline of available habitat and prey and is nearly extinct (Kraus & Marker-Kraus 1992; Nowell & Jackson 1996), with the remaining population estimated to number fewer than 200 cheetahs (Asadi 1998; Marker 1998).

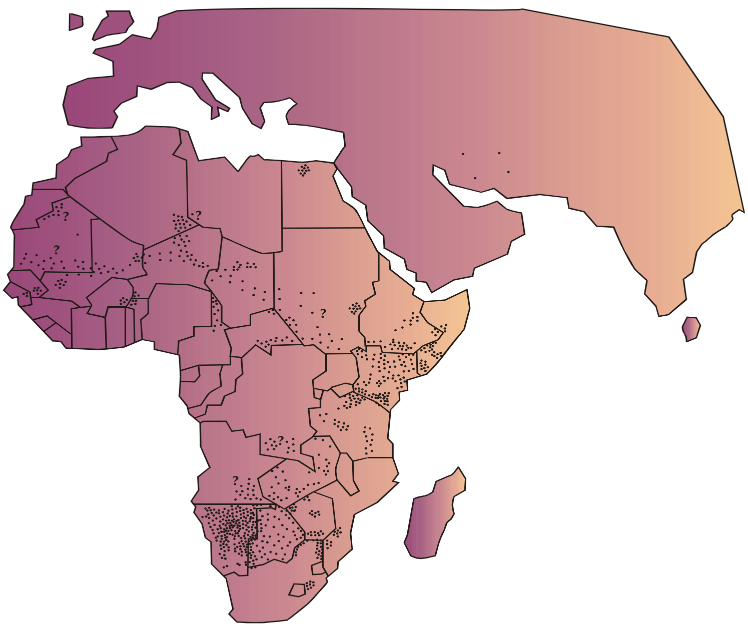
A census of such an elusive species as the cheetah is very difficult, particularly since it is largely diurnal and widely roaming. There has not been a comprehensive survey of African cheetah since 1975, when Norman Myers calculated the African population of cheetah to be between 7,000 and 23,000 animals in 25 countries. The population of cheetah in Africa had decreased by half since the 1960's (Myers 1975). On the basis of his research, he estimated that there would be less than 10,000 cheetahs by 1980. Current information about the status of the cheetah in many countries, especially countries that have been engaged in long civil wars, is lacking.

Today, small, fragmented populations of free-ranging cheetah inhabit a broad section of Africa including areas of North Africa, the Sahel**,** East, and southern Africa. From the information gathered, the current cheetah population is estimated at less than 15,000 animals throughout their range, with a low estimate of 9,000 animals and an optimistic estimate of 12,000 animals (Nowell 1996, Marker 1998). Cheetah populations are found in 29 African and 2 Asiatic countries (Marker 1998).

Perhaps for the cheetah, though, individual numbers of animals may not be the important point. The question is, what are the numbers of viable populations still existing? Viable populations may be found in only half or less of the countries where cheetahs still exist. They include the following countries: Algeria, Angola, Benin, Burkina Faso, Botswana, Cameroon, Central African Republic, Democratic Republic of Congo, Egypt, Ethiopia, Gambia, Kenya, Libya, Malawi, Mali, Mauritania, Mozambique, Namibia, Niger, Senegal, Somalia, South Africa, Sudan, Tanzania, Tunisia, Uganda, Western Sahara, Zambia, Zimbabwe, Iran and Pakistan (Marker 1998).

There has been limited information from North or West Africa in the form of personal correspondence with field researchers and the cheetah's future in these areas is questionable (Plowes 1991; de Smet 1990; Newby 1990; Grettenberger 1987; O'Mopsan 1998). Cheetahs continue to survive in small, pocketed groups in isolated areas throughout the Sahel. Most of these populations though cannot be considered viable for long-term survival. Controlling factors are: small populations, restricted habitats with a limited prey base, conflict with nomadic herder, and wars that have supplied guns and ammunitions to the populace who poach all forms of wildlife for food and profit. The two remaining strongholds are Kenya and Tanzania in East Africa, and Namibia, Botswana and Zimbabwe in southern Africa (Marker 1998).

Figure 1: Current world cheetah distribution



Section 2: Physical capture of cheetahs

(2.1) Methods of physical capture

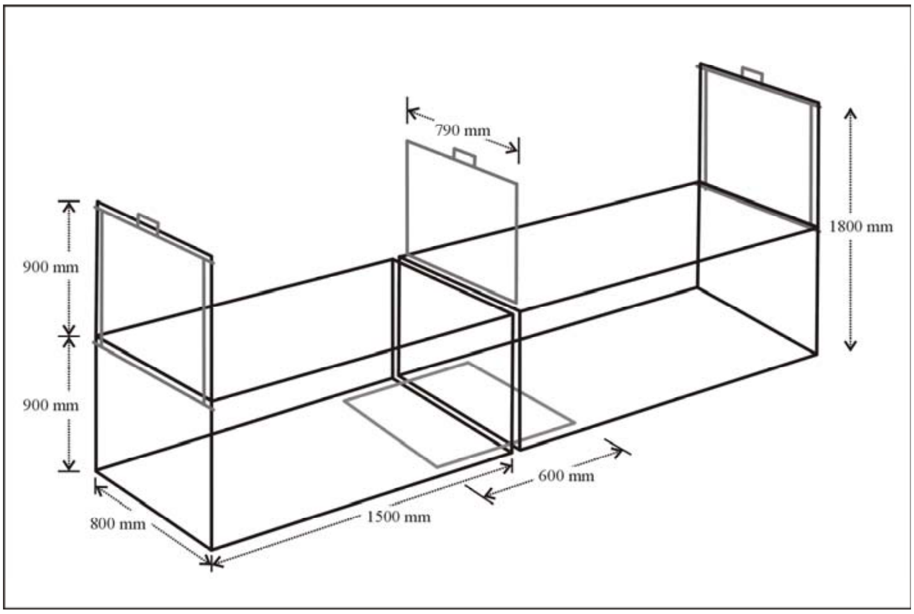
Various methods of physical capture are available for the capture of carnivores, and they include the use of different traps. The main three types of carnivore traps are as follows:

- Box traps (also known as capture cages)
- Gin traps (not recommended)
- Padded leg-hold traps (not recommended for cheetah capture)

(a) Box-traps

Cheetahs should be captured using box traps, and the design of such traps is shown below. Such traps usually measure around 2m by 0.75m, and allow the captured animal some space to move around. In addition, more than one animal can be held for short periods in box traps, for instance when several members of a social group are captured, although the time for such holding should always be kept to a minimum. Box traps should be built using strong, sturdy material without sharp pieces of metal where a trapped animal could injure itself. If used properly, the risk of injury using box traps is relatively low, although it is critical that the guidelines set out for their use should be strictly followed. Additional advantages of box traps include easy transfer of trapped cheetahs from the trap to a transport crate, while non-target animals captured can be released easily and without harm.

