Wildlife Conservation
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Lecture - 20
Chemical capture

In today's lecture will have a look at the Chemical capture of animals, a thing that also goes by the name of chemical immobilization of animals. Now, immobilization means that we are making an animal immobile so, that this animal is not able to move by itself and we are doing it by the use of chemicals. So, if you want to make an animal immobile, what kinds of drugs can we use?

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So, essentially there are two kinds of drugs that are used for chemical immobilization. The first ones go by the name of neuromuscular blockers. Now, in the case of neuromuscular blockers, immobilization occurs through the paralysis of voluntary muscles. So, essentially the animal is not able to move its muscles because, they are paralyzed, it does not have any sedative or analgesic properties.
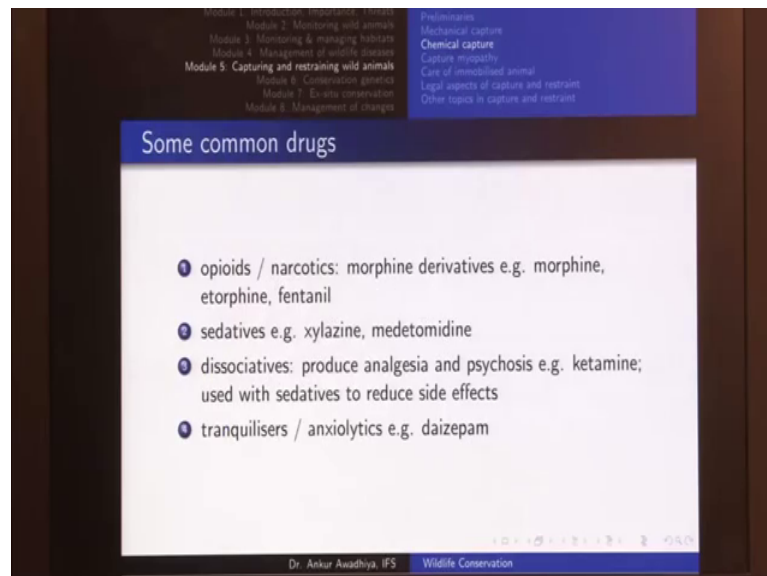
So, sedative property means that the animal does not feel down, the animal does not feel sleepy or lethargic. And in the case of analgesic properties means that it does not have any property to reduce any amount of pain so, essentially in this case, the animal remains conscious and it can sense all sorts of stimuli including pain fear stress and stimulation.

So, in this case the animal is not able to move its muscles, but then it can sense everything that is going on around it so, it feels a lot of stress. So, neuromuscular blockers are typically used along with CNS depressants. So, CNS depressants, it stands for Central Nervous System depressants so, these drugs produce anesthesia. So, in the case of anesthesia the animal would be losing it is consciousness so, what these drugs are doing is, they are reducing the activity of the central nervous system.

So, essentially the brain activity reduces and the animal does not sense any amount of pain or any amount of stimulus. Examples include diazepam and xylazine, but will look at these in more detail in a short while. Now, they may either reduce CNS activity or there could be some drugs that produce dissociation through hyperexcitability; for example, ketamine and nitrous oxide.

So, these other kinds of drugs they produce a dissociation, so, the animal feels in a dreamlike state. So, the animal does not know what is going on around it. It is just feeling like it is having a dream, it is hallucinating. It could be getting such stimuli that it cannot make any sense of because, the CNS is hyper excited in this case. So, these are the two kinds of CNS depressants.

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Now, talking about the classes of drugs? We have four different common classes of drugs- the first class goes by the name of opioids or narcotics

Now, opioid means that these drugs are derived out of opium or the poppy plant. Narcotics means that these drugs produce narcosis; narcosis means deep sleep. So, if you give an animal any of these drugs, it would feel extremely sleepy; it would just sleep and it would not be aware of its surroundings because, the central nervous system is put down.

Now, it also includes morphine derivatives; now morphine is also another drug that is made out of opium. So, it is morphine derivatives including morphine, etorphine and fentanil so, these opioids are some of the most potent drugs that are used for the chemical immobilization of animals.

Now, these drugs are so, potent let in the case of most of these drugs even if a small drop falls into our hands or on the skin then it might be absorbed and it might start showing their impact on the human beings. Now why is that so, now remember that in the case of chemical immobilization of animals suppose we want to immobilize a large sized elephant.

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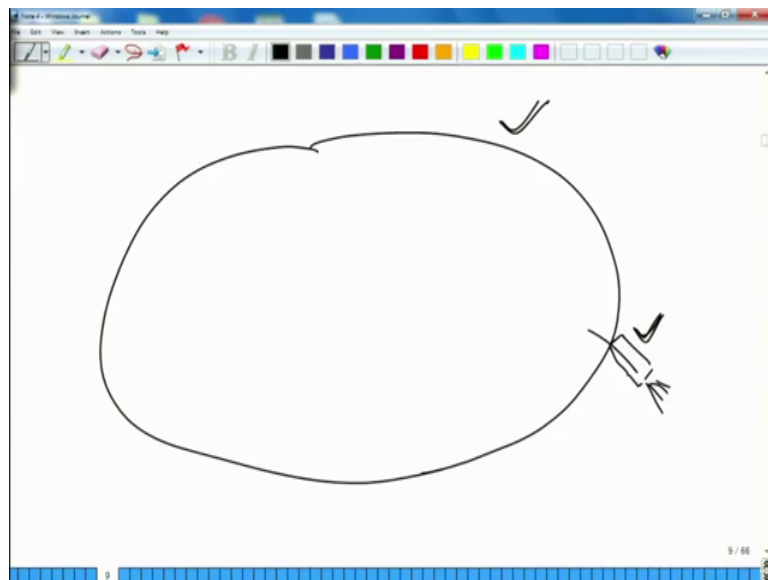
Now, to take another example we are suppose there is a person who is put for a surgery and in that case the person is administrate with anesthetics. So, the person loses consciousness so, that the surgeon can operate on this person.

Now, in the case of a surgery situation, we have an a human being that has a weight of say around 70 or 80 kgs and in this person we have ample amount of time because this person knows that I am going to be operated upon. So, this person would lie down, then all of these drugs would be given slowly and then in certain situations though the person might be asked to count backwards from ten and then he or she would truly lose the consciousness. There are so many people around that would be able to monitor the situation of this person when he or she is undergoing surgery.

But in the case of the elephant, so in the case of the elephant what we want is that we only have a small dart with which we can put our drug inside. So, again comparing the situation with that of surgery, in the case of surgery, you have a drip that is going into the body and then you can give very small concentrations of drugs and you can closely monitor this drug. But in the case of the elephant, you have got only one shot so, there is only one dart that will go and hit this animal and needs to put the drug inside.

Now, not only is this drug given in a very short duration, but at the same time just think about the quantum of the drug. If there is a drug that has to be given to a person who is like 70 kgs and in case the same drug needs to be given to an elephant that is say 5000 kgs. So, we are seeing a quantum jump in the amount of drug that needs to be given. So, the drug that will be given will be close to say around 100 times more in quantity so, when we are considering a 60 kg person and the 5000 kg elephant that is roughly 100 times more amount of drug that needs to be given.

But then, here we have a very small dart that we are going to use to give this drug. So, this huge quantum of drug needs to be in such a concentrated form that it should be able to fit in a dart that is say 3 ml or say 7 ml. So, again can the difference between the same drug that is given to human beings and the same drug that is given to the elephant would be that the drug that is used for the wild animals would be extremely concentrated.

Now, not only that in the case of the elephant we want that drug to be fast acting. Because we cannot just dart this animal and then wait for an are or so, so that this animal slowly loses consciousness. We want this animal to lose the consciousness fast and fast and in an extremely effective manner because, if this animal is say, half conscious and if there is a veterinarian that is going to treat this animal with this half consciousness also, this animal might kill the veterinarian.

So, we want this drug to be so, potent that the animal loses the consciousness fast and completely. So, essentially the kinds of drugs even though their classes are the same as those used with the human beings, they are much more potent, they are much more concentrated. And so, even if a single drop of these drugs falls into the hands of a human beings the amount that gets absorbed will be so potent that the human beings might lose their consciousness then end there.

So, it might even lead to in to a situation of emergency. So, coming back to the slides some of the common drugs include opioids and narcotics. But in this case also the derivatives that will be used will be a much more potent and also much more concentrated. The second class of drugs or sedatives; so, sedatives produce sense of lethargy in the animal so, they include xylazine and medetomidine.

