

The pioneers of venom production for Australian antivenoms

Peter Mirtschin*

Venom Supplies Pty Ltd, PO Box 546, Tanunda, South Australia 5352, Australia

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Abstract

Before the introduction of the first Australian antivenom was the era of the self-styled ‘snakemen’ and their diverse snakebite remedies. Many received multiple bites from highly dangerous snakes, some of which were deliberately taken to either prove a certain treatment or liven up their show. The mortality rate among these handlers and showmen was high. Production of the first effective Australian antivenom, the tiger snake antivenom, in 1930, began the scientific approach to treating snakebite and opened new frontiers for professional and amateur snake people. Collecting venoms in the development and early production of antivenoms was carried out by a number of professional herpetologists often with little or no reward and in some instances at the ultimate cost of their lives. This paper reviews the most important of those late nineteenth and twentieth century snakemen and their contributions to venom research, antivenom production and current toxinological knowledge.

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1. Introduction

After the early days of European settlement of Australia, snakes were abundant, and many bites occurred. By the early 1900s, with snakebite incidence high, the attitude to snakes was one that they should be eliminated as pests (Fig. 1A). The first antivenom, against tiger snake venom, was developed in 1930. Subsequently, in response to public pressure, other antivenoms were produced. Taipan, 1955; Brown snake, 1956; Death Adder, 1958; Papuan black snake, 1959; Sea snake, 1961; and the polyvalent, 1962 (Brogan, 1990). Many herpetologists were involved in catching, keeping and milking snakes for the development and production of these antivenoms.

The interest and enthusiasm was no better demonstrated when there was extreme urgency to develop the Taipan (*Oxyuramus scutellatus*) antivenom in the late 1940s to mid-1950s. A list of early taipan venom supplies is summarized in the handwritten document from CSL files (now in the Australian Venom Research Unit archives) (Fig. 1C). This work was undertaken by Australians who risked their lives handling snakes, often without any financial reward. The following excerpts provide a summary of these individuals and their contribution to Australian toxinology.

2. Early snake men and the snake

There were many herpetologists; naturalists, snake men, snake charmers and interested people on the periphery who collected venom or helped

*Fax: +61 8 8563 0020.

E-mail address: venoms@venomsupplies.com.

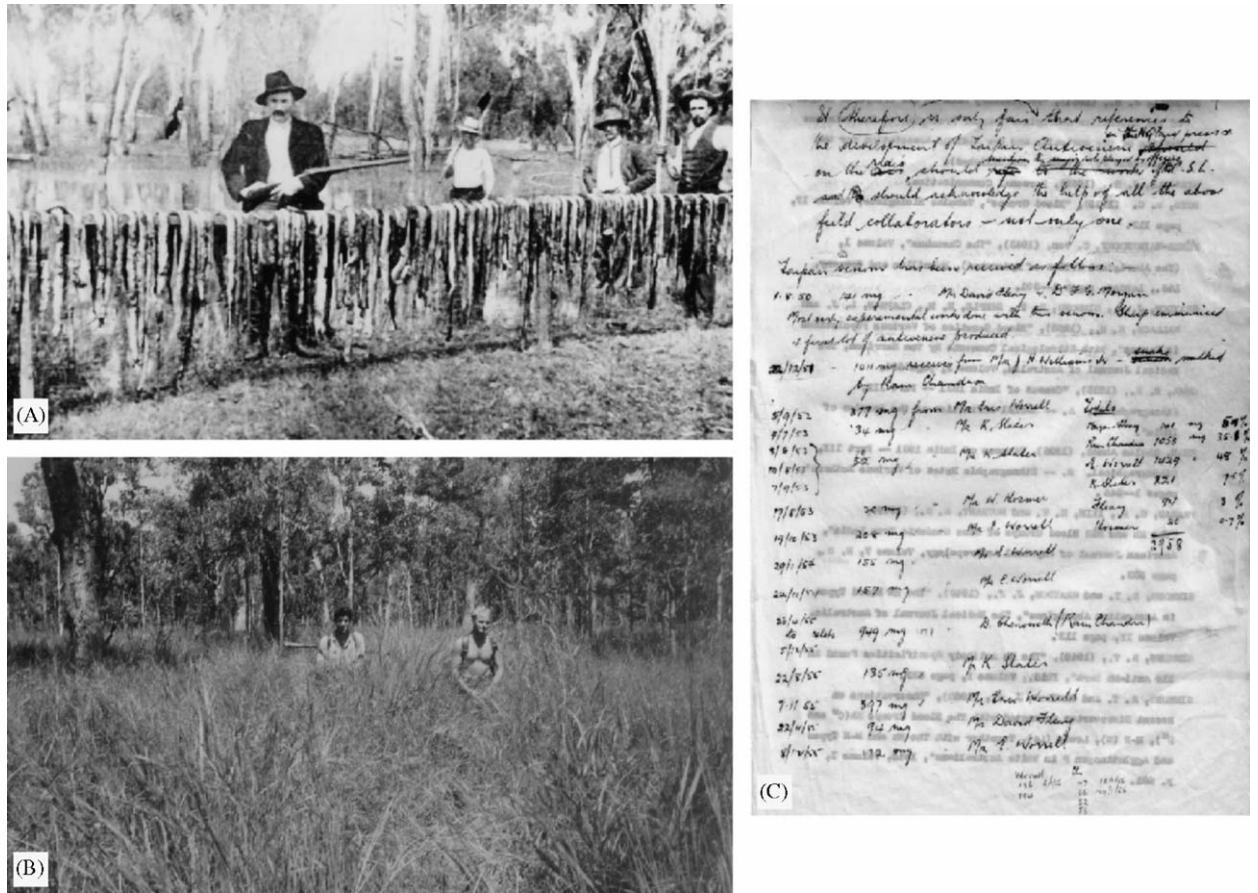


Fig. 1. (A) After the snake hunt in the Barmah Forest 1906. There were 111 snakes caught in one afternoon. Mr Dowell is the local farmer in the front (By permission of the National Library of Australia). (B) Kevin Budden (left) and Neville Goddard searching for Taipans in a sea of tall grass near the Blue Mountains Cape York Peninsula north Queensland April 1949. (Photo taken by Roy McKay and supplied by Neville Goddard). (C) A handwritten CSL record of the venoms produced by the respective snake catchers during the development of Taipan antivenom.

others do so. Some played valuable roles in educating the public about snakes sometimes using bizarre entertainment involving snakes (Fig. 2A). There were dedicated medical practitioners who provided the best care available at the time and others who offered nothing better than quack remedies. All, nevertheless, provided important stepping-stones to modern snakebite treatment.

Prior to the first antivenom development in Australia, many of the snake men had a vast array of snakebite remedies they either used for themselves in the case of bites or pedaled to the public. Treatments such as ammonia, strychnine, chlorinated lime, potassium permanganate, suction caps, alcohol, gunpowder, petrol, toad urine, iodide swabs and pig face plant juice were some that were

used and sold. Some snake men were highly influential and were even sought by overseas institutions to demonstrate their treatments. Many were bitten accidentally and many also took deliberate bites to demonstrate the efficacy of their treatments. Table 1 lists some of the snake men and women who died from such bites (Cann, 1986).

