Snake venom

Environment, Animals

Venom Venom Types Methods of Production Methods of Delivery Offense or Defense? Lethal injection or False alarm? Mysteries Warnings To most people venom and snakes go hand in hand. It is commonly believed that all snakes are venomous, but this is an erroneous belief. Of the 2. 700 known species of snake only 300 are venomous. So what is venom, how did snakes get it and why do they have it? These are questions that have interested herpetologists and other scientists alike. Venom itself is a poison secreted by animals for either defensive or offensive purposes.

Venom originated from digestive enzymes that were originally located in the stomach. Throughout the millions of years it has progressed quite a lot and in some animals has become quite different from it's origin. The type of venom depends on the type of animal. In spiders venom is kept rather simple. It is pretty much just digestive enzymes. Spiders use their venom to turn their hard shelled insect meals into nice and nutritious goo. So in a sense one can think of this type of venom as a form of starting the digestive process before you even start to eat the meal.

In insects venom is used predominantly as a defensive weapon. Wasps, bees and ants use formic acid in their stings to cause a painful burning sensation that will either kill or injure their enemy enough to make them think twice about attacking them again. Amphibians all use their venom for defense. In amphibians the venom is secreted through glands in the skin to make the animals unpalatable. So as we can see venom is a predominantly defensive adaptation. An adaptation that has found it's way into every class of vertebrates except one. The birds; the only class to forego any venom.

In mammals we have platypi with venomous claws, then there are the fish which comprise too many venomous species to count and finally we have the reptiles. All venomous reptiles are squamates and of them snakes make up the bulk. There are only two species of venomous squamates that are not snakes, the lizards of the genus: Heloderma. These lizards use their venom for defense as well and can deliver powerful and painful bites. In snakes venom has found a new use, for offense. Since snake prey generally has the advantage of speed (not to say that snakes can't be speedy. A black mamba traveling at 17 mph is nothing to sneeze at. snakes had to find a new way to take down their prey without running the risk of losing them or getting too hurt in the process. Enter venom, a fast and effective mode of subdueing prey items with minimal risk to the snake. Venom types Snake venom can be divided into two broad (yet fuzzy) categories. That of hemotoxicity and neurotoxicity. Hemotoxic venom effects the blood and organs, causing a breakdown or inflammation in the body. Hemotoxic bites are the most painful as breathing hurts and tissues start to die. Neurotoxic venom, as the name suggests, effect the nervous system, leading to everything from siezures to death.

Neurotoxic bites are the most deadly. Although we have these two wonderful different categories, no snake fits completely in each. Many snakes incorporate both neurotoxic and hemotoxic venom in their bites so when telling them apart one goes by which type is more predominant. For instance Ophiophagous hannah (King Cobra) has predominantly neurotoxic venom while Crotalus adamanteus (Eastern diamondback rattlesnake) has predominantly hemotoxic venom. Methods of production While getting bitten

by a snake might strike fear in people, the fangs are not where the venom comes from, they are mearly methods of transfer.

The place where the venom is made is in special glands located on the head of the animal. The venom glands differentiate into false and true venom glands. False venom glands (a misleading name no doubt) are made up either from mucus producing supralabial glands that run on either side of the head extending as a continuous strip from near the snout to below and well behind the eye. These then lead to several ducts that lead to the bases of many maxillary teeth. Alethinophidians are known to have this type of arrangement. Most colubrids have a different arrangement.

Rather than use those modified salivary glands they use a larger gland known as the Duvernoy's gland. This gland is situated right under the skin, above and near the angle of the jaw. These glands open from a duct at the base of one or more posterior usually enlarged fangs that may or may not be grooved. These glands do not have a lumen (central storage chamber) so the snakes must give off a continous stream of venom into their prey which means that they must continue to hold on to the animal to ensure envenomation. True venom glands are made uf thick connective tissue.

They contain a lumen, a separate compressor muscle and a duct connecting them to a single fang on each side of the jaw. These glands dominate all elapids and viperids (along with some atractaspidids) Methods of Delivery Their are four main types of teeth in snakes with which venom is transferred from gland to prey. While these forms seem to indicate a continual progression towards more complexity, they are misleading as it doesn't take into account the morphological variation in snake dentitions making for a

paraphyletic occurence (that is they all thought up different ways to accomplish the same goal).