So, in these cases the animal will feel extremely safe, it would feels some amount of sleepiness and also it would feel that it has lost all its energy to work. So, it would be depressing the whole of the system. The next is dissociatives; now dissociatives produce analgesia and psychosis. So, the animal would be hallucinating when you are giving it this drug, it would not be able to make out what is going on in it is surroundings.

So, drugs include ketamine and it is generally used with sedatives to reduce the side effects because in the case of a hallucination, the animal might feel stress. So, these drugs are generally combined with sedatives so, we for instance go for a ketamine and xylazine mixture. So, that the animal gets a dissociation, but at the same time it also receives some amounts of sedative so, that the side effects of the dissociative get reduced. The fourth category of drugs is tranquilizers or anxiolytics. So, by it is name itself, they produce a tranquil state, they produce a state where there is less of anxiety so, it tells of the anxiety that is there in the animal.

Say examples include drugs like diazepam so; we use tranquilizers mostly when for instance we are transporting an animal. So, you give it a tranquilizer, it will not feels the level of stress and it would be in a very calm state. It is also used along with dissociatives at times so, that the animal remains calm and it is also used along with the neuromuscular blockers.

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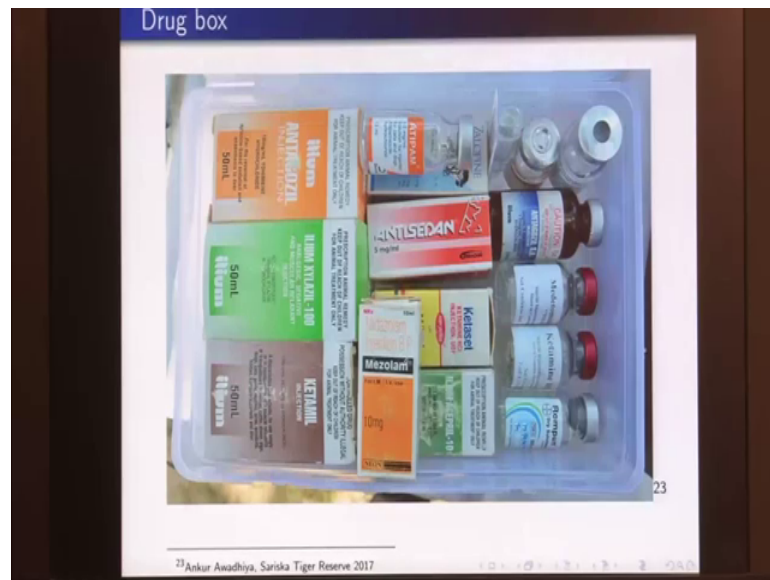
Now, when we use these drugs out there in the field we also carry with us the antidotes. Now, the antidotes are not only required to revive the animal back when we are done with our operations, but we also carry human antidotes just in case an emergency situation arises and a human being has pricked his or her hands or the drug has directly, it has his or her skin.

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Now, these drugs may be carried in a carry box or may even the be carried along with ice packs. So, that they are maintained at a cool temperature at which they maintain their potency.

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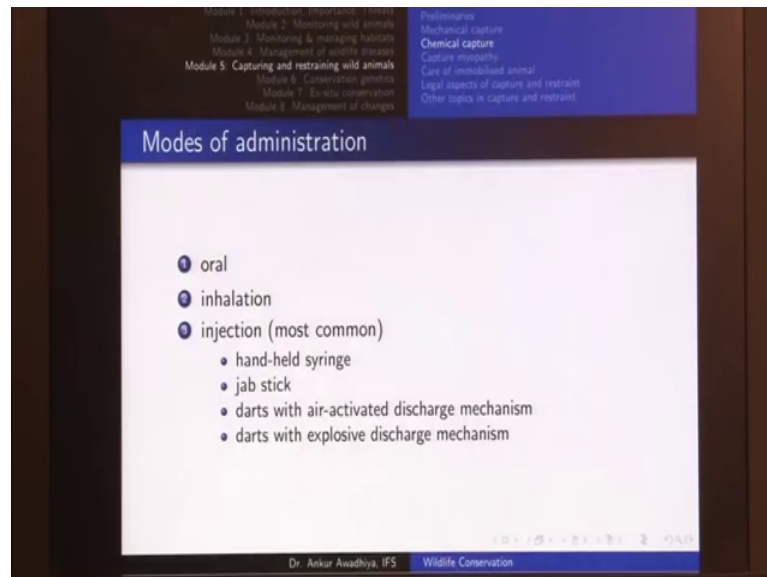
Now, how do we administer these drugs? So, these four kinds these 4 classes of drugs, they need to be given to the animal. Now, the modes of administration for this chemical immobilizing agents are 3; one is an oral mode. So, in the oral mode, you would put this drug along with the food or maybe along with the water for the animal to ingest.

Now, the problem in using this drug in an oral form is that we do not have much control on the amount of drug that the animal is taking. Now, if you remember these drugs are extremely potent and they are extremely concentrated. So, for instance if you need to give say 100 milligrams of a drug to an animal and suppose you added 100 milligrams to a piece of fruit.
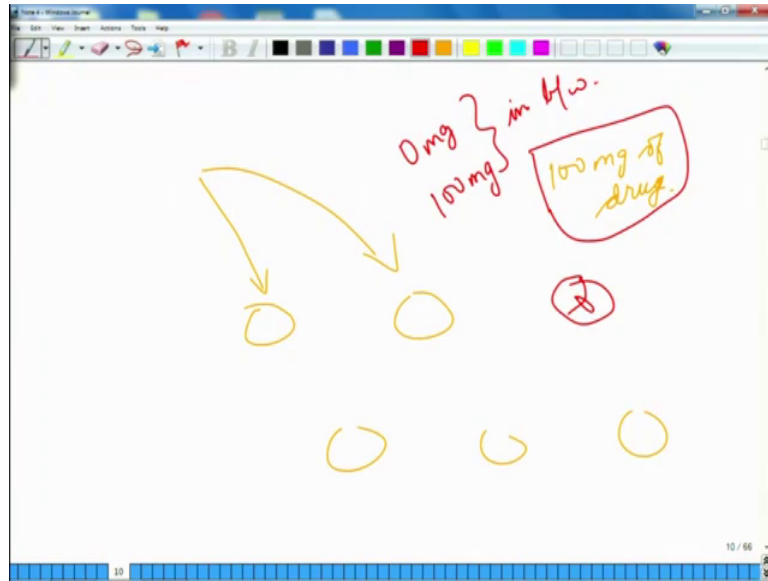
So, for instance you have a herd of animal and then you kept these fruits together and each of these fruits has 100 milligrams of drug. So, you left it in a zoo surroundings or maybe in the forest for the animals to come and eat. Now, what could happen is that an animal comes, eats up one piece of fruit and then because it is dominant it is able to displace all the other animals and then, it also eats up another piece of fruit. So, in place of getting 100 milligrams of drug, the animal has now received 200 milligrams of drug which may even be fatal for the animal.

So, in the case of oral administration, it is very difficult to keep a track of the amount of drug that the animal is having or for instance there could be a case in which there was an animal who is already half filled in its stomach with food. So, it comes to this piece of fruit, it eats up half of it and then it leaves the rest. Now, when it has left the rest we do not know whether this animal has actually eaten up the whole of the 100 milligrams of drugs in which case; suppose this drug capsule was here and the animal will ate it up.

So, we do not know whether it got 100 milligrams of drug or for instance the capsule was here and so, the animal did not get any of the drug; this could be another situation. The third situation is that the animal has eaten up part of the drug and the rest of the part is left out. So, we do not know whether this animal has received 0 milligram of drug, it has received 100 milligrams of drug or anything in between.

So, this is also another situation that makes it difficult for us to administer the drugs orally. However, oral administration can still be used in instances for example, if there is a tiger that is there in an enclosure that only has one tiger or a tiger that is there in a cage. So, in that case we can give it an oral medicine so, that we can immobilize this tiger and then, maybe put it for a betaine ad treatment or say put it up for translocation. The next mode of in of administration is inhalation now inhalation as the as the word itself tells us it is through breathing. So, things like nitrous oxide can be used in an inhalation mode.

However, as before in the case of inhalation we do not have a very high level of control on the amount of drug that the animal has received and at the same time we cannot use it in the forest settings. This can only be used when the animal is out there in an enclosure or for instance this animal was say immobilized by some other means and then this animal is being operated upon. It is on the operating on the operating table in the operating theater and then we can make use of inhalation drugs as well. But, the most common way of administering the chemical drugs is through injection.

