

# AUSTRALIAN SNAKES AND SNAKE BITE

## SNAKES

Australia has the world's most venomous and dangerous snakes. Mostly they belong to the Elapid family as typified by the Taipan shown in Fig.1. Elapids have a venom gland, venom duct and venom conducting fangs set in the front of their jaw. This venom delivery system is very efficient at delivering venom into prey or humans. There are a number of other venomous snakes that are not elapids, such as sea snakes. They may have very potent venom, but have trouble delivering it efficiently to humans.

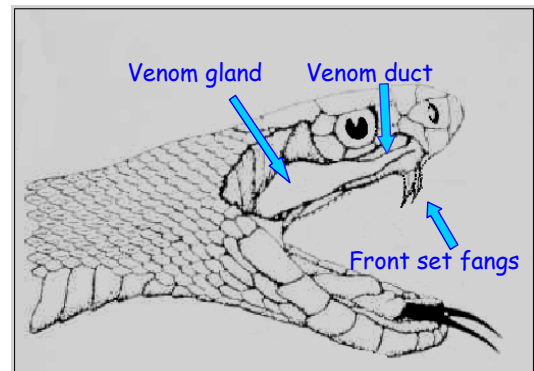


Fig 1 -Taipan

## SNAKE VENOM

Australian snakes have some of the most complex venoms in the world. Fangs and venom have a number of purposes. They are generally used to inject venom to immobilise and or kill their prey. Venom contains digestive enzymes to speed the digestion of the food, which is always swallowed whole as snakes cannot chew their food. Venom is also used for protection against a snake's enemies and this is usually where man became involved through misadventure and sometimes stupidity

The venom of Australian snakes contain the following components: -

- Multiple neurotoxins (prevent nerves working)
- Enzymes
- Haemolytic, haemorrhagic & coagulant factors (affect red cells and blood clotting)
- Myotoxic factors (damages muscle)
- Cytotoxic factors (destroys cells)
- Nephrotoxic factors (Damage the kidneys)
- Low molecular weight components

As you can see there is plenty of potential for damage in the case of a human or animal envenomation. The usual cause of death from snakebite is the effects of neurotoxins and they may be found in very high concentrations. For example the tiger snake venom has three distinct neurotoxins, two of which are of rapid action and act postsynaptically. The third acts presynaptically and may cause slow paralysis, which is difficult to reverse with anti-venom. It may then go on to cause rhabdomyolysis and acute tubular necrosis. Other venoms may produce haemolysis, haemorrhage and coagulation disturbances. Australian snakes are far more venomous and dangerous than any related overseas snake. Out of the worlds 23 most toxic snakes, 19 are Australasian with the Indian Cobra at 12, King Cobra at 17 and the Eastern Diamond Back Rattlesnake at 23.

Snake	Av venom yield mg	Lethal doses LD 50	Max venom yield mg	Lethal doses LD 50
Inland Taipan (Small Scaled Snake)	44	217,821	110	544,554
Taipan	120	94,488	400	314,961
Common Brown Snake	2	2,468	67	80,426
Chappell Island Tiger Snake	75	13,838	388	71,587
Indian Cobra	169	16,900	610	61,000
Death Adder	78	11,538	236	34,911
King Cobra	421	11,050	? 500	13,123
Eastern Diamond Back Rattlesnake	410	2,662	848	5,505

Fig 2 - Comparative Venom Toxicity

See the comparison of snake venoms in Fig.2. This data represents the number of mice that would be killed by an average and a maximum bite.. Note that the Inland Taipan is the snake with the most toxic venom in the world and even though it delivers less venom than the Eastern Diamond Back Rattlesnake, the venom is 800 times as toxic. The Inland Taipan is not a common snake but there is data to show that every bite from the more common but less toxic Taipan was fatal. This would lead us to presume that even today,

if you were bitten by a Taipan and could not get CSL anti-Taipan antivenom; you would certainly die!

## FIRST AID

Dr. Struan Sutherland at CSL developed the current first aid for Australian snakebite. It relies on the fact that the major toxic components of venom are high molecular weight and are too large to cross through capillaries to the blood. The venom travels around the body via the low-pressure lymphatic system to the Central Nervous System where the damage is done. A firm compression bandage prevents lymphatic return from a bitten limb but allows arterial and venous blood flow. A splint is then used to prevent limb movement causing peristaltic pumping of lymphatic vessels. This would force lymph past the bandage and speed systemic envenomation. Venom is not absorbed through the skin and the use of a tourniquet will only damage tissue through lack of oxygen. If the bite site is excised or cut, this only allows venom into the blood stream and increases damage.

## ANTIVENOM

In 1930 CSL introduced the first commercially available snake anti-venom. This was against tiger snake. Over a number of years a full range was developed for the 5 main types of Australian elapid snakes and a 6<sup>th</sup> antivenom for Sea Snakes. These are termed monovalent or specific antivenoms. There is a Polyvalent antivenom that is a mixture of the other venoms and is used only if the identity of the snake unknown. It is always preferable to use the specific monovalent antivenom than the Polyvalent type. It is less costly, more efficacious and safer for the patient. Each vial of antivenom is designed to neutralise the average bite although many vials may be



**Fig.3. – Tiger Snake Antivenom production in 1935**

required to neutralise a serious envenomation. Anti-venom is prepared by immunising a horse over a very long period with increasing doses of specific snake venom. The level of antibodies developed is monitored and serum is harvested when appropriate. The horse serum is fractionated to prepare a pure immunoglobulin, which is then pepsin treated to render it less immuno-reactive and allergeo-reactive to the recipient.

## SNAKE VENOM DETECTION KIT

Identification of Australian snakes by physical means is notoriously unreliable and is often wrong. The only truly reliable way is to use a snake ID key but this is also very difficult if you are not an expert. Often snake bites or repeat bites occur when people attempt to capture snakes. The Snake Venom detection Kit (SVDK) was developed to identify the presence of Venom and identify it immunologically so that the correct monovalent antivenom may be used. This test is a very simple and fast freeze dried sandwich EIA.



**Fig.4. – Snake Venom Detection Kit**

These antivenoms are the best in the world and the SVDK is a totally unique. They are used in almost every Australian medical care facility and together save many lives every year.