At the end of the 19th century, news of effective snakebite serums in Vietnam and Brazil (Hawgood, 1992, 1999) from work of Frenchman Dr. Albert Calmette and Dr. Vital Brasil from Brazil reached Australia. This news led Australian researchers to study Australian venoms more closely and develop cures based on antisera raised in animals. By 1901, Frank Tidswell had produced Australia's first

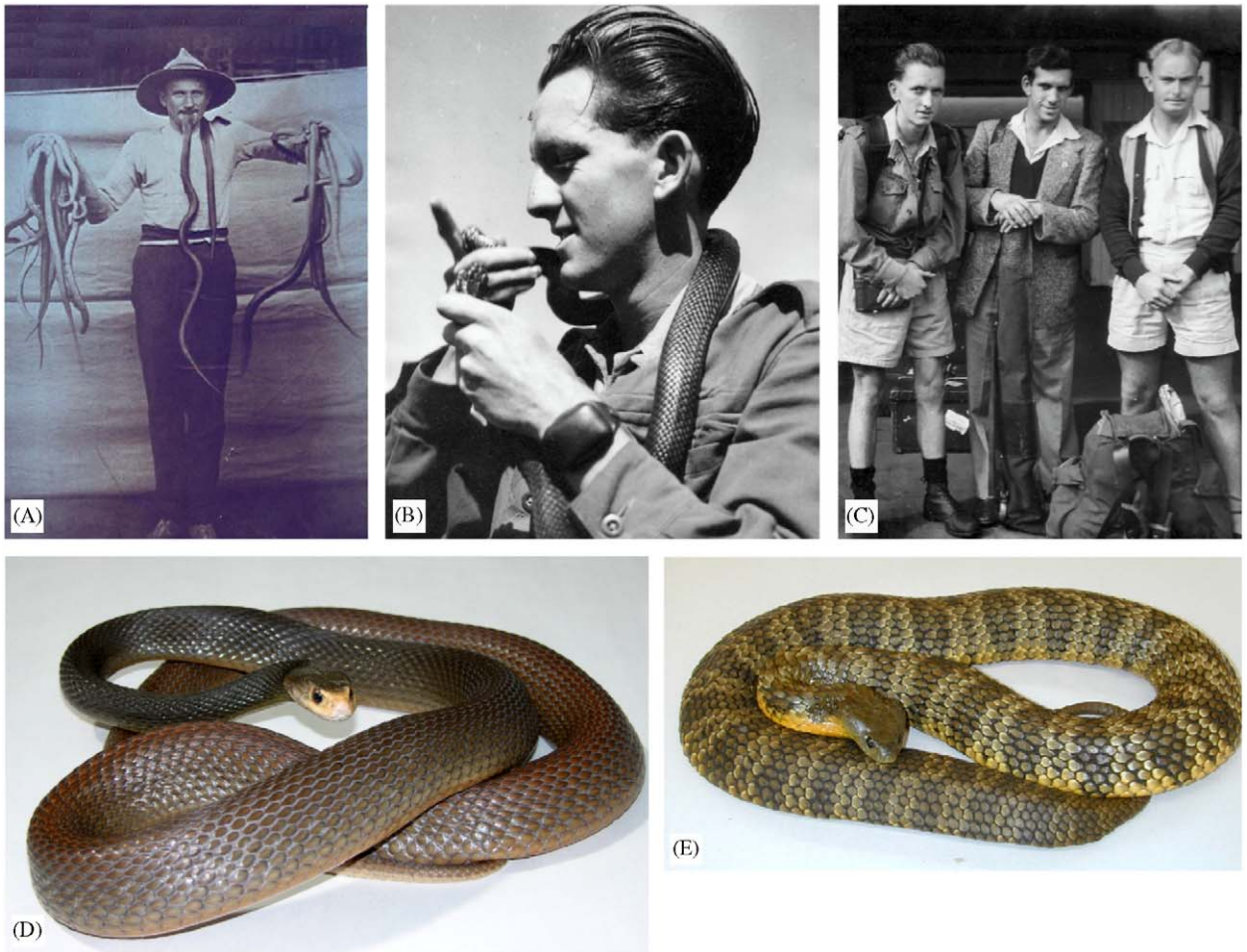


Fig. 2. (A) Herbert Hermann Heuzenroeder circa 1913, Tanunda Show used bizarre a form of entertainment (photo supplied by Steve Hoff). (B) Kevin Budden (photo by Associated Newspapers Ltd Sydney provided by Roy Mackay). (C) From L-R. Kevin Budden, Roy MacKay and Neville Goddard at Brisbane Station en route to Cape Yorke Peninsula Queensland in search of Taipans for antivenom development. (D) The Taipan *Oxyuramus scutellatus*. (E) The common Tiger snake *Notechis scutatus*.

experimental antivenom whilst working for NSW Department of Health. He injected a horse with *Notechis scutatus* venom over three and half years. Like Calmette, he found it ineffective against most other species (Cann, 1986, Hawgood, 1999). However, it was the work Kellaway and Hamilton-Fairley at the Walter and Eliza Hall Institute combined with Morgan at the then Commonwealth Serum Laboratories, that ultimately provided the first widely available treatments for Australia snakebite with the development of Tiger snake antivenom in 1930. This then involved some of Australia's herpetologists in the more credible activity of venom collection for antivenom development and production.

3. Twentieth century venom producers and snake handlers

3.1. Kevin clifford budden (1930–1950)

In 1949, Kevin Budden (Figs. 1B, 2B, 2C) and friends, Neville Goddard and Roy Mackay (Fig. 5), were interested in catching the highly feared and elusive taipan (Fig. 2D). The lack of a specific antivenom, combined with a venom of high apparent toxicity and efficiency of strike meant there was a real sense of urgency in this quest. They set out for Coen as Roy Mackay had found records of taipans from this locality in the Australian Museum where he was employed as a taxidermist.

Table 1

Some of the Snake handlers who died handling snakes many of whom had deliberately taken bites (compiled from Cann, 1986)

Person	Activity	Snake type	Year	Locality
Victor Hullar	Snake demonstration	<i>N. scutatus</i>	1893	Victoria
Harry Deline	Snake show	<i>N. scutatus</i>	1913	Melbourne
Garnett See	Snake show	<i>P. textilis</i>	1913	La Perouse, Sydney
Alex Rolfe		<i>N. scutatus</i>	1914	
George Vowells	Antidote vendor	<i>N. scutatus</i>	1917	Sydney
Jimmy Murray	Snake handler	<i>N. ater</i>	1920	
Theresa Caton	Snake show	<i>N. scutatus</i>		
John Miller	Snake exhibition	<i>N. scutatus</i>		Cohuna, Victoria
Pegleg Davis	Snake handling	<i>N. scutatus</i>	1930	
John Graves	Snake handling	<i>N. scutatus</i>	1932	Whittlesea, Victoria
Mrs Bydon	Bitten through trousers		1927	Rockhampton, QLD
Dot Vane	Snake show	<i>N. ater</i>	1928	Perth
C.J. French	Snake handling	<i>N. ater</i>	1928	Adelaide
Ernst Pollack	Snake handling	<i>N. scutatus</i>	1927	Melbourne
Curley Bell	Snake collecting	<i>N. scutatus</i>	1956	Haywood swamps
Gordon Kennedy	Snake exhibition	<i>N. ater</i>	1977	Brighton, Tasmania ^a
Fred Duffy	Snake exhibition	<i>P. australis?</i>	1977	Darwin
Tom Wanless	Snake bite exhibition	<i>Dendroaspis angusticeps</i>	1921	Durbin, Africa ^b
Anthony Kimbel	Snake bite demonstration	<i>N. scutatus?</i>	1922	Sydney
Harry Melrose	Snake demonstration	<i>N. scutatus</i>	1929	Perth
Julias Mitchell	Snake show	<i>N. scutatus</i>	1934	Kurri Kurri, NSW
Jimmy Murray	Snake show		1931	Marrawah, Tasmania

^aOne of them died despite having antivenom.