Now, injection can be done using a handheld syringe so, for instance if you had a physical capture of an animal, so you have this animal in your hands and once you have this animal in your hands, you can directly give it an injection. So, that is one way in which we can give an injection.

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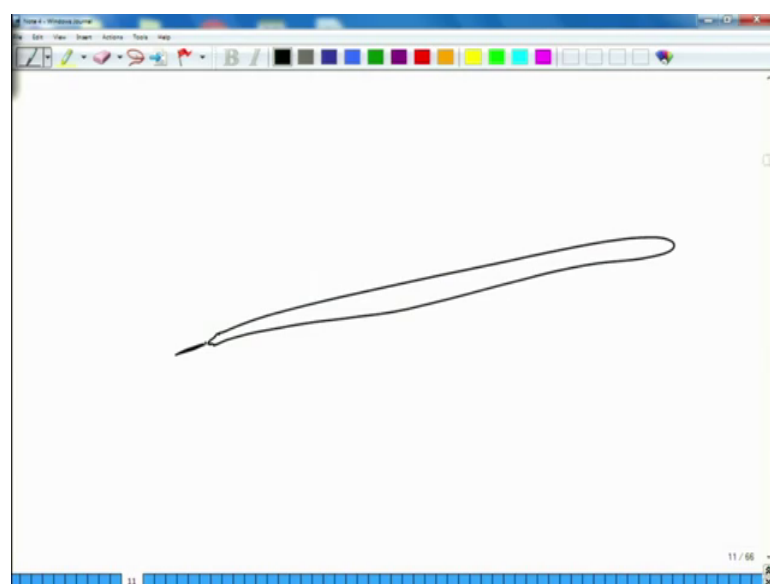
The second way is through a jab stick, now what does a jab stick mean? A jab stick is a device, in which we have a long pole and at the very end of this pole, we have an a device that can inject or drug into the animal. So, when do we use a jab stick? So, essentially if you have an enclosure in which say you have 20 animals and you want to inject all of these animals. So you can just take a jab stick, you can put your drug inside and then you can just from a distance because this is a very long pole say, it is say around 3 meters long.

So, from a distance of 3 meters, you can just poke this stick into the animal and the drug will get into the animal. So, this is how a jab stick is used for injecting of a drug. Third is darts so, we have two kinds of darts. Darts with air activity discharge mechanism and darts with explosive discharge mechanism and both of these are used in the case of our dart guns or immobilizing guns or tranquilizer guns. So, it depends on which term you want to use, but these are the most common ways in which we use the immobilizing drugs in the forest scenarios.

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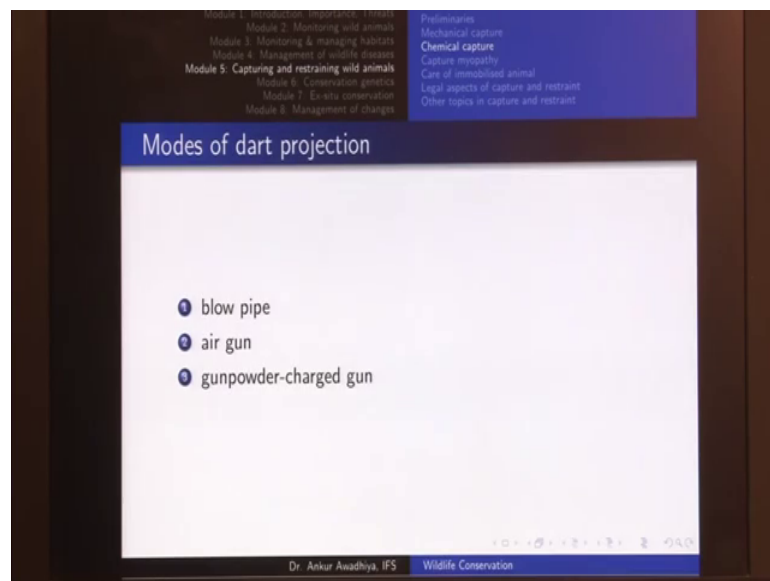
Now, once we have prepared a dart, now we will come to that preparation in greater detail in a short while. But once you have a dart so, you have a small dart that has the drug inside and now you need to project it to the animal.

So, that it goes hits the animal and delivers the drugs so, we can use 3 kinds of mechanisms: 1 is a blow pipe, 2nd is an air gun and 3rd is a gunpowder charged gun so, look at all three of these.

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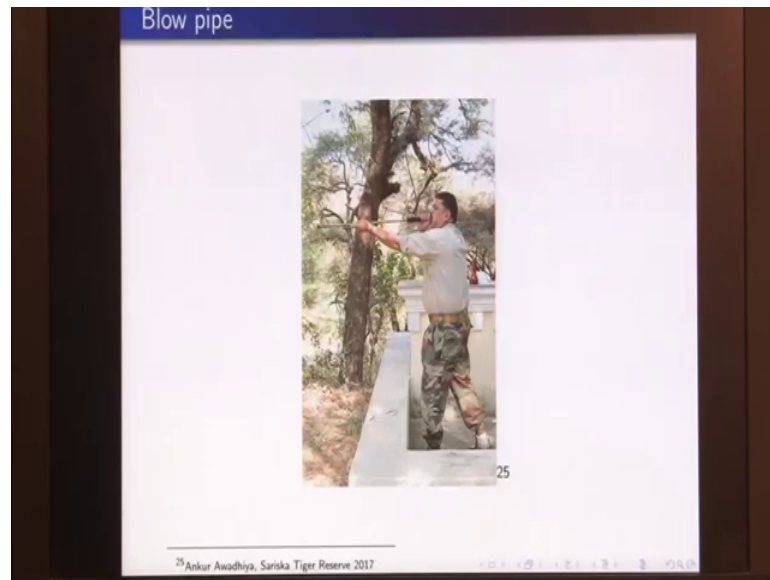
The first is a blow pipe, now a blowpipe is a very simple instrument. So, it is essentially a pipe in which you put your dart inside and then at the very end you put your mouth and then with a very sharp gust of exhalation. You use your breath to inhale the stick this dart from the blow pipe.

Now, pros and cons in the case of a blow pipe, you do not have a very high level of accuracy because, essentially you are just holding this pipe like this. So, you do not have a very close way of monitoring where your dart would be going so, target practice requires a lot of effort. Secondly, it does not propel your dart to a very long distance because; you are only using the force of your breath so, it is limited

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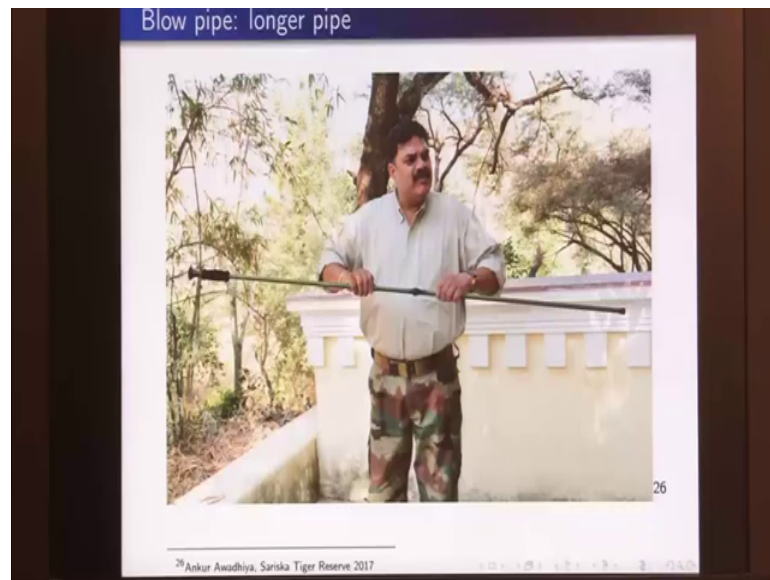
So, if you want to use dart gun and third also because you cannot use it especially with the case of carnivores. Because you have to come very close to the animal, it is generally used for herbivores and that to preferably in an enclosure setting. Now, you can also combine two blow pipes together to get a longer pipe which in some cases might increase your accuracy.