Aglyphous snakes Aglyphous (grooveless) snakes lack any groove in their teeth for venom to run down. Instead the venom drips down the teeth from any available opening essentially saturating the maxillae. In order for envenomation to occur the snake must chew on it's prey which is time consuming. Aglyphous snakes include blind snakes and some colubrids. Opisthoglyphous snakes Opisthoglyphous (rear grooved) snakes have elongate fangs located on the top of the back of their mouths. These fangs have a groove running on the lateral side of the fang which helps direct venom into the prey.

Since the fangs are located posteriorly the snake must make a point of taking a big bite into it's prey in order to assure envenomation. Colubrids make up the bulk of this group. Proteroglyphs Proteroglyphs (front groove) snakes are pretty much all elapids with an occasional actractaspidid like Homoroselaps (Harlequin snakes). In proteroglyphs the groove has run so deep that both sides of the groove overlap eachother forming a channel for the venom to flow. A lumen is located at the base of the tooth where venom eagerly awaits ejection while a discharge orifice lay on one side near the tip.

An adductor (jaw closing) muscle is attached to the glands so that when the snake bites down the glands get squeezed and a stream of venom flows into the prey. These snakes are " fixed fanged. " That is to say they are unable to fold up their fangs when not in use so the fangs must be kept short enough so as not to puncture the lower jaw. Interestingly enough fixed fanged elapids are known to hold onto their prey after biting. This would seem to

present a potential hazard for the snake, but the predominantly neurotoxic venom works so fast that the prey doesn't have enough time to struggle, thus ensuring the snake it's meal.

Some cobra types such as the rinkhals (Hemachatus haemachatus) and many species of Afro-Asian cobras (Naja sp.) have the ability to spit their venom at predators. Their fang tips have beveled, circular (sometimes pear shaped) apertures on the anterior surface just above the tip where the venom is ejected. African spitters go one stepped further. They have spiral grooves in their fangs that (like the riflings of a gun barrel) force a spin on the venom allowing for greater accuracy. This is only used in defense and is amazing effective as these snakes are adepth marksmen.

By expending venom in these little droplets, the snake is guaranteed the maximum use of it's (normally offensive) venom when battling a predator. How often can these snakes spit before running out. Well one black necked spitting cobra (Naja nigricollis) emptied it's venom glands by spitting fifty seven times in only twenty minutes. Truly a force to be reckoned with. Solenoglyphous snakes Solenoglyphous (pipe grooved) snakes make up the viperidae and show some of the most specialized teeth for the job.

Viperid fangs have the groove so deep now that the outside of the teeth completely cover it forming a pipe for venom to enter. The two fangs are attached to a short highly movable maxillary bone. This bone allows the snakes to fold their fangs up in their mouths. This ability to fold up the fangs allows for greater fang length. How much greater? Well compare a 3. 83-m Ophiophagous hannah's 11mm fangs to a 1. 8-m Bitis gabonica (Gaboon viper) with fangs measuring 29mm. Impressive no? Viperids have

predominantly hemotoxic venom and as such, their bites take longer to take effect.

Since the effect is longer, the snake can't risk holding onto the struggling prey for it would surely get hurt, but with their potent venom, quick strikes and hyperextendable fangs, these snakes are able to get in and out extremely fast. Not only can the fangs hyperextend (up to 1800) but with the separately jointed maxillae the fangs can move individually as well. So a viper can decide whether or not to move one fang or two. Inject one side or two. The amount of venom control in vipers is astounding as well as their venom reservoirs. The bulk of Bitis gabonica's head is it's venom glands. Shocking!

Offense or Defense As stated before, snakes predominantly use their venom to capture prey, but when push comes to shove, venom can mean the difference between life and death. Snake defense is rather limited when one thinks about it. They can't outrun their predators, a lack of limbs means that gaining the leverage for tail whipping is rather impossible (pointless anyway seeing as how most snakes have rather small tails). Some snakes can secrete nasty substances that make them unwanted to be around. Others feign their own deaths, but in general the best area of defense for snakes lies in their jaws.