Figure 2: Design of a box-trap



(b) Other capture techniques

Leg-hold traps, even padded ones, can often cause injury unless they are very sophisticated, and are not recommended as a way of catching cheetahs. Gin traps especially cause serious injury and should NEVER be used as a method of capture. The picture below demonstrates the damage that can be caused to animals captured in this way.

<u>Figure 3</u>: Injury caused by a gin trap

Additionally, while it is possible to capture cheetahs by physically running them down, the technique should also NEVER be used, as it is extremely stressful for the cheetah and the successful capture of an entire social group is very unlikely.

<u>(2.2) Placement of cheetah traps</u>

A trap just placed at random out in the bush or desert is unlikely to be effective at capturing cheetahs. For the successful placement of a cheetah trap, it is necessary to understand the ecology and behaviour of cheetahs in that area.

(a) Use of habitual scent-marking sites

In Namibia, cheetahs (particularly adult males) use certain trees as scent-marking locations, and these so-called 'playtrees' are effective sites for placing traps, although they are unlikely to capture a representative sample of the cheetah population.

In other countries, the use of playtrees has not been documented, but local people may know of areas and structures where cheetahs frequent and use to defaecate and scent-mark – for instance, the use of cement block road-signs in Zimbabwe. Such sites are very good capture locations as they have a relatively high visitation rate, and the cheetahs tend to have a strong desire to get to the scent-marking site. This drive is used to capture cheetahs, by blocking off access to the site and leaving only one access route, in which a box-trap is placed. In Namibia, for instance, thorn bushes are cut down and packed around playtrees, with a trap placed as the only way to get to the tree.

Figure 4: Placement of a box-trap by a playtree

(b) Roadways and fence-lines

In areas where sites such as playtrees are not known or cannot be used, another potential capture site is along roadways and fence-lines. Especially in areas of fairly dense vegetation, cheetahs, as well as other animals, tend to walk along roads and tracks. If such a route is blocked off, for instance by using bushes to create a barrier, a cheetah will often walk through an open gap where a box-trap can be placed. Fence-lines are another popular route used by cheetahs and the same technique can be used to capture cheetahs along fences. The most effective locations will be in areas where there is some evidence, for instance by sightings of tracks, that cheetahs use those routes relatively regularly.

Figure 5: Setting a trap along a road

(c) Waterpoints and livestock camps

In arid, open areas where there is little need for cheetahs to use roads or tracks, a more useful site of capture may be at waterpoints, whether it is a dam, waterhole or trough. Box-traps can be set up near waterpoints, ideally in a location that is not too exposed and set on the most likely route from the bush to the water.

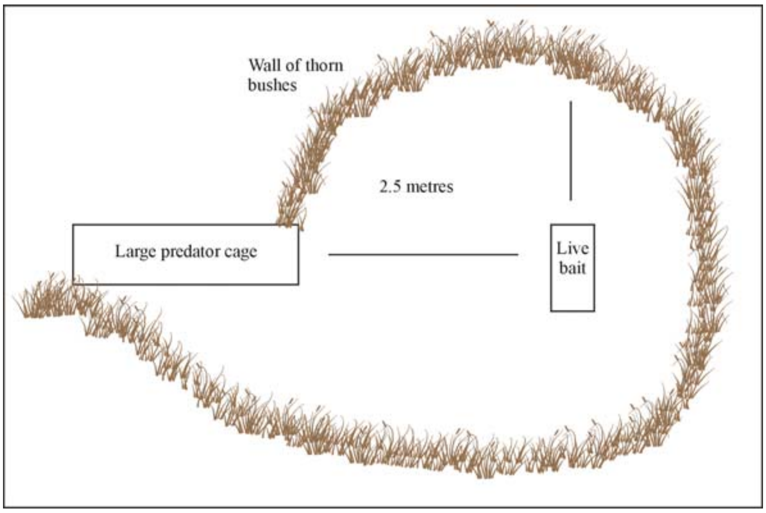
Livestock camps can occasionally be useful sites for setting cheetah traps, especially if an animal in the area has become a habitual stock-raider. Again, the same principles apply, with creating a route that seems to provide access to the camp, encouraging the cheetah to take that path, and placing a box-trap as the only way of getting to the camp.

(d) The use of camouflage and bait

Although traps for many carnivore species must be carefully camouflaged and are usually set with either live or dead bait, in most of the cases outlined above cheetahs will enter a box-trap even if it is very visible and contains no bait. That applies most in cases where the cheetah has a strong drive to get to the site in question, for instance a playtree or sometimes a livestock camp.

The only times where bait may be necessary are when there is no way of blocking off all potential routes of access for cheetahs, for instance around a waterhole. In such cases, a cage can be placed alongside the set cheetah trap, containing an animal such as a young goat or lamb that will call and attract the predator to that spot. If this is done, it is vital that the animal being used as a lure has adequate shade, food, water and bedding, is checked regularly and is not left for too long in the lure cage.

Figure 6: Using bait to catch a cheetah



(2.3) Catching an entire group of cheetahs

Cheetahs are relatively social felids, and as such often live in groups, such as a mother with cubs, newly independent littermate groups or a coalition of adult males. If one cheetah is captured, it is vital to ensure that the entire social group is trapped at the same time. If this does not happen, cubs still dependent on their mother (cheetah cubs are not independent until 16-18 months old) may starve, while the members of the group that remain free may struggle to hunt after losing a group member and may resort to taking livestock.

To make sure that the entire group of cheetahs is captured, when one capture is made adjacent traps should be set up beside the trapped individual. These traps should be left open for at least another day and night, with other access points to the trapped cheetah blocked off, ensuring that the trapped cat has plenty of shade and water, as well as some food if it has been trapped for more than one night.