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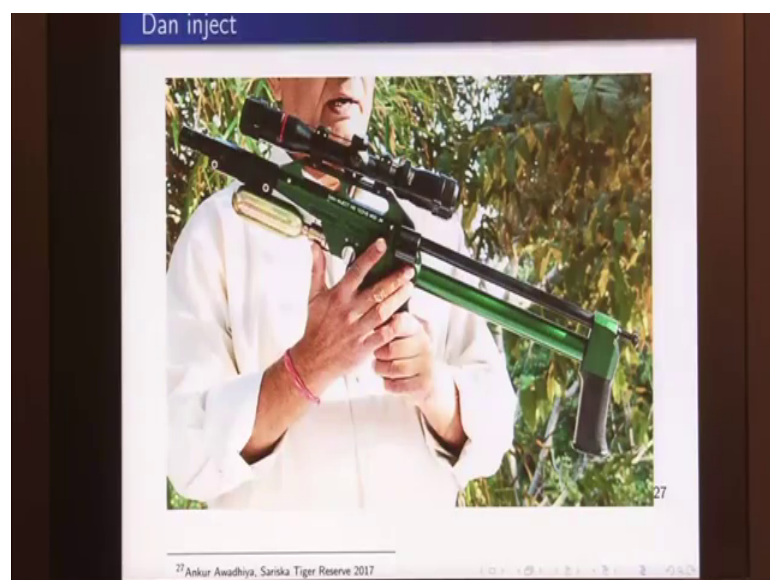
Next we have guns that are propelled by air or some gas so; this is a gun that goes by the name of Dan inject. So, here we have a cylinder that is filled up with a very pressurized

gas, in most cases this gas is carbon dioxide. So, what happens is that you put your dart inside and when you press the trigger so, the trigger is somewhere here, this carbon dioxide will move through the pipe and will then propel your dart outside, so, this is a level better than your blowpipe.

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We also have these air guns in which we have two barrels so; a two barrel gun is used when you need to have a very close control on the animal. So, even if one dart has missed you can fire a second dart. So, here we have the trigger this is the point where you would put your cartridge and then there are these two barrels and you would put one dart in each barrel this is your telescope in through which you can take the in of the animal.

And which of these two barrels are being used, will be decided by this small lever. So, you can either put it in the up position in which the upper barrel would fire or you can put it in the down position in which the lower barrel would fire. So, the only benefit here is that you are just carrying one equipment and you do not need to put another dart in case you have missed out the first dart.
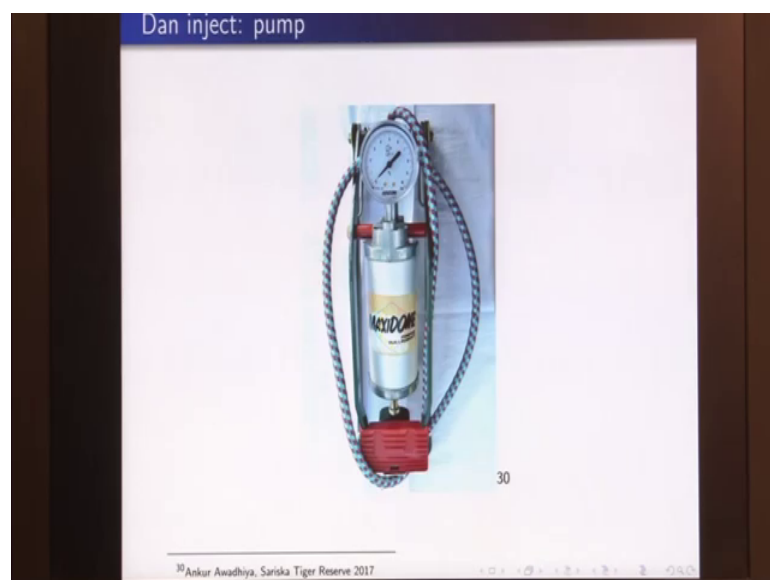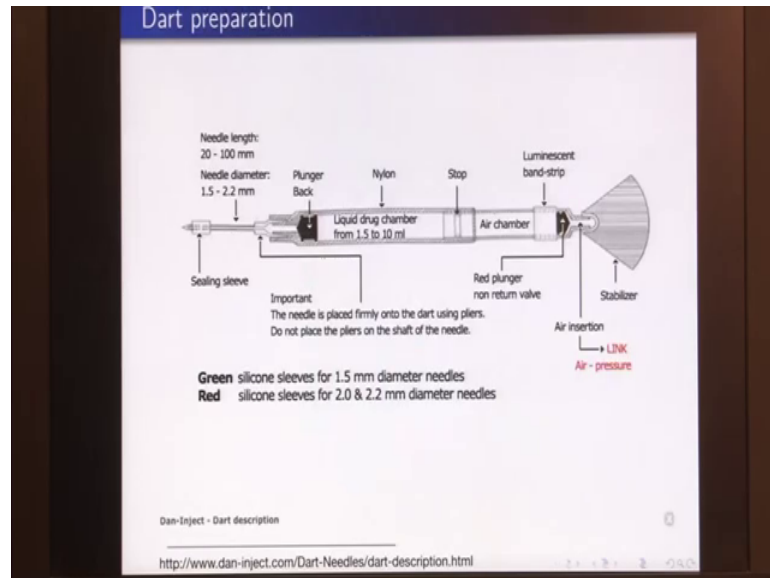
Now, in place of using a pressurized gas canister, we can also make use of these pumps now this is a pump that can be used by pressing of a foot. So, in that case also we can

select the pressure that needs to be given and then this pump can be used in the field situations.

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Now, how does a dart work? So, if we look at the anatomy of the dart here we have a nylon dart. A nylon dart is a very lightweight dart that we generally use in our blowpipes and also in the case of our for a gas propelled guns or the air guns. Now, this dart would have a stabilizer at the end so, this is stabilizer is generally red in color. So, that you can see this dart from a great distance to ensure whether your animal has received the dart or not. Now, at this point you have an air insertion tube so, and then this is your nylon container that will contain your liquid drug chamber.

So, this is the area in which you would put your drug here we have a small stop, this is a plunger and then this is the needle and then this is a sealing sleeve with the needle. Now, how do we use this dart? To use it first of all, we will pull this plunger back to this point. So, when the this black colored plunger comes here then all of this chamber is now empty and can be filled up with the drug.

Now, we put our drug inside and then we install the needle, once this needle is installed we use the sealing sleeve which is generally made out of silicone to cover the end of the needle. So, in this case once we have done this whole chamber so, this chamber on one end it is sealed with a silicone and on the other end it is sealed with a plunger.

So, all our drug that is inside will not be able to move get out of any of these sides, then on the other end we push in air to a high pressure. So, in that case now this area contains a high pressure air and this red plunger will stop this air from getting out, once we have done that we then install the stabilizer. Now, what happens is that when this dart goes and hits an animal so, the needle will get inside, but at the same time the sealing sleeve will move to the back.

So, once that moves to the back, so this end in the needle it becomes exposed and then because we have this high pressure air then pushes the plunger to the front. So, as this plunger moves to the front because of the high pressured gas or the air that is there at the back. So, all are liquid drug will all will also move along with the plunger and come out of these holes into the body of the animal.

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So, now let us look at each of these steps. So, in the dart preparation stage, the first thing is that you gather all the accessories that you require you gathered your drug. Now, this is a small pin that is used to move the plunger, the second plunger that is here so, this plunger.

So, when you push your pin here, so, the plunger moves back and then you are able to change the pressure of air in this second chamber. Then we have a needle and a sleeve this is just a cap that is used to when we are pushing air into the back. This is the