For a venomous snake, biting a predator means wasting precious venom; a commodity that doesn't come without it's price. Venom costs energy to make and takes a while to refill when empty. A snake would much rather save that venom for something worth it likefood, so it takes quite a bit of pressing to get a venomous snake to actually bite. In fact it is for these

reasons that venomous snakes have adopted so many warning strategies. From warning colors, to hoods, to rattles, venomous snakes do everything in their power to avoid biting the enemy. In contrast a boid or other constrictor will readily bite in defense.

While they lack venom, recurved teeth can be just as bad and since constrictors don't have to worry about wasting venom they can feel free to bite all they want. Lethal injection or False alarm? Along with warning well in advance, another common thing found in venomous snakes (especially viperids) is giving what is known as a " dry bite. " Dry bites occur when a snake like a rattler is cornered and forced to bite in defense. While the snake might be in last resort mode, it still has one more trick up it's sleeve. Venomous snakes (true venomous snakes) have the ability to choose whether or not they want to inject venom into something.

So if a rattlesnake bites a dog, it has the choice of either envenomating or bluffing the animal. In nature bluffs work much of the time and are the safest way for an animal to avoid a fight. By giving off a dry bite, venomous snakes need not waste their venom supplies. In fact over half of all rattlesnake bites are dry ones. A very comforting thought. Mysteries of Venomous Snakes One of the strangest things about elapids and viperids is that they seem to have evolved venom that is too potent for their own good. For instance, a Western rattlesnake (Crotalus viridis) injects it's prey (a mouse) with 300 times more venom than is necessary.

Or the Inland Taipan (Oxyuranus microlepidotus) which injects enough venom in one bite to kill two hundred thousand mice. Why the excess? No one knows for sure. Perhaps the mechanisms that produced the venom

never had any buffers for how powerful it got. Since the evolution of new traits involves the constantly ascending path (new traits are only kept if beneficial to the organism) the fact that ever potent venom would always guarantee the quick death of the prey means that it would always be selected for and will be until something comes to counter it.

While this is a nice theory and all, there is an underlying problem with it. Venomous snakes (of at least the elapid and viperid families) are able to meter out how much venom they intend to inject into their prey. So that Crotalus viridis is quite aware of the amount it is pumping into that mouse. Plus since venom replenishment is not the fastest thing (averaging between 4 days and three weeks) injecting so much venom seems wasteful. Another theory proposed was that it the venom helps to begin the digestion process. Surely this seems reasonable especially considered how venom effects tissue along with it's origins.

Yet that too does not give a perfect explanation for Brown tree snakes (Boiga irregularis) which inject three to eight times more venom than necessary, end up with half of that venom lodged in the skin. So for now, the reasons behind the excess venom delivery by venomous snakes are still unknown. Warnings about venom While no person should actively go out and try to capture a venomous snake (without good reason) in the even that one finds said snake, the best precautions are to examine the encounter. If you're far enough away to leave then feel free to do so, you need not worry about the snake following you.

If you're practically stepping on the snake things could be worse. At that point though one usually finds that one has been bitten. If bitten make sure

to ID the snake. Remember as much as possible about it. For an idea of the type of venom that might have been injected in you consider the area that you are at and how the snake looked. Vipers, due to their large venom glands, have heart shaped heads. Elapids have nice thin heads. Colubrids are harder to tell apart from elapids, but a venomous elapid will give warning or have some type of forewarning available.

Colubrid bites normally don't kill and are more a pain than anything else. Viper bites can be deadly and normally are very painful. Elapid bites are extremely lethal and antivenin treatment is a must if bitten. Although all this seems scary, it's best to remember that no venomous snake will attack without severe provocation. Look for the warning signs and watch where you step and you should be fine. Also remember many bites given are dry, so just because you were bitten doesn't mean you were envenomated. A good rule of thumb when dealing with a scared or cornered snake is that the last thing it's going to want to do is bite.

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