Figure 7: Members of a social group being used to catch other group members

In this way, the captured cheetah's calls should attract social group members and they should subsequently be able to be trapped. Once two cheetahs have been captured, the one captured first can be removed to a holding facility while the procedure is repeated with the second cat, until it is fairly certain that all members of the social group have been captured. Some farmers use scat (faeces) from trapped cheetahs to try to capture other cheetahs in the area. It is important to check around the trap sites regularly for signs such as fresh cheetah tracks as an indication of whether there are other cheetahs in the group still free.

(2.4) Handling cheetahs once they have been captured

Once the entire social group has been caught, the cheetahs must be removed and taken to the holding facility for examination. This is done by transferring the animals from the box trap into a **transport crate** and the method used will be demonstrated during the course at CCF. Ideally, the transport crate should be fitted with a **squeeze panel** to ensure easy administration of the anaesthetic once the cheetah is at the holding facility.

Cheetahs trapped in cages are very easily stressed and this should always be at the forefront of your mind. People should approach the box trap slowly and quietly, with only essential personnel coming up to the trap. All noise should be kept to a minimum, with no-one talking loudly, approaching closely in vehicles etc. To transfer the cheetah, everyone apart from the person necessary to close the crate door should stand back and stay at the end furthest from the transport crate, to encourage the cheetah into it. The transport crate should be kept dark, e.g. by covering it with a blanket, and should have no-one standing around it for the transfer. Most cheetahs will move into the crate fairly easily, although sometimes it takes a little time. **Harassing the cat to move quickly by shouting and poking at it is unlikely to help speed things up and will just stress the cheetah involved.**

(2.5) Human safety

Although cheetahs will not attack a human in the wild, they are still wild animals and as such can be dangerous when captured or cornered. Because of this, cheetahs should always be given some space when they are confined in small areas, to avoid getting into dangerous situations. Care should be taken when approaching trapped cheetahs, as they will become very stressed and may strike out at the observers. This is particularly important to be aware of when using traps with vertical bars, as cheetahs can get their legs through the bars and can potentially cause quite serious injuries if people get too close. Keep people around the traps to a minimum, and be careful and observant at all times.

Important points regarding physical capture: a summary

- **Traps should be set ensuring that there is adequate shade and water for captured animals, and food must be provided if the animal is held for several days**
- **Traps MUST be checked regularly (at least daily, preferably early in the day, especially in a hot location)**
- **All possible efforts must be made to capture all members of a social group at the same time**
- **People and domestic animals etc. should be kept away from trapped cheetahs as much as possible.**
- **Take care not to stress the animal in the trap, and be observant about human safety**

Section 3 - Chemical capture

(3.1) Preparations before chemical capture

If the animal to be immobilised is already in a well-managed captive situation, then it should ideally be fasted for at 24-48 hours, and have no water for the two hours prior to the administration of the capture drugs. Water should not be restricted, however, in situations where the animal is likely to dehydrate rapidly, e.g. if it is in a trap cage on a hot day. Water must ALWAYS be removed prior to administering any drugs, however, as a disorientated animal under the effects of drug administration may drown in any water if it is left available. If the animal is having to undergo repeated anaesthesia every few days, for instance for veterinary treatment, then it may be necessary to provide food more frequently, although a 24-hour fast before anaesthesia is still advisable.

If the cheetah is held as one of a group, then it should be separated from other animals prior to being anaesthetised, as it is at risk of being attacked by them once the drug starts to take effect.

Before using drugs to immobilise a wild animal, the following factors must be considered:

- Which anaesthetic agent to use, and its properties, effects, hazards and legal regulation for use
- Which method of drug administration is to be used
- Whether the personnel involved have all the equipment and expertise necessary to successfully perform the anaesthesia

(3.2) Choosing an anaesthetic agent

There are numerous agents that can be used, alone or in combination, to immobilise wild animals, and there are several good reference books on the subject to decide which is best for a particular situation (see *The Capture and Care Manual, McKenzie 1993)*. Many drugs can have adverse effects on cheetahs, and the drug usually chosen at CCF for dealing with cheetahs is Telazol, which is a 1:1 combination of tiletamine hydrochloride and Zolazepam.

The Telazol used at CCF contains 250mg tiletamine and 250mg zolazepam in a glass vial and requires hydration with water before use. The standard ratio of water to Telazol is 1ml for 100mg, i.e. 5ml of sterile water is added to the 500mg vial for use in cheetahs to give a 100mg/ml solution. The concentration should be **clearly marked** on the vial in question to ensure that there is no confusion regarding the dose given.

Telazol is used as it has a wide safety margin (also called a therapeutic index), i.e. the lethal dose is far higher than that required to achieve effective anaesthesia, and a degree of overdose can be tolerated without severe effects. This is particularly important when dealing with wild animals, as the dose given depends on body weight, which must be estimated in advance, often without a close examination of the animal in question.

Some anaesthetic agents have a reversal agent that can be administered in the case of an emergency (e.g. atipamezole reverses the effects of medetomidine), but this is not the case with Telazol. Although the existence of a reversal agent is an advantage, the wide safety margin of Telazol means that it is a relatively safe anaesthetic drug to use and the need for such reversal should be low.

Advantages and disadvantages of Telazol (Burroughs 1993):

Advantages - Wide therapeutic index
Rapid, smooth induction
Good muscle relaxation
Good pain killing effect
Minimal cardiac and respiratory depression
Rapid, smooth recovery

Disadvantages – Excessive salivation
Once powder is rehydrated, it should be used within three days if not refrigerated, or within one week if kept in a fridge. Because of this, it is important to **label** the rehydrated solution with the date of hydration.
No antidote is available

During the many years of using Telazol at CCF, we have never experienced serious problems with excessive salivation, and find Telazol to be effective for up to three weeks if kept refrigerated, but it is essential for all concerned to be aware of these potential problems.

Certain drugs available for anaesthesia can be very dangerous for the administrator, and care should always be taken when handling such substances. People who are likely to be handling any drugs should ensure in advance that they, and their co-workers, are fully aware of the potential effects of the drugs being used and the course of action to be taken in the event of a spillage or overdose, whether human or animal. In addition, laws governing the handling and administration of such agents vary between countries and it is the researcher's responsibility to ensure that such rules are understood and followed properly.