stabilizer, this is a syringe with a connector that is used to push air into this dart and then we also use a regular syringe to push to put our drug into the drug chamber.
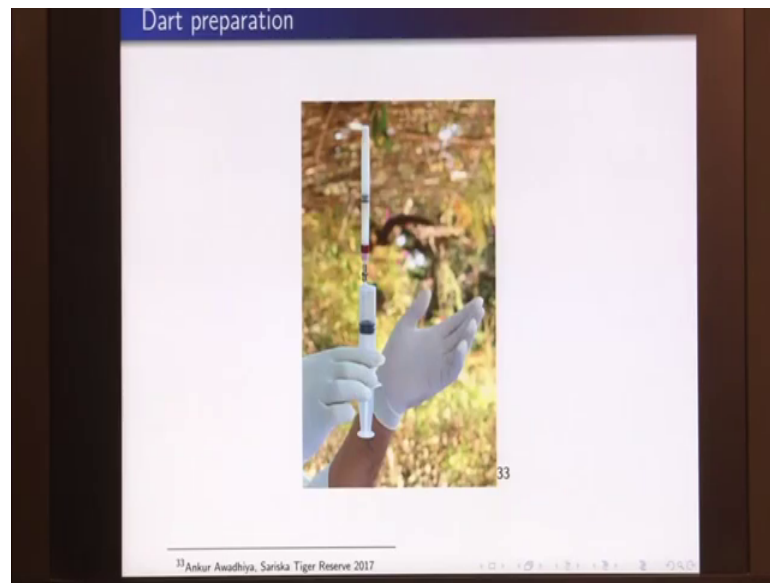
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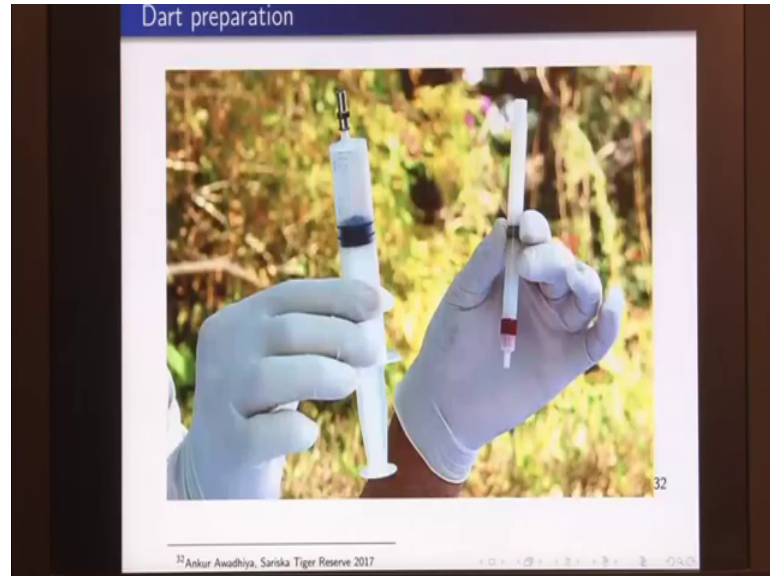
So, on beginning the first thing to do is to push your pin from this end from the red end. So, that this plunger moves back and this air chamber it becomes open. Once that is done we put our a syringe the syringe with the connector at this end because, the plunger would have come to the very end because it is already a used dart.

So, in that case we will push air so, that this plunger moves back. Once it has moved back, we will push air from this side to see that this plunger is moving freely. Once that is done we will push the plunger back here back to this point. Now these nylon darts are reusable darts so, we can use them again and again.
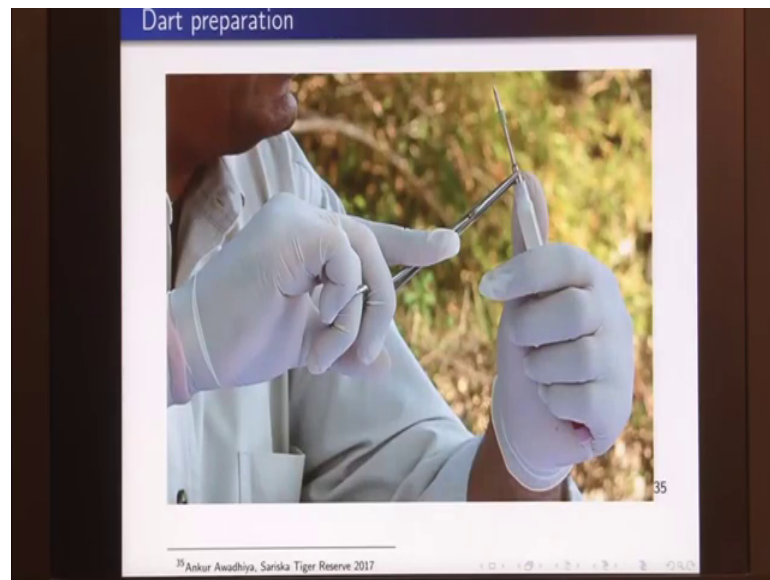
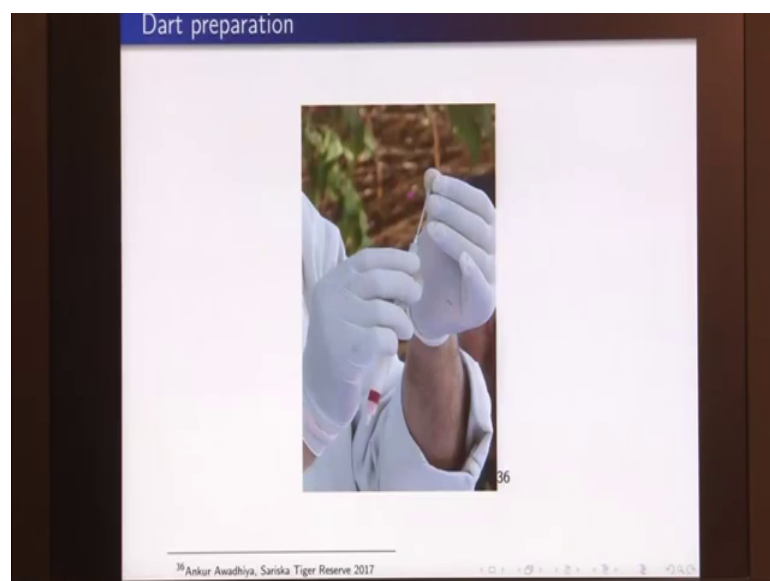(Refer Slide Time: 23:28)

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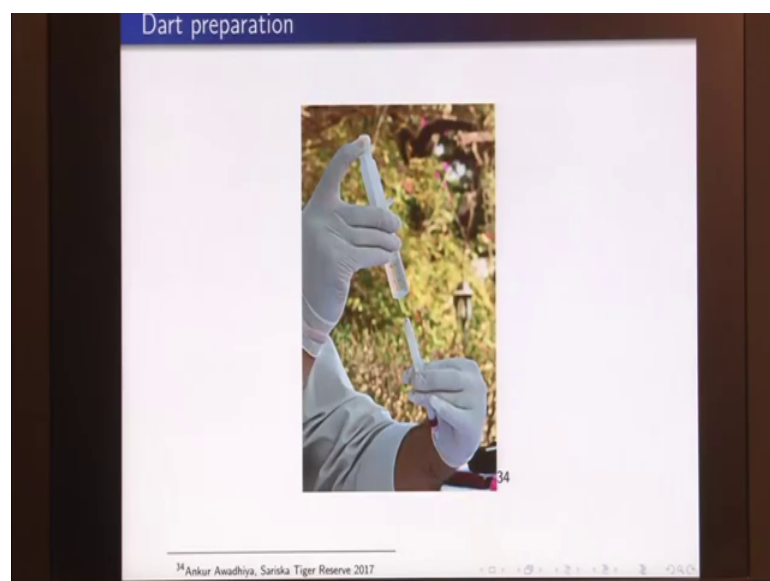
So, this is how we connect our syringe to the dart to move our plunger. Now, once that is done, we take another syringe and now our plunger has moved to the other end. So, we can now inject our drug into the drug chamber after that is done, we install our needle.
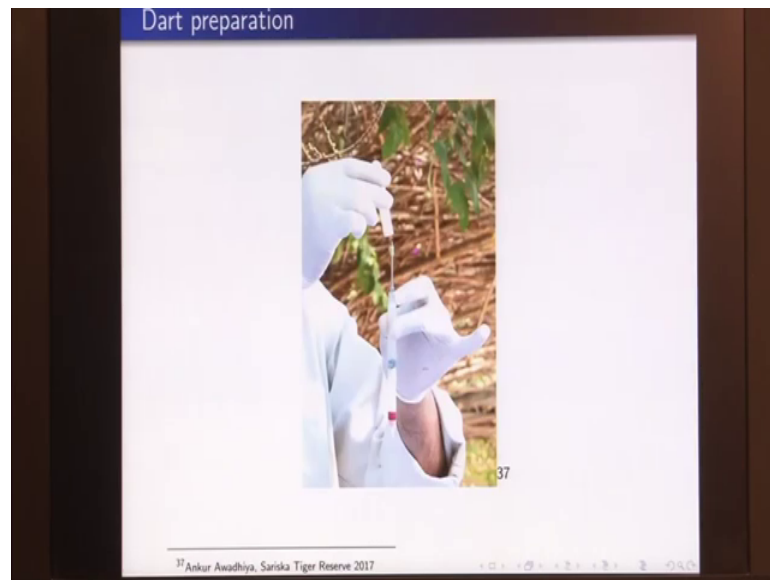
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Now, these this needle is generally installed with the help of pliers after that is done, we adjust the sleeve. So, that it covers the hole in the front of the needle; once that is done, we cover the needle portion with a cap. Now, this cap is just a plastic cap and by do we use it because after this point we need to pressurize the back chamber.