^bHe had deliberately taken numerous bites in Australia prior to his death and was in Africa on a visit. He had taken bites prior to his death from the green mamba, black mamba and puff adder.

Upon arrival, they found themselves in a sea of tall grassland (Fig. 1B) that made it almost impossible to see snakes. There were not any sheets of iron lying around which would have made it easier to catch them. They missed one which slid through Neville Goddard's legs and another which sought refuge in the roots of a tree beside the Coen River would not re-emerge whilst they waited (Goddard, 2004).

Kevin Budden was a safe snake handler and wanted to set up a reptile park with Neville Goddard. He already had good experience with dangerous southern Australian snakes including the difficult to handle common brown snake. Kevin's parents wanted Neville to accompany him on a second trip north in 1950 in his pursuit to secure taipans but he was already committed to go to the Admiralty Islands to in a highly paid government job instructing Japanese war criminals which would provide funds for the reptile park (Goddard, 2004).

Once in Cairns, he caught 27 snakes before finding a taipan at the rubbish dump near Edge Hill. He caught it without any catching equipment or snake bag and walked to the nearest road and summoned a truck upon which he sat beside the

driver with the snake in his hands. When he arrived at his friend's place, the identity of the snake was confirmed. Unfortunately, Budden relaxed his grip whilst putting it into a bag and it bit him on the boot, before fastening on to his hand (Worrell, 1958; Jones, 1977; Goddard, 2004). Horrified onlookers wanted to kill the snake but Budden insisted it was too valuable for research and it was secured and he was rushed to Cairns Base Hospital. At the hospital he was in good spirits and was more worried about the welfare of the snake than himself. Unfortunately, early signs of paralysis appeared, his condition gradually worsened and, despite receiving Tiger snake antivenom, he died on 28th July 1950 (Benn, 1951). The Queensland Naturalist Club wrote on a piece of particleboard at his gravesite in 1992 "Kevin Cliff Budden, 1950, He gave up life for all Queenslanders, let us not forget him" (Goddard, 2004; Dale, 2004).

3.2. The *Cann* family

Whether "snakemen" were promoting quackery or furthering the development of conventional antivenoms, one family was perennially at the

forefront of fostering snake education and promoting venom production for antivenoms. The Cann family played a vital role in snake collection, education, and training since 1897. Father George Cann (Fig. 3A) and sons George (Fig. 3C) and John Cann (Fig. 3D), put on their weekly snake shows at La Perouse in Sydney for the public and carried on a long family tradition of public education after George senior died in 1965. John continues the shows today but George junior died in 2001.

George Senior, from a very early age was interested in snakes. From the age of 16, he was involved in snake shows around the eastern Australia, especially at La Perouse in Sydney. He was bitten many times including in the period before antivenom was available (Cann, 1986).

In 1938 George took a job as Curator of Reptiles at Taronga Zoo and during this time he kept 200 tiger snakes at home in outside pits for venom production for Eric Worrell. George with both sons George junior and John, at various times assisted Eric Worrell collect and milk snakes. Many herpetologists were influenced by George Cann

senior. Amongst them was reptile expert Eric Worrell, Ken Slater, Charles Tanner and Eric West (Cann, 1986).

3.3. *Ram Chandra (1921–1998)*

Edward Royce Ramsamy (Fig. 3E) began his adult life as a showman under the pseudonym Ram Chandra (Jones, 1977).

From 1942 in Sydney then in various places in Queensland Ram Chandra traveled around with his snake shows at different times in association with Nazir Shah, Syd Trevor, Lee Short and Reg Cusko. It was Cusko who convinced him to take up the stage name Ram Chandra. He made good money from three shows a day with the show on the road. Whilst in Sydney on tour, he purchased 20 tiger snakes from George Cann from Taronga Zoo which he used to perform various tricks. During one of these performances he was bitten by a tiger snake (Fig. 2E), refused to go to hospital preferring his own version of first aid. He developed nausea, early symptoms of paralysis, breathing difficulty and



Fig. 3. (A) George Cann Senior. (B) Bill Hosmer 1950 (Photo Roy Mackay). (C) George Cann Junior (John Cann). (D) John Cann. (E) Ram Chandra (Albert Ramsamy). (F) Tom Eades (John Cann). (G) David Fleay handling a 2.1 m Taipan (photo supplied by Rosemary Thomson).

blurred vision and required antivenom. The next day, he convinced the hospital staff to release him early and he was back in the pit doing his snake show, one handed as his other arm was in a sling. Just after 11.00 o'clock he was bitten again as a result of clumsiness having to handle the snakes with his left hand. He used his own first aid measures again and this time felt no ill effects possibly due to remnant antivenom in his system (Jones, 1977).

One day late in December 1951, a taipan that was captured north of Mackay was brought into a small museum operated by Jack Williams. A thin wire had been inserted through one nostril and the bottom jaw to prevent it from biting. Ram Chandra requested permission to milk it in a pit he had erected in the garden beside the Williams' family home. It attracted a number of spectators, the editor of the Mackay Daily Mercury, a reporter from the Australian Broadcasting Commission and Deputy Superintendent of the Queensland Ambulance Transport Brigade. The wire was removed from the taipan's mouth and it was released into the pit. As it slid around the pit, unknown to most who attended, a bottle of methylated spirit in the pit was knocked over and the ABC reporter dutifully reported that the snake could be readily identified by the smell, which resembled methylated spirit. The snake was milked and killed and preserved (Jones, 1977).

Ram Chandra was regarded, as an amateur by the authorities and CSL did not ask for any more venom from him. For a few years Ram Chandra had no involvement in venom production from the taipan. This stirred the locals into action and they lobbied the government on his behalf resulting in his finally being rewarded (Jones, 1977). In March 1955, Ram Chandra decided he would try and make his own antivenom against the taipan using household substances. He tried to convince his local doctor to carry out a test on him using the "antivenom" and freshly milked taipan venom. His doctor convinced him to try it out on an animal first so one Saturday afternoon it was arranged where a kangaroo rat was injected with venom straight from the taipan then followed by Ram Chandra's "antivenom". The doctor had a medical officer with him with his CMF pistol handy. The local police officer arrived in the middle of the experiment on post-mortem business and was not amused to find a live taipan, a service pistol and a kangaroo rat in the surgery. The rat died (Jones, 1977).

His doctor, Dr Chenoweth, offered to get the venom processed after Ram Chandra had milked the snakes. He took it to the Sugar Research Station to have it vacuum dried, packed and also dispatched it to CSL. CSL were happy to accept this crystalline venom (Jones, 1977). By mid-1955 CSL had taipan antivenom available and distributed and it soon saved the life of 10-year-old Bruce Stringer who was playing in the schoolyard of the Freshwater school near Cairns. Ram Chandra traveled to Cairns to meet the victim. Like Worrell, Tanner and Fleay, Ram Chandra also describes the taipan as not being "aggressive in situations normal to its way of life. It will flee from contact with humans if the way is clear to do so, but if trodden upon, caught in a confined space or confronted suddenly as it is journeying from one point to another, the snake will defend itself (Jones, 1977)".