(3.3) Dosage

Dosage depends on the anaesthetic agent used, but Telazol is administered to cheetahs **intramuscularly** at a dose of **4mg/ml**. It is important for researchers to be able to accurately estimate the weight of captured cheetahs, to give the correct dose required for good anaesthesia. A guide to the average weights of cheetahs in different age groups, and the dose to administer, is shown below.

Table 1: Weights and dosage for cheetahs of different ages

Age group (years)	Average weight		Dose of Telazol (mg)		Volume of 100mg/ml solution (ml)	
	Male	Female	Male	Female	Male	Female
0 - 6 months	15	13	60	52	0.60	0.52
6 months - 1 year	19	19	76	76	0.76	0.76
1 - 1.5 years	37	30	148	120	1.48	1.20
1.5 - 4 years	42	35	168	140	1.68	1.40
4 - 8 years	46	37	184	148	1.84	1.48
8 - 12 years	46	38	184	152	1.84	1.52
Over 12 years	39	36	156	144	1.56	1.44

The dose given should be slightly lower for old animals or those that are dehydrated or in poor condition. In one rather extreme example, an adult male cheetah of about 4 years of age came in to CCF exceptionally dehydrated, and although the usual dose for him would be around 160mg, only 50mg gave deep anaesthesia for several hours. Alternatively, procedures that are particularly invasive or painful may require a slightly higher dosage. It is always important to get another person to **double-check** the dose being given, regarding the concentration of the solution, the estimated dose that is appropriate and the volume of solution being drawn up. When drawing up the dose, air should gently be squeezed out of the syringe to avoid error in measuring the volume. In addition, the bottle and batch number of the drug given should be noted down for future reference in case of any adverse reaction.

It is important that the entire dose needed is given at the same time, as otherwise the anaesthesia achieved is of poorer quality, with the cheetah taking more time to fall asleep and the effect being lighter.

(3.4) Administration of the anaesthetic agent

Telazol is usually administered intramuscularly, and care should be taken to ensure that the dose is delivered into a muscle, by checking that there is no blood drawn back into the syringe at the intended injection site. Where darting is being used, the person doing the darting should have enough experience to be hit a muscle, and to make sure that the dart does not hit areas such as the stomach, spine, or the major nerve running down the flank.

There are three main ways of administering anaesthetic agents to cheetahs:

- Hand-syringe while animal is held in a squeeze crate
- Use of a pole-syringe
- Darting, whether via a blow-dart or by using a dart-gun

(a) Hand-syringe in a squeeze crate

The usual method employed at CCF is to transfer cheetahs straight from the box trap into a special transport crate fitted with a side squeeze panel, which will be demonstrated at CCF. The side panel is held securely in place during transit, but once at CCF metal poles are attached to the panel and are used to push the cheetah against the side of the crate. Once this happens, the cheetah can be held firmly while a muscle is found for drug administration, and the drug can be injected into the muscle. When doing this, the plunger on the syringe should be pulled back briefly before injecting the drug, to ensure that the needle has not entered a vein. Care should be taken to ensure that the cheetah is kept still until delivery of the drug is complete, as if it moves unexpectedly the entire dose may not be injected, or the researcher may inject themselves instead!

Advantages – Easy to find a good injection site
Administration is straightforward and it is easy to see that the cheetah has received the entire dose intended
Does not require additional sophisticated and expensive equipment
Disadvantages – Can only be used in cases where the cheetah can be easily transferred to a squeeze crate

(b) *Using a pole-syringe ('jab-stick')*

Pole syringes are useful in cases where the animal is in a small, confined area or in a crate that is not equipped with a squeeze panel. Some expertise is required in administering injections effectively using a pole syringe, as the increased likelihood of the animal moving away suddenly means that there is a risk of the needle breaking off during the process. The injection must be done smoothly and quickly, applying continuous pressure until the entire dose has been injected.

Advantages – Can be used in crates and small pens where a squeeze system is unavailable
Allows drugs to be administered with the handler some distance from the animal, lessening both the stress to the animal and the risk of injury to the handler
Disadvantages – Risk of needle breaking off while the injection is being given
More difficult to spend time locating a good injection site than in a squeeze crate

(c) Darting

Cheetahs are relatively light and slim big cats, so fairly light darts should be used – further information on the choices of darts and delivery systems can be found in many reference guides, such as the '*Wildlife Restraint Series 1991*' or '*The Capture and Care Manual*'.

Darts can be projected either using a blow-pipe or a dart-gun, and we use Telinject systems at CCF. Blow-pipes are useful when the animal is relatively close, and require less preparation and adjustment, while the dart-gun is used at longer distances when more force is required. At CCF, we use either a blow-pipe or an air-pumped dart gun, both of which will be demonstrated during the course.

Advantages – Darting can be used where the cheetah is free or in a large enclosure
Due to the remote system used, the animal does not have to be caught or confined, so is subject to less stress

Disadvantages – Requires skill on the part of the operator to hit the animal in a suitable muscle – risk of injury if darted incorrectly
Difficult to hit an exact spot, especially in windy conditions or over long distances
Difficult to know if the entire dose has been delivered

Figure 8: Darting a cheetah using an air-powered dart-gun

If the cheetah being darted is free-ranging, then it is vital to make sure that it is kept track of following the darting, and is not lost in the bush where it could be in danger from other animals etc.

Important points regarding chemical capture: a summary

- **All personnel involved should be well-informed regarding the drugs used: their effects, dangers, legal regulations and contra-indications**
- **Everyone should be well-trained in what to do following drug spillages, accidental ingestion or overdoses, whether human or animal**
- **Some drugs can be very hazardous and require extra precautions**
- **Accurate drug delivery requires considerable training and expertise**

Section 4 – Anaesthesia

(4.1) After administration of the drug

After the drug has been administered, everyone should move away from the animal and one person should observe quietly from a distance, to check that there are no unexpected problems. All noise and movement around the cat should be kept to an absolute minimum to ensure a smooth transition into anaesthesia.

The time taken to achieve anaesthesia varies case-by-case, but in most cases the cheetah will be lying down 4-6 minutes after Telazol delivery and will be anaesthetised after 8-10 minutes. Ideally, the cheetah should be left quietly until the drug has taken full effect, to aid a rapid and deep anaesthesia.