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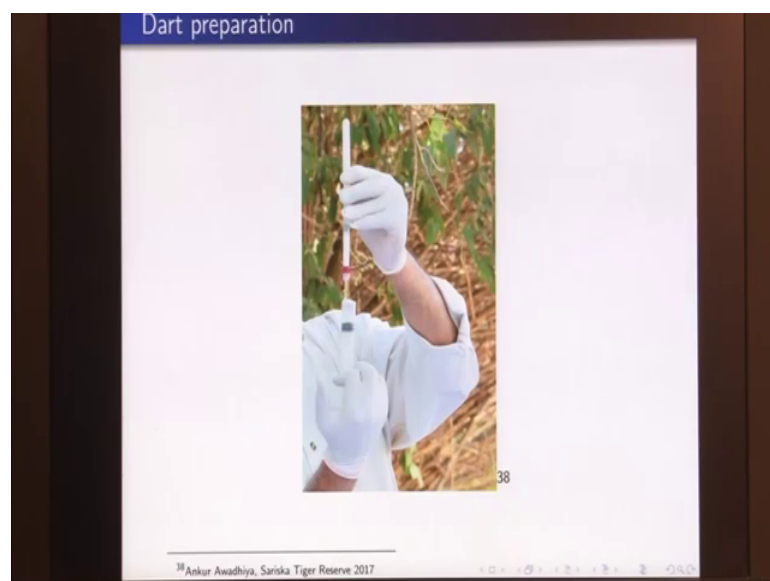
So, when we are pressurizing the back chamber using this syringe with the connector, if this needle is not installed properly or if the sleeve is not installed properly, the drug may come out. Now, if this drug comes out, then this cap is the only protection that we have because, if this drug comes out and if it gets into the contact of the veterinarians skin, then it might lead to a situation of emergency. So, just for protection we make use of this cap.

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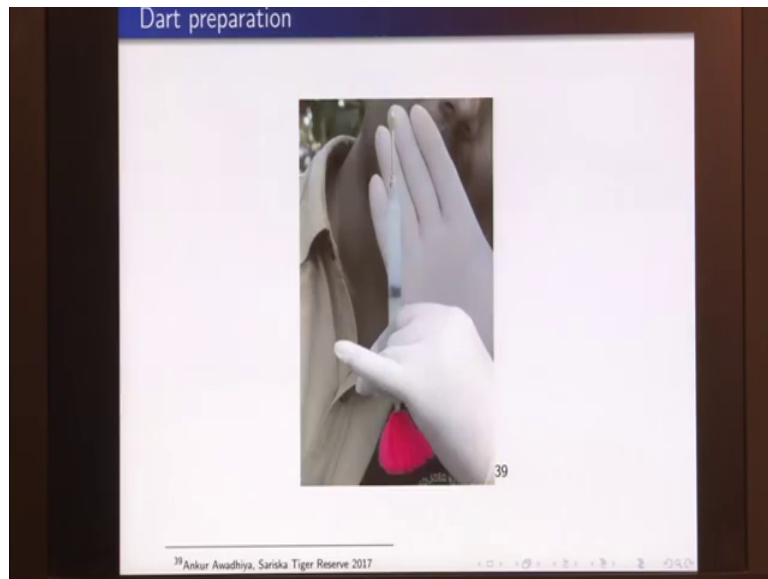
Now, once the back chamber is filled with pressurized air, so then we have our dart and then we installed this stabilizer and now our dart is complete. So, in this dart we have the sleeve in the front which is covering the hole of the needle, then we have this drug chamber that is filled with the drug. We have this back chamber that is filled with pressurized air and then we have the stabilizer.

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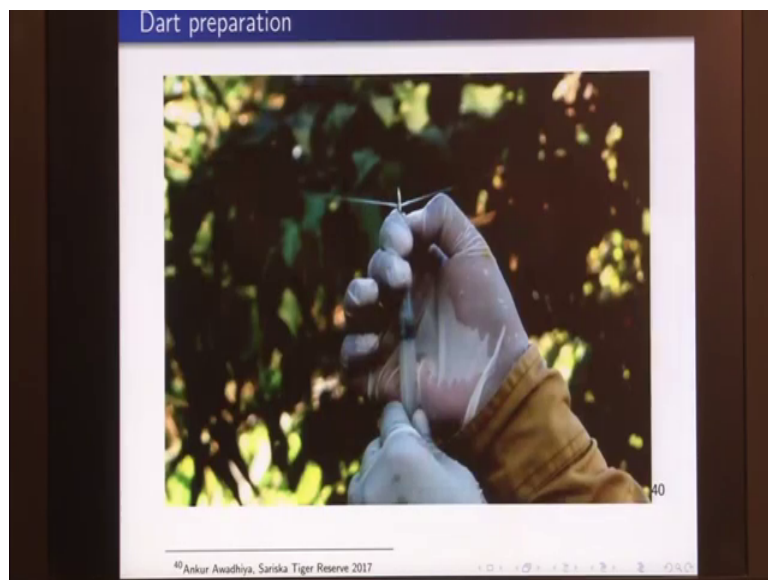
Now, when this dart goes into the body of the animal the sleeve moves back and when the sleeve moves back here, we can see that this drug will come out at a high speed because this plunger would be pushed by the pressurized air in the second chamber. The plunger will move forward and all of this drug will come out into the body of the animal.

Now, if this dart preparation looks a bit tedious to you, then we also have things called as speedy darts.

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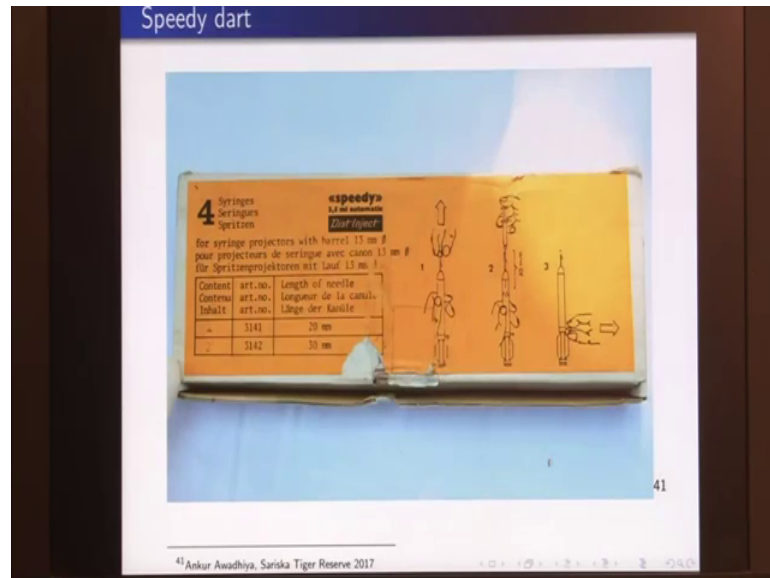
Now, speedy darts have all have most of this mechanism done beforehand for us. So, these are one use darts only. So, in this case this back chamber already has pressurized air inside, we have this cap in the front, we take this cap out, we inject our drug directly from the front of the speedy dart and once we are done we just remove this back plug and we are done.

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So, speedy darts come in different shapes and sizes. And as you can observe here in the front, all these needles appear different.

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Now why is that so? Because for different applications, we require different kinds of needles; we may make use of barbed needles, collared needles or plain needles. Now plain needles such as these are used in scenarios in which we want the dart to get into the animal and maybe just get out after a while.

So for instance, if you are trying to administer some antibiotics into the animal so, you can even use these darts to give antibiotics. So, in that case, if this dart will just get inside and after a while it will drop off. Now, collared dots on the other hand are used for scenarios in which you want this dart to remain in the body of the animal for some time. So, essentially when you fire this dart, this collard portion will also get into the skin and it will hold this needle in place for a while.

Now why is this used? This is used in scenarios in which you have a herd of animals that needs to be darted upon and when your dart is there on the body of the animal, you can very clearly see that yeah this animal have been darted. So, for such scenarios you do not want the dark to come off immediately, but you want this dart to stay in the body of the animal for some time so, that you can identify which animals have been darted.

Third is a barbed dart, so, in the case of a barbed needle, here we have this small projection that comes to the back. So, if you ever use such a needle this needle will not come out of the body of the animal till you go and surgically remove this needle. Now these are used in scenarios in which you want your dart to remain on the body of the animal till you go and take this animal out. So, for instance when we are using a dart to chemically immobilize an elephant, we want our dart to remain on the body of the elephant.