A month after Ram Chandra was bitten by the taipan whilst demonstrating snakes to ambulance men at Mackay, he decided to embark on a survey to define the distribution of the taipan. This would allow an appropriate distribution of the specific antivenom. He travelled through coastal Queensland and subsidized his costs doing demonstrations wherever he went and sometimes assisted by friends. The demonstrations enabled him to show the people what the various snakes looked like. He asked everyone to preserve the heads of any snakes they killed so positive identifications could be attributed to taipans in any area. There was little government support for his work. In 1957, Ram Chandra continued on with his task of mapping the distribution of the taipan. He visited Toowoomba, Proserpine, Grafton and Nambour. A taipan head had even been collected from Mt Warning South of Queensland border (Jones, 1977).

In 1965, he was passing through Armadale in New South Wales when he became stricken with a strange condition that paralyzed his legs. After two operations and a number of long-term physiotherapy sessions and a number of years he managed to re-gain limited use of his legs. He managed a laundry business for a short while before taking up limited snake shows again. In 1973 with the support of the local government in Mackay, Ram Chandra received financial assistance from the Queensland Department of Health in the form of an "Ex Gratia" payment of \$2000 (Jones, 1977).

In 1975 he was awarded the British Empire Medal in the Queens Birthday Honors. In 1995 he was awarded the Order of Australia Medal (Jones,

1977). In Longreach, Ram Chandra features in the Australia Hall of Fame as one of Queensland's unsung heroes. In 1982, he received the Australia Day Award called the Pioneer Shire Citizen of the Year. Ram Chandra (Edward Royce Ramsamy) was born in Lawrence near Grafton New South Wales in 1921 and died at the age of 77 in 1998. Ram is survived by his wife Nolear and his 11 children (Albert Ramsamy, 2004).

3.4. Tom Eades (1883–1942)

Originally from New Zealand, Tom Eades (Fig. 3F) came to Sydney when he was 16, learnt the differences between venomous and non-venomous snakes and their preferred habitats from “Professor” Fred Fox (Wildlife *Australian Nature Magazine*, 1939).

Having mastered the skills of snake handling he ventured out “a safe distance from his boarding house” and did public demonstrations in a different suburb each week. Whilst *en route* to Tamba Springs near Bamba, he and a colleague stopped at a swamp to replenish their stocks and were observed by a party of Hindu hawkers who called him Pambo—the “great snake man”. Sensing this name would add something to his shows, he dressed in eastern clothes and painted his exposed skin brown and called himself Pambo. So convincing was his disguise that he even fooled other Hindu's who thought he was a fellow countryman. Some of his favorite show places were places like St Kilda foreshore and Bourke Street in Melbourne (Wildlife *Australian Nature Magazine*, 1939).

In 1915, he took his stock to Melbourne Zoo. In the same year, he enlisted in the AIF and found himself playing bagpipes in a band. In 1920 he returned to Melbourne and was appointed curator of reptiles at Melbourne Zoo at the instigation of Sir Colin MacKenzie who was on the board (Cann, 1986; Wildlife *Australian Nature Magazine*, 1939).

Dr Neil Hamilton-Fairley and Dr Charles Kellaway later discovered him when they decided to work on snake venoms. Tom Eades collected the snakes, cared for them and milked them. He was employed by the Walter and Eliza Hall Institute as a full-time assistant to Dr Kellaway, then he moved to the Commonwealth Serum Laboratories to take complete charge of the snakes for antivenom production. He had strong resistance to tiger snake venom though this tapered off due to less frequent bites. In the 1930s he had several bites

requiring antivenom and was placed on the critical list a number of times (Wildlife *Australian Nature Magazine*, 1939; Cann, 1986).

Many snakebites and frequent inhalation of powdered venom led to the development of an asthmatic condition, which forced him to have to wear a mask when handling reptiles, and eventually to retire. It was so bad, he experienced a violent and painful physical reaction even if he touched a piece of snakeskin—he eventually died from asthma. He was born in 1883 in Hastings in New Zealand and died in 1942 in Melbourne (Carter, 1956; Cann, 1986).

3.5. David Howells Fleay (1907–1993)

David Fleay (Fig. 3G), a professional scientist and naturalist, suffered from poliomyelitis from the age of 18 months, which affected his left side but overcame it and even managed to excel in some sport. Influenced by his mother he became interested in all animals at an early age (Fleay-Thomson, 2003). In 1934, using his own stock, he built a Fauna section at Melbourne Zoo, but deeply regretted not being able to obtain a pair of Tasmanian tigers (*Thylacinus cynocephalus*) due to lack of funds (Fleay-Thomson, 2003). He resigned from the Zoo in 1937 over a disagreement regarding animal food, and took on the Directorship of the Sir Colin MacKenzie Sanctuary in a bush land setting at Healesville in Victoria where he created a successful tourist attraction and bred many animals in captivity including the platypus (Fleay-Thomson, 2003).

In 1952, Fleay moved his fauna collection to 65 acres of natural bush land Burleigh Heads in Queensland. From here he educated the public about the importance of the native fauna through his weekly articles in a Brisbane newspaper. He made it a viable concern from gate takings and sale of venom to the Commonwealth Serum Laboratories (Fleay-Thomson, 2003). David Fleay made some outstanding contributions to science in his close association with Dr C.H. Kellaway and Dr F.G. Morgan during the 1920s and 1930s and, more recently, in co-operation with Drs John Trinca and Struan Sutherland in their work on Australian animal toxins and treatment (Fleay, 1984). His initial involvement commenced in 1927 producing both tiger snake and copperhead (*Austrelaps superbus*) venoms for antivenom production (Fleay-Thomson, 2003).

In 1950, Budden's dying wish after being bitten by a taipan (Fig. 2D) was for the snake to be sent south for research. It was sent to Dr F.G. Morgan, Director of the Commonwealth Serum Laboratories who requested that David Fleay undertake the task. David Fleay "felt sympathy for Budden's parents and deep sorrow for the lad" but did not imagine that he himself would become involved and described his mood at the challenge as in a "blue funk".

As I was writing this account, with 90 taipans used for venom extraction close by, I felt tremendous respect and admiration for David Fleay who carried out his pioneering work on an unknown species. There was little information, no antivenom if bitten. Today, we are more experienced in treating taipan bites with an effective antivenom and over 60 years of experience keeping the species to which was all pioneered by great men like Fleay. Of Fleay,

Professor Struan Sutherland wrote "showing considerable skill and equivalent amount of bravery, he successfully "milked" the taipan, obtaining sufficient venom to set in train the studies which led to release of the taipan antivenom in 1955 (Sutherland, 1993)".

Here is Fleay's own historical account of the first taipan (Fig. 4A) ever milked for venom production reproduced from the *Courier Mail* in 1970 (Fleay, 1984). "That afternoon in the preparator's room at the National Museum's top floor, the air freighted box sat alone on a table—ominously quiet. It was flywire covered and contained a tied bag containing another bag, inside of which we supposed the coiled taipan to be". "With Dr Morgan's somewhat cheerless kit at hand and Messer's Pesscott, Goodisson and Museum staff present I ripped off the wire, drew out the bag—which was quite heavy—and cut the string".



Fig. 4. (A) The Taipan, *Oxyuranus scutellatus* (now held Museum Victoria specimen number NMVD8175) that killed Kevin Budden and the first Taipan to milked for venom for antivenom development by David Fleay (Photograph courtesy—Jane Melville). (B) The inland Taipan, *Oxyuranus microlepidotus*. (C) Eric Worrell (center) extracts venom from a Taipan in 1951 with John Dwyer (left) and Wal Lorking (right). (D) Frank Little, Mt Molloy Far North Queensland 1982 (Peter Mirtschin).