Often, cheetahs undergoing anaesthesia show some signs after drug delivery including head bobbing, excessive salivation, scraping the ground with the legs while lying down, and sometimes a resistance to the effects, leading to rapid breathing and some agitation. These signs are a normal part of the process and, while they should be monitored, are not usually a cause for panic – we have found that very few cheetahs have problems with Telazol.

(4.2) Once the cheetah is anaesthetised

One of the most critical things to remember is that during a normal immobilisation, the cheetah is not under surgical anaesthesia and is still to some extent aware of light, movement, sensation and noise. To ensure a smooth process, noise and movement around the cat must be kept to a minimum.

Under the effect of Telazol, the cheetah's eyes remain open and the pupils are dilated, so the eyes must be covered to protect them from bright light. In addition, the blinking reflex is suppressed, so a bland ophthalmic ointment should be applied to protect the corneas.

Figure 9: Protecting a cheetah's eyes during anaesthesia

At this stage, someone should be appointed to ensure that a suitable recovery area or crate is available in a quiet location.

(a) Monitoring vital signs

The most critical procedure following anaesthesia is the monitoring of **heart rate, respiration and body temperature**. Body temperature is often elevated following capture, and must be monitored closely as the cheetah's ability to thermoregulate is hampered under anaesthesia. Normal vital rates for cheetahs under anaesthesia should be in the region of:

Body temperature – 101ºF, 38.5ºC
Heart rate – 120-140 beats per minute
Respiration rate – 15-20 breaths per minute

All three parameters are likely to be elevated at the start of the examination but should reach these norms fairly quickly. They will become elevated again if the animal is stressed or subjected to an invasive procedure

The most important thing is to appoint one person to check these signs regularly - at least every 10 minutes if they appear to be stable around the expected values, and more often if they are fluctuating a lot or are showing extreme values.

(b) Temperature control

Temperature regulation is critical, and should be carefully monitored, with action taken before changes become too extreme.

If the animal is too hot (104ºF or above), ice packs wrapped in towels should be placed where the legs join the body, fans should be used, and alcohol can be used to wipe down the pads. In addition, cold water should be rubbed into the fur, using cool water on the head and taking particular care to avoid getting water into the airway or ears.

If the animal becomes too cold (99ºF or less), blankets and heat pads can be used, and if fluids are being administered, care should be taken that they are warmed before being delivered.

(c) Dehydration

A simple skin-pinch test over the ribs can be used to test the level of hydration, with the skin forming a 'tent' at the pinch site if the animal is dehydrated. Even if an anaesthetised cheetah is well-hydrated, subcutaneous fluids are routinely administered as the cat will not have access to water until the following day, and it helps to flush the drug out of the animal's system more rapidly.

If the cheetah shows signs of dehydration, an intravenous drip should be administered as well, and this technique will be demonstrated at CCF. Intravenous drips require careful monitoring to ensure that no air is allowed to enter the vein, that the vein does not rupture, and that the cheetah is carefully handled so that the drip-line is not pulled out by accident.

(4.3) Recovery from anaesthesia

A dose of 160mg Telazol on a healthy, well-hydrated adult cheetah weighing around 40kg will give approximately 45 minutes of good anaesthesia, although this differs case-by-case, depending on the animal's individual drug tolerance and the method of drug delivery.

Signs of recovery include yawning, growling, twitching of the ears more, movement, and providing resistance when attempts are made to move the legs, open the mouth or insert a thermometer. When these signs begin, there is still some time to calmly transfer the cheetah into the crate or recovery area – it is not an instant recovery. When moving the cheetah at this stage, one person should keep hold of the head, making sure that the throat is not constricted and taking care to avoid the cheetah biting at objects or people.

If a recovery crate is being used, the cheetah should be placed in the crate with its head straight, making sure that the throat is not kinked and that the airway is clear. The crate should be kept in a quiet, darkened, cool area, with someone observing the recovery from a distance. Most cheetahs will scratch a little with their legs and move around in the crate while recovering, but this should not be extreme. The recovery must be monitored to make sure that if the cheetah thrashes around, it does not get stuck in a position where the airway is obstructed. Individual cheetahs react in different ways to different drugs, and if the recovery is very violent, vets should be consulted about ways of managing this, e.g. by giving Valium during recovery, or by using a different drug combination.

(4.4) Post-anaesthesia

Cheetahs must NOT been given access to food or water for at LEAST eight hours after anaesthesia, and ideally should be left without food or water for 12 hours or so. If they are not fully recovered, cheetahs can choke on food or drown while attempting to drink. Also, they must not be put with any other animals while in the recovery phase (minimum 12 hours after anaesthesia, or while showing any signs of still being affected by the drug) as they are at risk of being attacked for acting strangely. If the cheetah is to be released, it must be kept in holding until it is fully recovered, and then it can be fed, watered and released.

Important points regarding anaesthesia: a summary

- **Everyone must keep noise, movements and bright lights to a minimum around the anaesthetised cat**
- **The cheetah's eyes should be lubricated with ophthalmic ointment and then kept covered**
- **Body temperature, heart rate and respiration must be taken as soon as possible and be monitored closely throughout the procedure**
- **Action must be taken to deal with changes in body temperature etc. before they become critical**
- **Recovery must be monitored to ensure that the cheetah does not get into a position where it cannot breathe**
- **Following anaesthesia, food and water should be withheld until the animal is fully recovered.**
- **The cheetah should not be put with other animals or be released until it is fully recovered**

<u>Section 5 – Biomedical examination</u>

All cheetahs should undergo a thorough biomedical examination, and the protocol for this and the data sheets used at CCF will be demonstrated. Each cheetah examined is given an accession (AJU: '*Acinonyx jubatus*') number to identify it, and repeated examinations on the same cat are recorded as 'AJU # - 2', "AJU #-3' etc. In addition, photographs are taken of the animal's coat pattern on the body, face and tail for future reference, as shown below.