Because, in any case we are going to go there and we are going to say perform some surgical operations on the elephant. Now, the benefit of using a barbed dart would be that we could use a transmitter along with our dart so, that when this dart remains on the body of the animal, we can use our VHF or Very High Frequency antenna and receiver to go and actually home into the animal. So, that we can very easily and very quickly find the animal out.
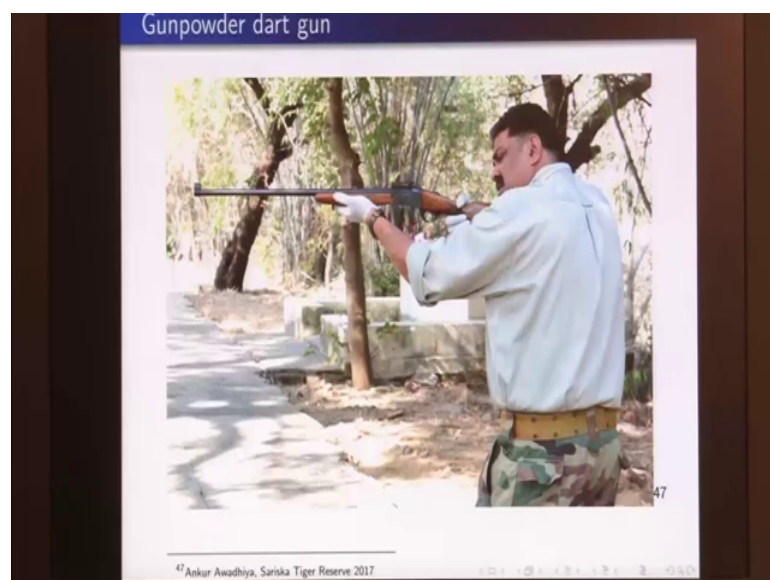
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Now, similar kinds of needles are also there on this speedy dart and here we have one more addition. So, this is a kind of attachment that is used when you want your needle to come off very quickly

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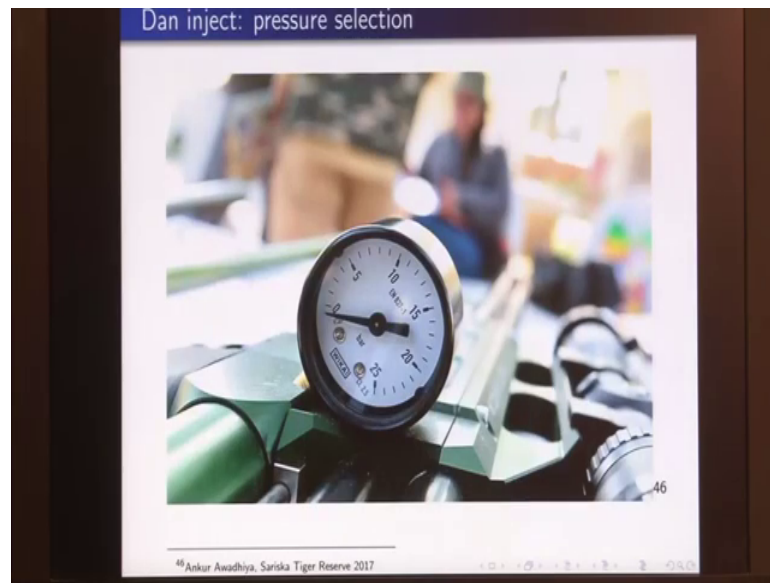
Now, when we are using these darts in the gun, then the amount of pressure that we put into our gun will determine the distance to which our dart would go. So, we also have a barometer at the very end of the gun so, this barometer can be used to adjust the amount of pressure that should be given to the dart which should then to give us it is flight path and the distance that it would move.

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Now, similar to an air gun we also have a gunpowder dart gun in which we make use of gunpowder as an explosive to project our dart.

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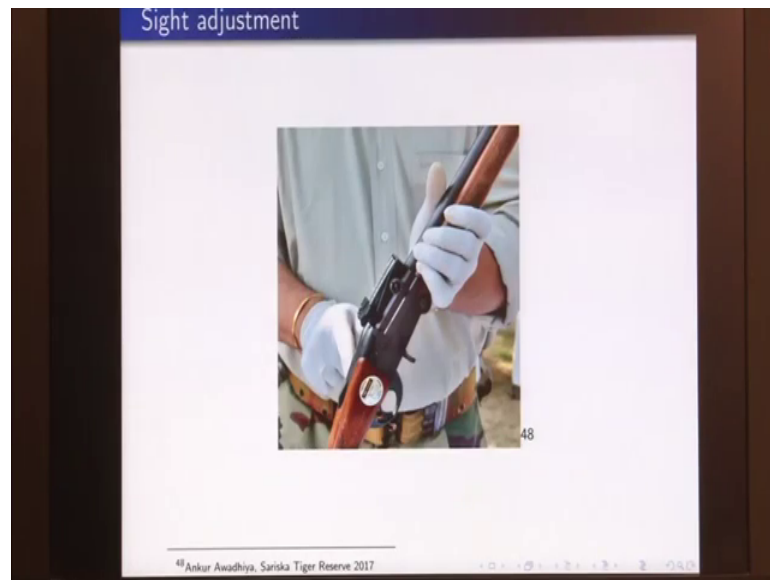
Now, in the case of our air guns, we could modify the amount of pressure with that we were exposing our dart through. In the case of a gunpowder dart, we do not have that mechanism. But, we all we have this mechanism of a site adjustment that can be used to compute the distance and flight path of herd dart.
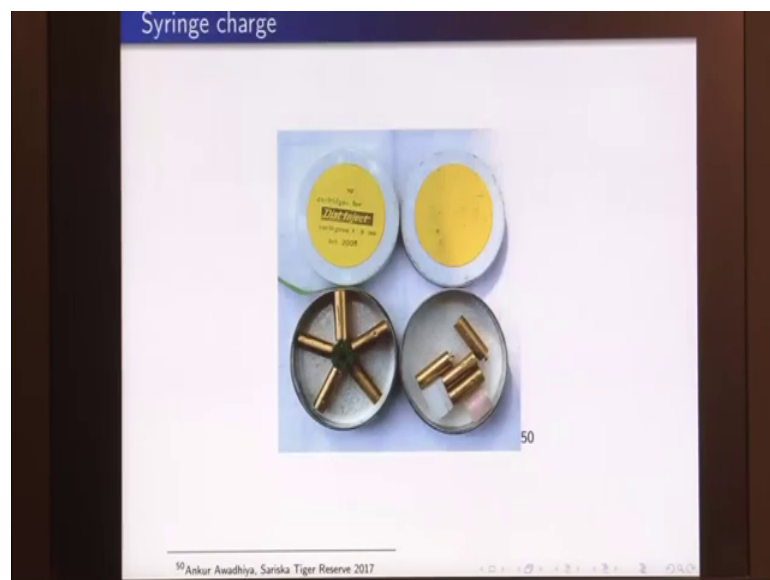
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So, how does gunpowder driven dart look like? So, this is a gunpowder driven dart, now in the first instance you can make out that while the air gun dart was made out of plastic, this is made out of metal all through except for maybe the stabilizers. So, in this case this

is our chamber that contains the drug here we have the needle and we can use different kinds of needles here. Here we have the plunger, on the back of the plunger we have this syringe cartridge so, what it does and then at the very end we have this stabilizer.