“The second bag was present all right, but the taipan—over 2 meters in length—fell out first and gyrated savagely on the floor. It had already escaped from the second bag!” “Warmed to an extremely active state by room radiators, the reddish-brown, heavy-bodied reptile struck out and showed itself to be in an exceedingly savage temper. I hooked at its neck with the snake stick and scored a lucky grip”. “Then working closely and intently, I managed to seize it tightly with thumb and fore-finger, immediately at the base of the head. Its extraordinary, muscular power was at once apparent as it exerted itself to become free”.

“Dr Morgan brought up a rubber-covered collecting phial into which the snake bit viciously, chewing again and again. Dr Morgan expressed reserve venom by massaging above the head glands. The snake’s tail and lower body wrapped around one of my legs until Mr. Goodisson did the unwrapping”. “Dr Morgan brought up the second phial and again the snake chewed long and savagely, breaking the rubber. About half a teaspoon of whitish, clear and—as we all knew—shockingly deadly venom collected within the vessel. The abnormally large fangs, dwarfing those of the largest tiger snake, were clearly visible”.

“The intensity of my grip was giving rise to muscular cramp—a sure sign that it was time to return the strong and thick-headed snake to a safe receptacle. I lowered its tail, then the body, into a large bag suspended from a door knob”. “To be finally rid of the life-and-death head grip meant a downward flick and release. But so stiff and resistant was the taipan that even this was not accomplished with a great margin of safety”. “However, it was done and twitched with wire the bag was enclosed in the box. It was a moment of great relief from tension”. “According to Dr John Trinca, then deputy director of the CSL, this first taipan—in spite of having bitten a man several days previously—yielded a very large quantity of venom (78 mg being three times the yield of tiger snakes (Fleay, 1956)). All experimental work leading to the preparation of the first lot of taipan antivenene (now called antivenom) was done with this material obtained as the result of Kevin Budden’s heroic efforts (Fleay, 1984)”.

David Fleay extracted venom from all dangerous species between 1927 and 1982 for the Commonwealth Serum Laboratories and Walter and Eliza Hall Institute in Melbourne. He made many observations on taipans whilst keeping them for

venom extraction. “They do not seek trouble, vanish in a flash but if provoked will react with unequalled ferocity (Fleay, 1956; Fleay, 1984)”. His records were remarkably accurate. He noted they fed on rats, mice and bandicoots. Later, Shine and Covacevich dissected 114 *O. scutellatus* from museum collections and found they contained predominantly mammals (Shine and Covacevich, 1983). In fact only a single non-mammal (a bird) was found in one stomach demonstrating the preciseness of Fleay’s observations (Shine and Covacevich, 1983).

His affection for taipans grew with increased familiarity. He bred them in 1958, 1959 and 1960 and averaged 20 eggs per clutch (Fleay, 1981). He was a copious writer on the natural history of animals, especially reptiles. He was probably the first author to describe the temperament of the rough-scaled snake, *Tropidechis carinatus* and recognize its true potential. He wrote, “we find the rough-scaled snake to be almost invariably nocturnal, persistently pugnacious, lunging fast and furiously with coughing hisses when approached (Fleay, 1990)”. “Captivity doesn’t mellow it” and he regarded it as the “fightingest” small snake he had encountered (Fleay, 1990). In another account he claimed it to be a “foul-tempered little fellow”; its threat is “accompanied by explosive hisses, it lunges again and again and is faster and more accurate than a death adder (*Acanthophis antarcticus*), tiger snake or black snake (*Pseudechis porphyriacus*) (Fleay, 1960)”. A victim bitten on the finger in Sydney 1959 by a 25-inch specimen, died in 7 min (Fleay, 1960). David Fleay was instrumental in highlighting the dangers of this species and worked with CSL to ensure existing antivenoms adequately covered bites from this species (Fleay-Thomson, 2003).

All herpetologists have their occasions of humor. When Fleay was Director of the Sir Colin McKenzie Sanctuary at Healesville, Victoria in 1940, a 1.37 m tiger snake (Fig. 2E) bit him. He had to get to the hospital quickly as it was a big Tiger snake and the amount of venom injected was likely to be high. The driver sped along bush tracks and skidded around corners and all but capsized on one occasion. Fleay said, “Look here, I don’t mind dying of snakebite, but I don’t want a broken neck (Hetherington, 1963)”.

David Fleay was born in 1907 at Ballarat in Victoria and died in 1993 aged 86 at his home at Burleigh Heads (Sutherland, 1993). He was renowned for many contributions in conservation

and appreciation of Australian fauna. He was the first person to breed the platypus in captivity and the first to breed taipans in captivity. He educated generations of Australians in an appreciation of their natural fauna and snakes in general. He provided much advice and assistance to the Commonwealth Serum Laboratories in particular in the development of the taipan antivenom (Sutherland, 1993). “A great man with vision, dedication and commitment to what he believed in, what is Australian, especially its flora and fauna—a man who has blazed a pathway for us to follow, but one he himself had to discover” (Mason, 1993). He was awarded the Natural History Medalion in 1942 (Fleay-Thomson, 2003). He received the honorary title of Doctor of Science from the University of Queensland in 1984. He received an MBE in 1960; Order of Australia in 1980; Advance Australia Award for science 1984; he was made a Corresponding member of the prestigious Explorer’s Club of New York; a Rotary International Paul Harris Fellow and was awarded joint Freedom of the City of Gold Coast with Alex Griffiths the founder of the Currumbin Bird Sanctuary (Fleay-Thomson, 2003), (Van Dyck, 1993). According to his daughter, Rosemary Fleay-Thomson, David Fleay was also a ‘greenie’ before it was fashionable (Fleay-Thomson, 2003).

3.6. Bill Hosmer (1925–2002)

Bill Hosmer (Fig. 3B) was an English migrant who had joined the Australian Reptile club. He worked for a time with Donald Thomson managing his field collections was bitten by black snakes a number of times (Sunday Telegraph, 1950). He was a good friend of Kevin Budden’s and initially planned to accompany Kevin on his ill-fated expedition to North Queensland in search for taipans. At some stage, Bill Hosmer acquired a taipan. There are no details available but CSL records (Fig. 1C), show that he contributed some venom (20 mg) to the taipan antivenom development. Bill traveled widely and collected reptiles in Central Australia, Borneo and North Queensland as a consequence there are many museums from around the world with his specimens—he was a highly skilled taxonomist. He died on 28th December 2002.

3.7. Frank (Francis) Calder little (1904–2000)

Frank Little (Fig. 4D) was born at Murphy’s Creek near Toowoomba, Queensland, on 14th July

1904. In 1915 he spent his schoolboy days at Mount Carbine near Mount Molloy and he spent the rest of his life at Mount Molloy (Crothers, 2004). He worked most of his life in the timber industry and during the second World War he served between 1942 and 1945 in the volunteer Defence Corps. Many of the taipans collected for venom extraction used by Eric Worrell, Charles Tanner, David Fleay and Ram Chandra were collected by Frank Little from Mount Molloy (John McLoughlin, Pers Comm). John McLoughlin said that he used to pay Frank £12 per snake, which was more than the average weekly wage at the time (McLoughlin, 2004).

Frank was a superb bushman, this skill provided his family with food during the great depression. He had a trappers permit to catch possums in 1929 and also sold wallaby and kangaroo skins. “Catching taipans was all in a days work to him. He had the expertize and he knew it. It was no big deal to him and the danger he did not dwell upon; it was just as though there were none (Crothers, 2004)”! He was an excellent marksman and even in his final years when he did not have the strength to support the gun he was inventive to get around his disability. He tied a leather strap to a rail to steady the gun to shoot troublesome cockatoos, which ate his vegetables. The leather strap is still on the fence rail today (Crothers, 2004).