<u>Figure 10</u>: Body identification photograph

<u>Figure 11</u>: Face identification photograph

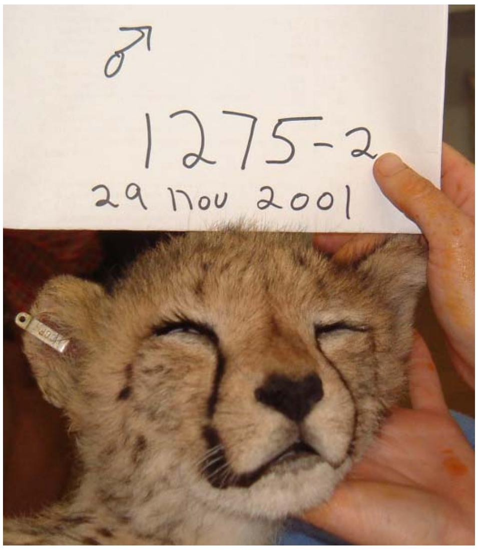
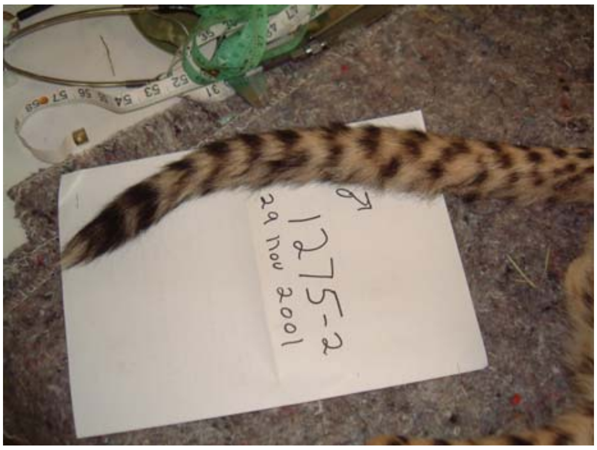


Figure 12: Tail identification photograph



There are four main parts to the biomedical examination: marking the cheetah for future identification, collection of biomedical samples, collection of morphometric data and observation of abnormalities.

(5.1) Marking the cheetah for future identification

Three methods of marking are used at CCF: ear-tagging, transponder insertion, and, in some cases, radio-collaring.

(a) Ear-tagging

All cheetahs handled by CCF are ear-tagged, as shown in the picture below. Ear-tags are cheap and easy to use, are visible externally, and can be used on cheetahs of all ages. They are subject to being ripped or torn out, however, and care must be taken to place them correctly, so that the edge of the ear is not bunched up but there is not too much space for objects to snag between the ear and the tag.

Figure 13: An ear-tag in place

(b) Transponder insertion

Transponders are unique microchips that are inserted subcutaneously. They have the advantage that they cannot be torn off, and can be used on cheetahs of any age, but they are not visible externally and are relatively expensive, with a transponder reader needed too. At CCF, the transponders are inserted beside the spine near the base of the tail, on the right for males and on the left for females, but apparently unmarked cheetahs should be scanned all over the body, as the site of insertion varies between organisations.

Figure 14: Inserting a transponder

(c) Radio-collaring

CCF only radio-collars cheetahs that will be released within the core study area and can be tracked during weekly flights. Radio-collars are a highly visible method of marking and provide a lot of useful information regarding movements and home ranges, but cannot be used on young animals that are not yet fully-grown. Care must be taken when fitting radio-collars to ensure that they are not too tight but are fitted well enough so that they do not become snagged on branches etc, resulting in them coming off or choking the animal. One useful guide is that it should be possible to fit three fingers between the collar and the neck when it is fastened.

Figure 15: A radio-collared cheetah under anaesthesia

(5.2) Collecting biomedical samples

Anaesthetising a cheetah provides an invaluable opportunity to collect biomedical samples that can provide a lot of important information regarding the genetics of the wild cheetah population and the prevalence of various diseases. We routinely collect skin, hair and blood samples on cheetahs examined, and all of these collection techniques will be demonstrated at CCF.

(a) Collection of hair

The cheetah's hind leg should be lifted, and hair should be plucked from the inside thigh. Care must be taken to remove the entire hair, including the follicle at the base, which is done by plucking the hair firmly in the opposite direction of growth. The hair should be placed in a film canister, which should be marked clearly with the animal's identification (AJU) number, its sex and the date.

(b) *Collection of a skin sample*

The purpose of this is to obtain viably frozen samples of aseptically prepared skin biopsies. From CCF, These are frozen and transported in vapour-phase liquid nitrogen carriers to Dr. O'Brien's lab where they will be treated to establish permanent fibroblast cell culture lines. These lines will serve as permanent sources of DNA and protein products of the animal's samples.

The skin sample is collected from the area that has been plucked clean of hair on the inside thigh. It is important that the area from which the skin is taken is free from hair, so after plucking the area is closely shaved, using betadine to lubricate the skin. After shaving, the area must be cleaned intensely using gauze swabs, alternating between swabs soaked in betadine and those soaked in methylated spirits ('meths'). Once the area is clean, it should be wiped with methylated spirit swabs until there is no trace of the betadine left.

Just before the sample is taken, a final swab should be made using gauze soaked in methylated spirits. A few seconds should be allowed for the meths to dry, and then a piece of skin should be lifted gently using forceps, and sharp scissors used to cut off a sample of skin.

The skin sample is then processed as below:

1. Open a tube of *biopsy transport medium* – wipe the outer surface of the lid with alcohol first before opening. Drop the piece(s) of skin into the tube, make sure they are immersed in the fluid and cap tightly. Biopsies can be kept several hours up to 1-2 days in this medium.
2. When ready to proceed, wipe neck of transport tube with alcohol swab before opening carefully, pour off most of the fluid, open a small sterile petri dish, then dump the skin pieces(s) with the remaining medium into the dish. Replace lid.
3. Pick up sterilized scissors and forceps.
4. Remove lid of dish and cut up skin with scissors while holding the forceps. Cut into the smallest pieces possible (a 6mm biopsy punch should be cut into at least 4 pieces).
5. Have a thawed cryotube of *freeze medium* ready – label, wipe neck with alcohol swab, and loosen the cap.
6. With forceps, transfer pieces of skin from dish into cryotube – make two tubes if there is enough skin.
7. Tightly cap cryotube.
8. Label cryotube with: date, skin, sex of animal and cheetah identification (AJU) number.
9. Freeze overnight in freezer, then place in liquid nitrogen.