Now, how does this dart function? When this dart is fired and when it goes into the body of the animal, so it stops here. So, now, there is a momentum that causes this pin this small pin that is there in the so, when this dart is fired into the body of the animal this portion of the needle gets into the body of the animal and because of the momentum this syringe charge this small portion, it gets pressed and then there is an explosion air. Now that explosion would give out a number of gases because of which this plunger would be moved forward thus injecting all the drug into the body of the animal.
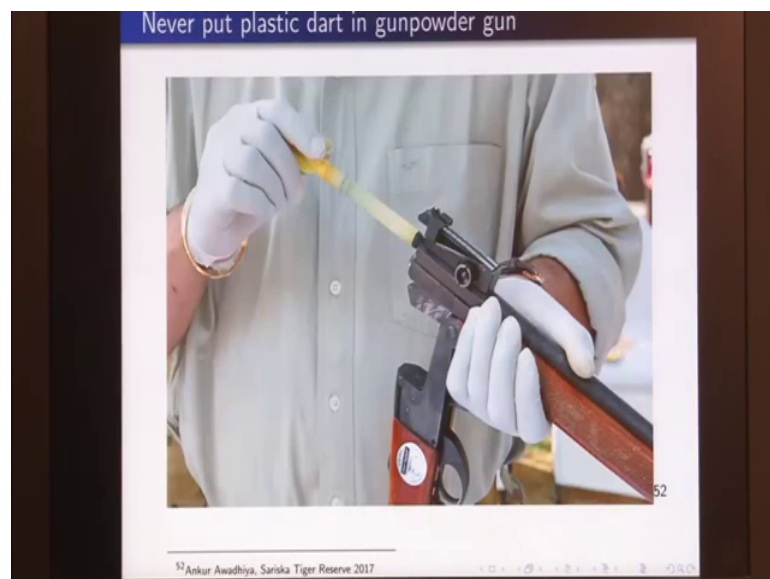
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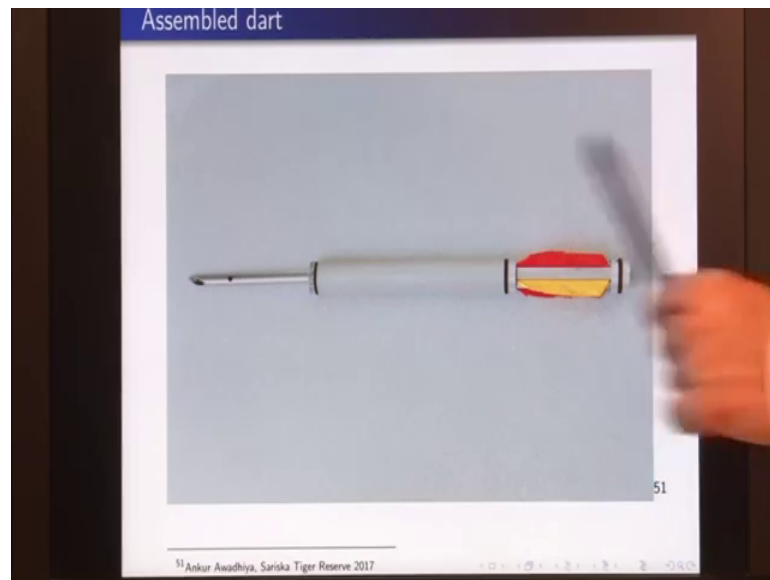
Now for the syringe charge, we have different kinds of syringe charges and also this is how the assembled dart would look like. So, in this assembled dart, we would have a plunger here and a syringe charge here the drug here and then it will be used in the gun.

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Now, one thing to keep in mind is never to put a plastic dart in a gunpowder gun. But just for demonstration in this case, the instructor is now putting this plastic dart or a speedy dart into the gunpowder gun.

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And then when this dart is fired this is what will happen because, these parts are made out of plastic. So, in the case of the explosion this plastic may get burnt, it may get walked, it may get wobbled and in that case the flight path of the projectile will be have hazard and this dart will not be able to work properly.

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 Then the earlier charge that we saw was to project the drug into the body of the animal, but then how do we project our a dart from the gun into towards the body of the animal. So, for that we make use of rifle charges in the case of rifle charges.

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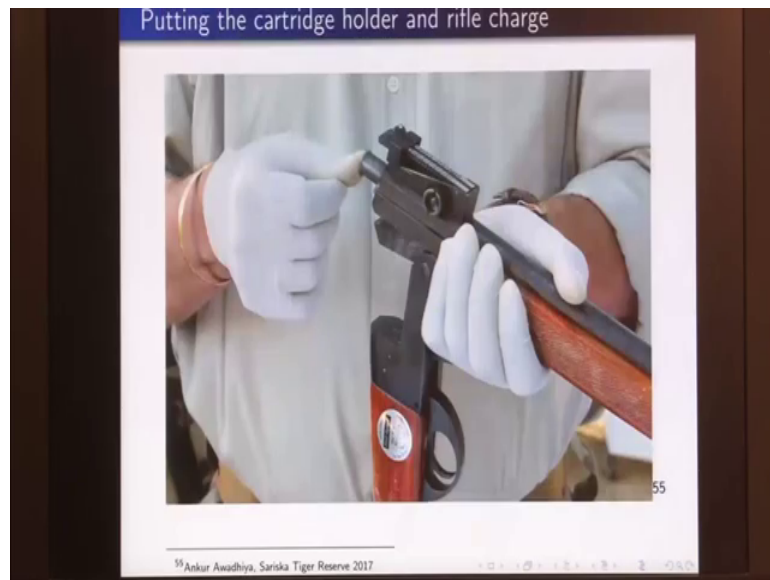
Once you have put your dart inside you would place a cartridge holder along with the rifle charge and then when you close it, when you press this trigger, this would hit on the rifle charge leading to an explosion that would then send off your dart towards the animal. Now, once that is done, your dart will go towards the animal, now how do you approach the animal is a next thing?

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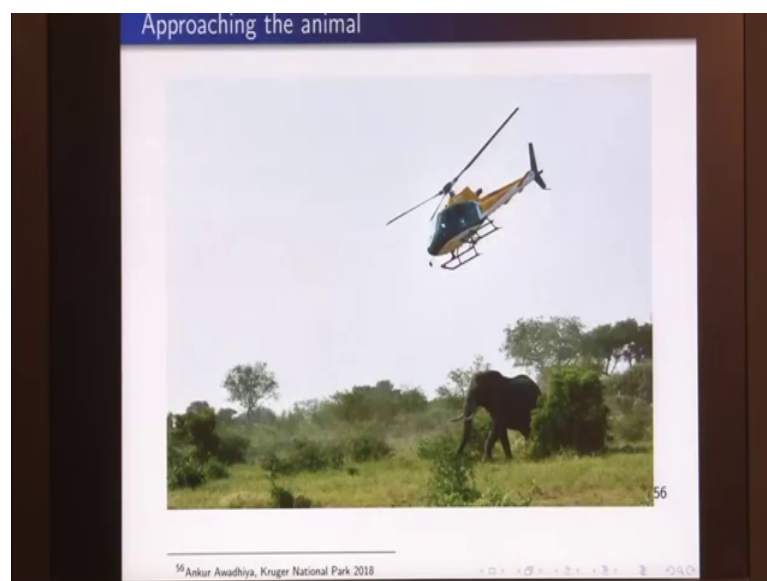
So, we can make use of n number of mechanisms to approach the animal because, in the case of any animal you cannot dart it anywhere. So, there are essentially things like the

back hind region is one that can be used for darting, the second is the shoulder region. So, we want those regions that have enough amount of muscles and do not have any critical organs that might lead to the death of the animal.

So, one way to dart an animal is to use a helicopter that we normally see in countries such as South Africa. So, when we were given this demonstration, this helicopter was flown around the animal once this animal had been identified. And then the veterinarian shot the dart from this helicopter towards the animal.

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And this is a perfect shot because in this case this dart and we can see this dart with the red color at the back. So, this dart was aimed at the hind region of the elephant and it hit the hind region of the elephant, otherwise we could make use of the shoulder region as well, but this is a perfect shot.

Now, in the case of Indian scenarios, when we have very dense vegetation very dense canopies of trees in which helicopters cannot be used, we generally make use of another elephant. So, we make use of a captive elephant or a camp elephant to approach the animal and then fire the dart.

In the case of animals such as tigers, we can make use of our captive elephants to approach the animal or we can approach the animal on a vehicle or maybe we can even take cover of some bushes or some trees there and fire on the animal. So, firing of the

animals or approaching of the animal can be done in a number of ways, but it is important to keep in mind that whenever we are using these darts. So, for instance in the case of a gunpowder driven dart, it hits the animal with quite a lot of speed and momentum.

So, in that case if you hit an animal that has a soft body with a with one of these gunpowder propelled darts, it might even lead to the fracture of a limb of the animal. So, a basic thing to keep in mind is that we make use of a gunpowder propelled dart for animals that have thick skins such as the elephant, the rhinoceros or maybe a buffalo, a water buffalo whereas, other animals such as macaques or monkeys or leopards or tigers should always be fired upon within air gun dart.

So, that they do not suffer excessive amounts of injury in through their body. So, in this lecture we looked at different drugs that are used for chemical immobilization of animals; different kinds of needles, different kinds of darts, different kinds of projection mechanisms, blow pipes, air guns as well as gunpowder guns that are used for the chemical immobilization of the animals, so, that is all for today.

Thank you for your attention.