In 1939, a northern death adder (*Acanthophis praelongus*) bit him on the foot whilst he was walking near his wood heap in the evening. He cut the bite-site with his pocketknife to make it bleed, propped himself against the wall then applied a cloth ligature which was loosened at intervals. The Mount Molloy matron and the schoolmaster (who was the local ambulance man) were summoned. The matron wanted to inject strychnine and the schoolmaster wanted to give him a nip of brandy, both of which were flatly refused. His daughter, Joan Crothers, who was 8 years old at the time, remembers his being fine the next morning (Crothers, 2004).

Joan Crothers remembers 101 taipans being collected by Frank Little between 1957 and 1980. These were supplied to venom producers (Crothers, 2004). I can remember an experience collecting taipans with Frank in 1983. After meeting Frank with his wife Pearl and son (called “Boy”), the day before, I came to Frank’s place early the next morning. Frank was dressed as usual (they tell me) in his khaki shorts and shirt with tennis sand shoes

(Fig. 4D) on his feet, because catching taipans was serious business. Normally he got around in bare feet. Frank was 79 at the time and his wife, he called Ma, was not all that happy with his going out after taipans at his age but he was as fit as a mallee bull. Frank died on the 17th July 2000 (Crothers, 2004).

3.8. John McLoughlin (Born 1936)

John McLoughlin supplied snake venoms to the Eric Worrell from 1964 until 1982 when he then supplied it direct to CSL until 1989. He then supplied it to the Australian Reptile Park from 1993 until 2001 when he finally retired (McLoughlin, 2004). John accompanied Eric Worrell on a number of trips looking for taipans and was the advance party who gathered taipan intelligence to help narrow down the odds. He said if we only knew then what we know now about taipans it would have made the game a lot easier (McLoughlin, 2004). Eric Worrell met John McLoughlin—'Johnny Mac', a young carpenter and local nature enthusiast on one of his trips north. John proved to be a vital ingredient to the success that the team had in procuring two hard-won taipan specimens. A year later they secured nine taipans and had plans for a breeding program (Weigel, 2004).

Unfortunately, in those days the husbandry requirements of snakes was not well known, and Eric had only minimal luck with the precious few taipans, possibly due to the lack of tropical warmth. For a number of years Johnny Mac forwarded taipans to Eric on an irregular basis (Weigel, 2004).

In the early 1960s Johnny Mac suggested to Eric that perhaps his taipan venom program would benefit if the snakes were maintained in tropical conditions—at his Cairns residence. This came to be, and Johnny became employed by the Australian Reptile Park in 1964. This proved to be one of Worrell's best business decisions. The taipans thrived, and it soon became apparent that all of the Reptile Park's snake venom production activities would benefit by way of being transferred to John's care. In 1968 Eric funded the construction of a purpose-built venom production laboratory just north of Cairns, at Trinity Beach, as designed and constructed by John McLoughlin (Weigel, 2004).

From that time on, Worrell was not directly involved in the production of snake venoms, other than to continue to be contracted to CSL for about half of their snake venom requirements—which were produced by John McLoughlin on Worrell's

behalf (Weigel, 2004). John was fortunate to make contact with two good suppliers of taipans. One was Vince Edwards who worked on the railway line between Redlynch and the Kuranda range. The other supplier was Frank Little who was an excellent bushman and snake catcher. These two catchers kept him in good supply of taipans for the important taipan venom production (McLoughlin, 2004). John McLoughlin's production of venoms, especially taipan venom, played a vital role in maintaining the supply of venoms required to make snake antivenoms and certainly solved the problem early keepers had keeping taipans alive in southern climates.

3.9. Roy Reynolds (1913–1992)

Roy Reynolds (Fig. 5A) was born at Narrandra, on the edge of the Murrumbidgee river irrigation area and moved to Yanco at the age of 14 and eventually married his wife Flo. He worked as a farmhand at the Yanco Agricultural College and found himself in the midst of a healthy population of brown snakes, *Pseudonaja textilis* (Cann, 1992). Common brown snakes, *Pseudonaja textilis* were widespread across southern and eastern coastal Australia and caused a significant number of snakebites. It is unclear if around the 1930s to the 1950s when antivenoms were being developed, whether they caused more snakebites than tiger snakes. Nevertheless, deaths were occurring but because the venom yields from brown snakes were significantly lower than for tiger snakes and brown snakes were harder to obtain in large numbers; obtaining sufficient venom was a problem. Today, bites from the brown snake genus, *Pseudonaja*, are the biggest cause of snakebites and snakebite deaths in Australia. Tiger snakes have declined dramatically in numbers with subsequent drops in envenoming (Mirtschin et al., 1999).

Development of the brown snake antivenom by CSL was largely dependent on the work of Roy Reynolds who was able to collect sufficient large brown snakes for venom production. In the 1930s, CSL failed to produce brown snake antivenom because they had insufficient venom despite using goats, which required less venom than horses (Cann, 1992). In the mid-1950s, the venom suppliers, Worrell, Fleay, Tanner and Slater were unable to supply sufficient venom for continuing the brown snake antivenom project. About that time, there was an explosion of brown snake population when