(c) Collection of blood

Blood samples are collected for various biological analyses, including genetic, over-all health and disease studies. A minimum of 25 ml of blood is collected, including samples of heparin, serum and EDTA.

Blood samples can be taken from various sites, but at CCF the preferred site is the saphenous vein, which runs down the inside of the hind leg. If the hind leg is raised, the vein can easily be raised by having an assistant put pressure in the groove between the muscles at the top of the inner thigh, as shown below.

Figure 16: Collecting blood from the saphenous vein

Before collecting the blood, the site should be cleaned using gauze swabs soaked in methylated spirits. Then a Vacutainer needle is inserted into the vein, taking care to steady the vein so that it does not ‘roll’ and make the needle pierce right through the vein. The Vacutainer needle should be inserted bevel-up and running fairly parallel with the vein. Once the Vacutainer needle has been inserted, at least seven Vacutainer tubes should be filled from an adult cheetah – four red-topped tubes, two green-topped tubes and one purple-topped tube. The green and purple tubes contain additives to be mixed with the blood, so must be rocked gently to combine the contents once they have been filled. After all tubes have been filled, the pressure on the vein can be stopped and a meths swab held over the collection site for a few seconds after needle removal.

The red-topped tubes contain no additive and are used to separate off serum, the green ones contain sodium heparin and are used to give plasma, white blood cells and red blood cells, while the purple ones contain EDTA and are used to prepare blood smears.

After collection, blood should be allowed to settle for at least an hour and then should be processed as follows:

Processing green-top tubes for genetic analysis

Purpose: To obtain plasma, white blood cells (“buffy coat”) and red blood cells, from heparinised blood, processed and frozen within 24 hours after collection.

1. Centrifuge green tubes at 2200-2500 rpm for 10 minutes. Plasma should be clear (pink to yellow). If not, spin longer.
2. With disposable transfer pipette remove most of the plasma (do not disturb the “buffy coat”) and fill two 2cc cryotubes and put the rest in 4-5cc cryotubes.

3. With transfer pipette, reach down through remaining plasma and remove the "buffy coat" (interface between plasma and red blood cells containing white cells, you will be removing some RBCs as well). Pool the buffy coats from all the tubes into "blue top" tube.
4. Add equal amount of "easy blood" to buffy coats and mix gently.
5. Label tube with date, cheetah accession number and sex of animal.
6. From the bottom of the original tube(s) remove red blood cells with transfer pipette and dispense 1.5-2cc to each of 2 cryotubes. Label and freeze upright. (The highest concentration of red blood cells will be at the bottom of the tube where they have packed during centrifugation.) Remainder of RBCs may be discarded.

Processing of serum (red-topped tubes)

1. Centrifuge red tops at 2200-2500rpm for 10 minutes.
2. Serum should be clear (pink to yellow). If not, spin longer.
3. With disposable transfer pipette remove serum and fill one 1cc and two 2cc cryotubes, transfer remaining serum into 4-5cc cryotubes.
4. Label with date, contents, cheetah accession (AJU) number and sex of animal.
5. Place in freezer.

Making a blood smear

1. Have 3 clean slides ready.
2. Collect blood from the EDTA (purple top) after it has been rocked gently to ensure blood is well mixed, using sterile needle and syringe.
3. Put a small drop of blood close to the end of a slide. A small drop is important to prevent the smear from being too thick.
4. Lay the slide down on a flat surface.
5. Take a second slide and dip the back of one end into the drop of blood, as shown in the diagram:
6. Let the drop spread across the back edge of the top slide.
7. Then slowly push the top slide the full length of the bottom slide to spread the drop of blood over the surface of the bottom slide.
8. Repeat this procedure to made a second blood smear.
9. Allow the slides to air dry.
10. Fix in methanol.
11. Label with date, cheetah accession (AJU) number and sex of animal.

(5.3) Collecting morphometric data

Various studies have been conducted on cheetahs to gain information regarding morphology, but it is difficult to draw accurate conclusions unless the methods used are clear and standardised. The CCF protocols are described in detail here, and we would urge other researchers either to follow the same techniques or to state clearly where their methods have deviated, to ensure that future studies can be compared more meaningfully.

This is particularly important with the Asiatic cheetahs, as the extent of morphological differences have not been scientifically described.

(a) Ageing of cheetahs

Before collection of morphometric data, it is important to decide on the age of the cheetah being examined. This is done by examination of the weight of the animal, tooth wear and discolouration, gum recession, pelage (coat) condition, body measurements, the social groupings of animals caught together, and reproductive condition. The cheetahs examined at CCF are assigned to one of the following eight age groups using these indicators:

(1) Young cubs (6 months old or younger)
(2) Large cubs (>6 months – 12 months)
(3) Adolescents (>12 months – 18 months). Cheetahs in these age classes were still considered to be dependent upon their dam.

Independent cheetahs were classified as either:

(4) Newly independent cheetahs (>18 months – 30 months)
(5) Young adults (>30 months – 48 months)
(6) Prime adults (>48 months – 96 months)
(7) Old adults (>96 – 144 months) or:
(8) Very old adults (over 144 months).

A guide to placing animals in these categories is given below.

Table 2: Factors used to place cheetahs into age categories

Age class	Category	Age (months)	Teeth	Haircoat	Approx. weight (kg)	Approx. length (cm)	Approx. chest girth (cm)	General
1	Young cubs	< 6 mo	Deciduous canines and incisors erupt at 28-30 days, molars by 45-50 days	Leg spots and yellow coat colouring develop at 6-7 weeks, and the loss of the mantle starts at 3-4 months	M=up to 19 F=up to 18	M=up to 96 F=up to 92	M=up to 54 F= up to 54	Eyes, open 7 – 10 days, cubs emerge from den about 6 weeks
2	Large cubs	6 - < 12 mo	The lower incisors are lost at seven months old, while adult teeth start to come in at around eight months, by 9.5 months old, the last adult molars have erupted	Cheetahs between 6-12 months old still have long fur on the back of the neck, although it is no longer a defined 'mantle'	M=12 - 31 F=12 – 30	M=84 -120 F=82 –114	M=42 - 61 F=40 – 57	Lanky appearance until 8-9 months, then begin to fill out; acquire two-thirds of adult size at 12 months old
3	Adolescents	12 - <18 mo	No tartar or yellowing	Some long fur on back of neck, fur on face and body fuzzy, scruffy, not smooth	M=30 - 38 F=25 – 35	M=110 - 133 F=105 – 125	M=60 - 76 F=56 – 64	Full size but not filled out, leggy not in proportion not at adult weight, still with dam
4	Newly independent	18 - < 30 mo	No tartar or yellowing	Some fur on back of neck, smooth, sleek-look to coat	M=35 - 48 F=28 - 38	M=119 - 129 F=116 - 130	M=64 - 71 F=63 - 66	Develop muscle tone
5	Young adults	30 - < 48 mo	Slight yellowing and tartar	Slight mane still, males have scars, females usually have cubs or are pregnant	M=39 - 56 F=30 – 41	M=115 - 140 F=113 – 126	M=64 - 83 F=64 – 69	Full grown, males not fully muscled, prime physical condition
6	Prime adults	48 - < 96 mo	Yellowing and tartar; slight receding of gum lines, some gingivitis	Mane on back of neck is gone	M=37 - 58 F=31 – 52	M=118 - 137 F=115 – 126	M=66 - 80 F=63 – 75	Fully muscled, prime physical condition but beginning to show signs of ageing
7	Old adults	96-< 144 mo	Yellowing and tartar, receding gum lines, gingivitis, canine tipped, loss of teeth, esp. incisor	Coat beginning to look ragged, poorly groomed, scarred	F=26 – 48	F=105 – 131	F=**26 – 48**	Pads becoming elongated and smooth due to wear, sunken face; body looks more thin, loss of muscle tone
8	Very old adults	>=144 mo	Yellowing and tarter, receding gum lines, gingivitis, broken teeth, canines severely tipped, loss of teeth esp. incisor and canines	Ragged coat, poorly groomed, scarred				Pads quite smooth and elongated, sunken face; body delicate/frail

(c) Collection of data

Vernier callipers are used to record skull length, skull width, muzzle length, tooth lengths, and foot measurements, and allow measurements to be recorded to 0.1cm. All other measurements aside from body mass are taken using a 200-cm measuring tape, and are recorded to the nearest 1.0cm. Leg measurements are taken while the legs were positioned as if the cheetah was taking a normal step. Figure 1 describes the measurement protocol in more detail.

Body mass is measured at CCF using a stretcher on a hanging scale and is recorded to the nearest kilogram, taking care to adjust the reading on the scale for the weight of the stretcher.

Figure 17: Weighing an anaesthetised cheetah

The sheets used at CCF to record data from cheetahs are shown in Appendix I. Care must be taken to fill out EVERY sheet FULLY, with particular care taken to note down the **AJU number** of the animal concerned. The diagrams shown in Appendix II and the photographs below show how various measurements are taken.

Figure 18: Measurement of head - body length

Figure 19: Measurement of foreleg total length

(5.4) Observation of abnormalities

Cheetahs are known to have an unusually low level of genetic variation, and certain morphological abnormalities have been recorded in both wild and captive cheetahs that may have a genetic basis. To aid in understanding this further, three particular abnormalities are looked for to determine their level of occurrence in the wild population: crowded lower incisors, focal palatine erosion and kinked tails.

(a) Crowded lower incisors

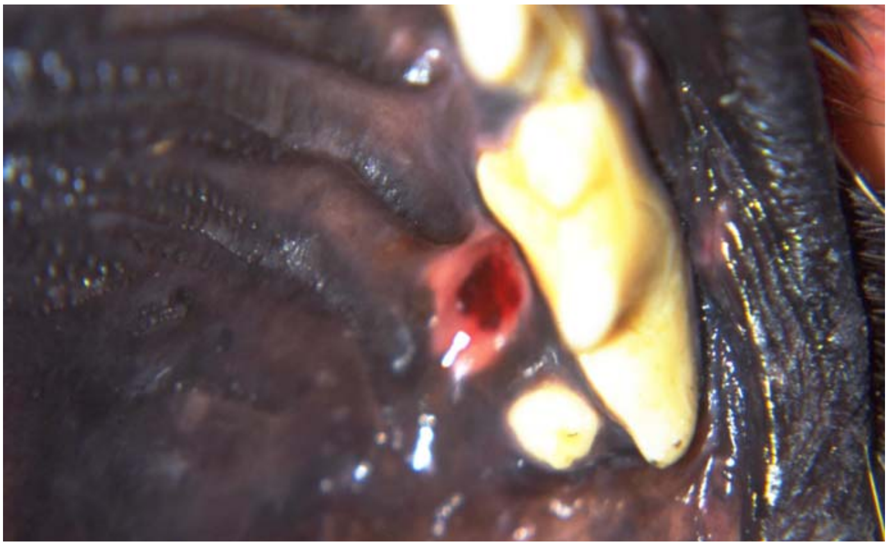
The normal arrangement for the lower incisors is one straight row, but in some cases the teeth are crowded together and become crooked, sometimes to the extent of being crowded into two rows instead of one. An example of a cheetah exhibiting crowded lower incisors is shown below.

Figure 20: Crowded lower incisors

(b) Focal palatine erosion (FPE)

This is a condition where the first lower molar penetrates the palatine mucosa of the upper palate. It was first noted in captive cheetahs and was thought to be linked to a 'soft' captive diet, but has since been observed in wild cheetahs never held in captivity, so may have some genetic cause. FPE is characterised by reddening and bleeding in a groove in the upper palate and investigation of it will be demonstrated at CCF.

Figure 21: Focal palatine erosion



(c) Kinked tails

A distinct kink at the end of the tail has been observed in quite a high proportion of the cheetahs examined by CCF. Again, this abnormality may have a genetic basis as similar kinked tails have been seen in Florida panthers, a highly endangered subspecies of the North American puma that also exhibits very low genetic variability. Sometimes the kink is very obvious, as shown below, and in other cases is relatively slight, so every cheetah's tail should be carefully examined to see if any sign of a kink can be felt.

Figure 22: Kinked tail

(d) Other abnormalities and injuries

Although these three abnormalities are the main ones that are examined at CCF, any other abnormalities or injuries seen in cheetahs examined should be investigated and documented. One example of an injury seen occasionally in Namibia is damage to the eyes, which may be a result of penetration from thorns in the thick bush, as shown below.

Figure 23: Eye injury seen in captured cheetah