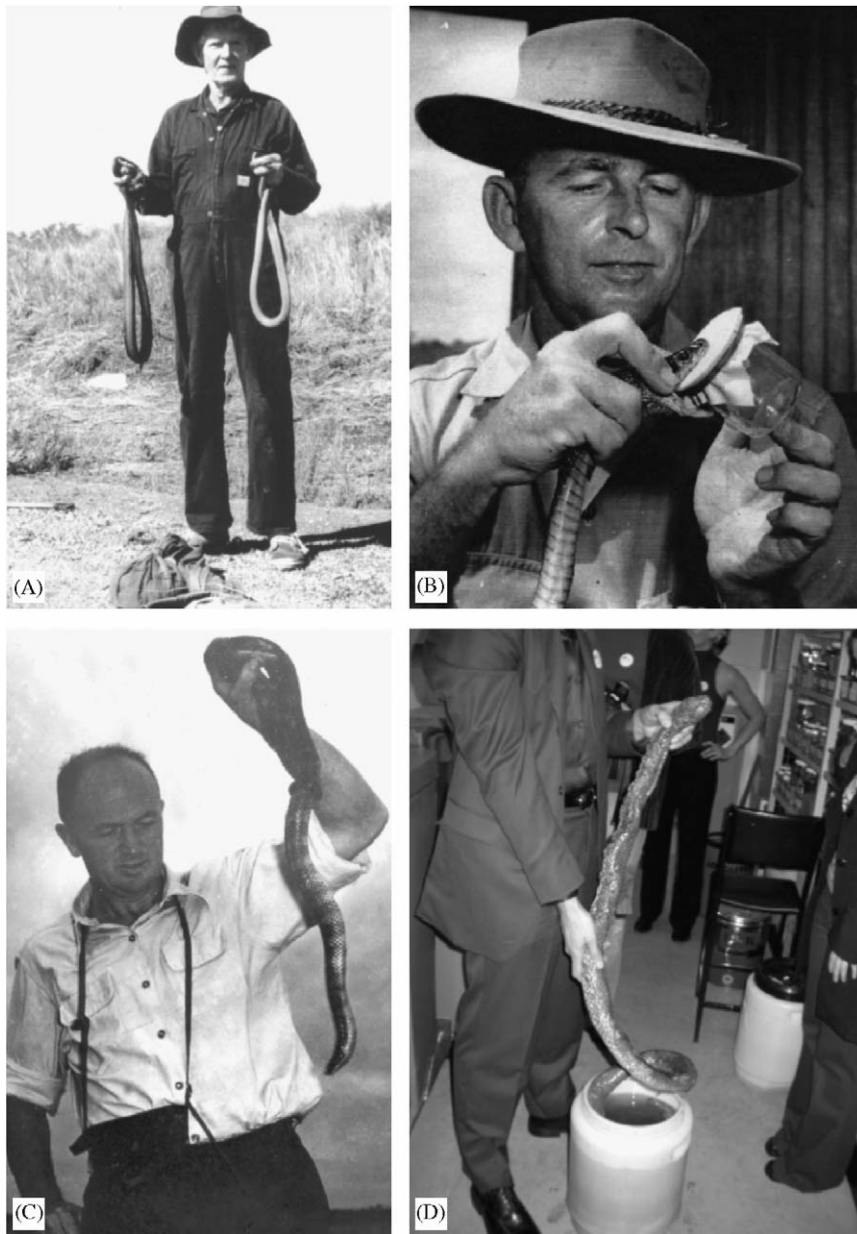


Fig. 5. (A) Roy Reynolds—Leeton NSW (John Cann). (B) Ken Slater milking a Papuan Taipan. (C) Charles Tanner (J Cann). D. A large mulga snake *Pseudechis australis* in the Donald Thomson collection, Melbourne Museum (Peter Mirtschin).

the irrigation canals were built in the Riverina district of NSW. Snakes and mice inhabited the tunnels that formed in the earthen mounds created by the excavation of the irrigation canals. In the canals themselves, weed formed which encouraged golden bell frogs to multiply in their thousands (Cann, 1992). Roy caught an exceptionally large brown snake and rather than kill it he sent it to George Cann Senior who was Curator of Reptiles at

Taronga Zoo in Sydney. He caught a second brown snake, which he sent to Eric Worrell (Cann, 1992).

A CSL biochemist, Merv Hinton, suggested the price for brown snake venom should be substantially increased to provide a greater incentive to collect more brown snake venom. Worrell offered Roy 10 shillings per foot for brown snakes over 4 foot, £5 for 6 foot snakes and £10 for snakes over 6.5 foot. This encouraged Roy to catch hundreds

more snakes which he packed off by train from Leeton to Sydney on the coast, a distance of 640 km, which became known as the “Brown Snake Express”. Roy’s kitchen table was marked as a measuring rod and Roy would hold the head and Flo would stretch the tail. Roy thought at times Flo would break their backs trying to get the last inch from the snake (Cann, 1992). Roy, who using a pinner to capture the snakes behind the head, caught hundreds of brown snakes for Worrell and only once required antivenom when he received a bite that nearly killed him. Eric Worrell only learnt about Roys near death experience when he received the hospital bill. He paid for it without question (Cann, 1992). Roy Reynolds died at the age of 79 in 1992.

3.10. Ken Slater (1923–1999)

Papua New Guinea (PNG), on Australia’s doorstep was a frontier with a snakebite problem far more desperate than Australia. We are well aware today that antivenoms developed for Australia also work very well in PNG. Fortunately, a keen professional herpetologist, Ken Slater (Fig. 5B), resided in PNG at the time of the early production of taipan antivenom and was able to contribute with precious samples of taipan venom (from *Oxyuranus scutellatus canni*) to make up the pool of taipan venom required to produce this antivenom at the Commonwealth Serum Laboratories in Melbourne. He also provided all the venom required to develop the Papuan black snake antivenom which was also used for some time to treat king brown snake (*Pseudechis australis*) bites as well as other occasional *Pseudechis* bites in Australia. Early production of this antivenom was also totally reliant on supply of this venom from Ken Slater (Slater and Slater, 2003).

His early training was in the engineering industry, and he was self-trained in zoology, herpetology and wildlife conservation theory and practice. He was strongly influenced by the writings of Darwin, Mary, Dobzhansky, Elton, Rensch and Simpson. To get closer to wildlife he took a job in the oil industry in 1952 in PNG and then became Acting Animal Ecologist for the Department of Agriculture Administration of the PNG government and became responsible for wildlife investigation until he returned to Australia in 1959. In Australia, he was appointed Senior Wildlife Officer for South Australia in 1960 and then Acting Wildlife Biologist

for the Northern Territory Administration in 1963. He joined the CSIRO in 1966 as Supervisor of Laboratory Craftsmen in Plant Industry Division (Slater and Slater, 2003).

Ken kept his snakes at the Kila Kila Agricultural Station where he milked them every 2 weeks and venom was sent to the Commonwealth Serum Laboratories. He had difficulty getting the snakes to feed on their natural food of rats and bandicoots so he had to tube feed them liver and baby food directly into their stomachs (Gasson, 1959). On one collecting trip, on the 27th August 1957 at mid-day, at Bereina west of Port Moresby, Ken Slater found a couple of Papuan taipans mating and grabbed the female and bagged it. On trying to catch the 1.83 m male, it displayed “astounding ferocity and speed” and buried its fangs into his right forearm. Both fang marks bled freely. He applied a tourniquet and incised the bite site and bleeding was stimulated using a rubber suction cup whilst a friend held the male taipan pinned with a stick. The male was bagged as well (Tonus, 1957; North Queenslander Register, 1957; Slater, 1957c).

Slater found it difficult to find a vein in his left arm despite a tourniquet being applied, a job made more difficult by a faulty syringe. He was eventually successfully entering a vein in the left ankle. He gave himself 3000 units of the new taipan antivenom and a further 3000 unit intramuscularly (Slater, 1957c).

After 25 min post-bite, classic envenoming symptoms ensued. He was transferred to Port Moresby hospital and a further 3000 units of taipan antivenom given next morning. His condition worsened but by late on the 28th August some improvement was noticed. By the 31st August his strength began to return and his vision was almost normal by the 4th September. He was discharged on the 6th September with residual pain in his forearm and sluggish legs. Dr J.J. Graydon from the Commonwealth Serum Laboratories believed his “presence of mind, coolness and efficiency” of giving himself an intravenous injection of antivenom and prompt first aid saved his life (Slater, 1957; Graydon, 1957a).

The venom used in the development and production of the Papuan black snake (*Pseudechis papuanus*) antivenom is fully attributable to the work of Ken Slater. This antivenom was the only effective treatment for the Papuan black snake and also was effective against the king brown snake (Hinton, 1958a, b). In 1959, a young boy was bitten by a Papuan black snake and was treated initially with

tiger snake antivenom then Papuan black snake antivenom. This child was the first person known to survive the bite of this snake (South Pacific Post, 1959a, b). Not only was the milking of snakes by Ken Slater a life saving activity, it also earned some money for the PNG Department of Agriculture Administration. On one occasion in 1958, he earned £120 by milking eight taipans and four Papuan black snakes (South Pacific Post, 1958a, b).

Ken Slater resigned from his position of Government Ecologist in 1959 and a scheme was established to continue snake procurement (James, 1959). To keep up supplies of Papuan black snake venom for the newly released Papuan black snake antivenom, the Department of Agriculture offered £3/foot for every healthy Papuan black snake over 3 foot and for continuing supplies of taipan venom for taipan antivenom production, £8/foot to the public (South Pacific Post, 1959a, b). Ken was unhappy about the lure of big money for the snakes and believed that “many may be tempted to take most serious risks” and that catching snakes “should be left to those specially trained for the task (James, 1959)”. “In 1989 it was related to Bart Currie (Specialist Physician Port Moresby Hospital 1986–1989) that during this time, at least one native Papuan had died in PNG as a result of taipan envenoming while collecting snakes for the early Australian venom research and antivenom production. However, no formal documentation of such fatalities was found” (Currie, 2004). His snakes were sent on to Sydney, where for a time he continued to milk them but the survival of the snakes and production of venom there was poor (Cochrane, 1959).

Whilst on annual leave from PNG, Ken worked with Eric Worrell milking snakes and going on collecting trips for tiger and brown snakes. He also worked there for 18 months after leaving PNG. He received two tiger snake bites during this time for which he received antivenom at least once. He also received a brown snakebite as well but no antivenom was used nor did he seek treatment (Slater and Slater, 2003). Ken Slater played a vital role in describing the dangerous snakes in PNG and collection of venom for antivenom development and production. Dr Frank Morgan, of the Commonwealth Serum Laboratories, he described his contribution, as “meticulous recording of essential data relating to each specimen of snake collected has been a model of painstaking and methodical description” (Morgan, 1956). Ken Slater was born

in Bondi, Sydney 22nd June 1923 and died in Bellingen, NSW 15th August 1999 aged 76.

3.11. Charles Tanner (1911–1996)

Charles Tanner (Fig. 5C) had a life long passion for reptiles and collected 522 frogs and 573 reptiles for the Victorian Museum and 302 frogs, 548 reptiles and 42 mammals for the Queensland Museum, mostly in his spare time (Covacevich et al., 1997). Many snakebite victims from the early 1960s to 1985, could attribute their survival to the work of Charles Tanner who milked Australia's deadly snakes for the Commonwealth Serum Laboratories on his snake farm at Cooktown in far north Queensland. Charles Tanner was first to collect and milk the Inland taipan, *O. microlepidotus* (Fig. 4B), re-discovered in the early 1970s after being lost to science for nearly 100 years (Covacevich and Wombey, 1976). The venom of which proved to be the most toxic of any snake in the world (Broad et al., 1979a, b). Compared with the coastal taipan *O. scutellatus*, the venom from individual milkings of Inland taipans showed remarkable homogeneity (Broad et al., 1979a).

Many of the venoms produced by Charles Tanner now form a valuable part of the national collection of venoms held by the Australian Venom Research Unit at the University of Melbourne (Covacevich et al., 1997). Charles Tanner was reluctant to discuss his many snake bites because they reflected on his handling ability—he referred to antivenom as “mother's milk” (Covacevich et al., 1997). He developed a high degree of skill for keeping and breeding snakes in captivity. Some of his breeding records became important to understanding the ecology of certain species. One instance was the use of his data (copulations, clutch size and hatchling sizes) from the *Oxyuramus* species by Professor Rick Shine and Jeanette Covacevich (Shine and Covacevich, 1983). Herpetologists throughout the world use some of the apparatus such as jigger, potato masher, hide boxes with trapdoors and the use of large plastic bags for milking large particularly nervous snakes he designed all making it easier, safer for the snake keeper and less stressful for the snake (Covacevich et al., 1997).

After receiving antivenoms a number of times after nine snakebites, by the time he was 46 years old he had developed an allergy to antivenoms (Weiner, 1960; Cann, 1986). Dr Saul Weiner from CSL decided to try and build up his immunity to

tiger snake venom (Weiner, 1960). The venom was treated with hydrochloric acid with the intent of removing the procoagulant fraction, which was erroneously thought to be unimportant and toxoided with formalin (Weiner, 1960; Tibballs, 1994). He was injected 24 times with tiger snake venom over 13 months after which, mice could tolerate 10–15 LD₅₀ doses of venom when incubated with his serum. His antibody titer dropped rapidly after his last dose of tiger snake venom. Part way through his treatment, he was bitten by a western brown snake *Pseudonaja nuchalis* which caused marked dyspnoea, collapse and was unconsciousness for 15 min. He was admitted to hospital and 4 hours later symptoms disappeared except for general weakness for 2 days (Weiner, 1960).

He was always interested in helping research projects and took special interest in investigating antibody titers among the serums of herpetologists exposed to venomous snakes. His serums along with many other herpetologists are stored at the Australian Venom Research Unit for medical research (Covacevich et al., 1997). Charles Tanner was born on 19th January 1911 in Brighton England and died 23rd December 1996, Cairns Australia. Jeanette Covacevich described him as “a herpetologist born, not made” (Covacevich et al., 1997).

3.12. Donald Fergusson Thomson (1901–1970)

Donald Thomson (Fig. 6A) was born in Melbourne and as young boy had a love for natural history. He kept a kangaroo as a pet in the Melbourne suburb Camberwell. He was not a normal student, having much wider and bizarre interests than most boys but he won a photographic prize at his school speech night for “Photographic contributions to the Scotch Collegian” and was dubbed the “naturalist of the school” (Thomson, 1985).

He paid his own way through Melbourne University by doing part time jobs and took on science and graduated in 1925 in botany and zoology. He was keen to do field work and in 1926 worked as a cadet journalist for the Melbourne Herald to raise funds for expeditions. He studied anthropology at Sydney University in 1927 whilst working as a part time demonstrator and graduated in 1928 with a diploma in anthropology. He wasted no time organizing an expedition to Cape York Peninsula in Queensland starting from Melbourne University. Thomson spent 8 months in the field on

Cape York Peninsula gathering vast amounts of anthropologic, zoological and photographic material. He returned again to Cape York Peninsula in 1929, which he financed, by the publication of syndicated articles.

From 1930 to 1931 he worked at the Walter and Eliza Hall in Melbourne investigating the development of tiger snake antivenom for treatment of tiger snake bites. His final expedition to Cape York from the University of Melbourne was in 1932. Expeditions to Cape York Peninsula were hard living with the risks of malaria, difficulties finding water, food for the pack horses, storage of food, development of tropical sores. Moreover, all scientific and photographic equipment had to be carried by hand.

In 1934 he completed his doctorate and from here he became more focused on social sciences. He traveled to many remote parts of Australia and studied the aboriginals whilst also continuing his fauna surveys. His well documented specimens were a model for future scientific collectors. He caught a number of taipans and milked them to see how much venom they produced. He did nothing with the venom but stored it (Jones, 1977). In 1933, he described the big brown snake as *O. scutellatus*, the taipan (meaning brown or rainbow snake), and was sure it was the same species as described by Peters in 1867 which was published in the Monatsberichte der Deutschen Akademie der Wissenschaften (Jones, 1977) but different to the *Pseudechis* genus in which Peters had placed the species (Jones, 1977; Masci and Kendall, 1995). It was Donald Thomson who first introduced the aboriginal common name taipan to this species.

Donald Thomson in his work lived with the nomadic aborigines on Cape York Peninsula for 20 months. During this time more than 300 specimens of snakes were collected. A substantial collection of reptiles from Thomson now forms a separate collection in the Victorian Museum. Here is Donald Thomson’s own account: “We captured several specimens of giant king brown Snakes (Fig. 5D), and extracted venom from them regularly each week—collecting data on their “primary” yields of venom, on the rate of secretion, and data on the factors that influence this. A published account (Kellaway and Thomson, 1930) of venom yields may include some of this data but nevertheless it is early documentation of the venom yield and toxicity capability of the venom from this species. Talking to the natives, I heard much of a giant copper-colored snake, which they called “taipan” and in which they

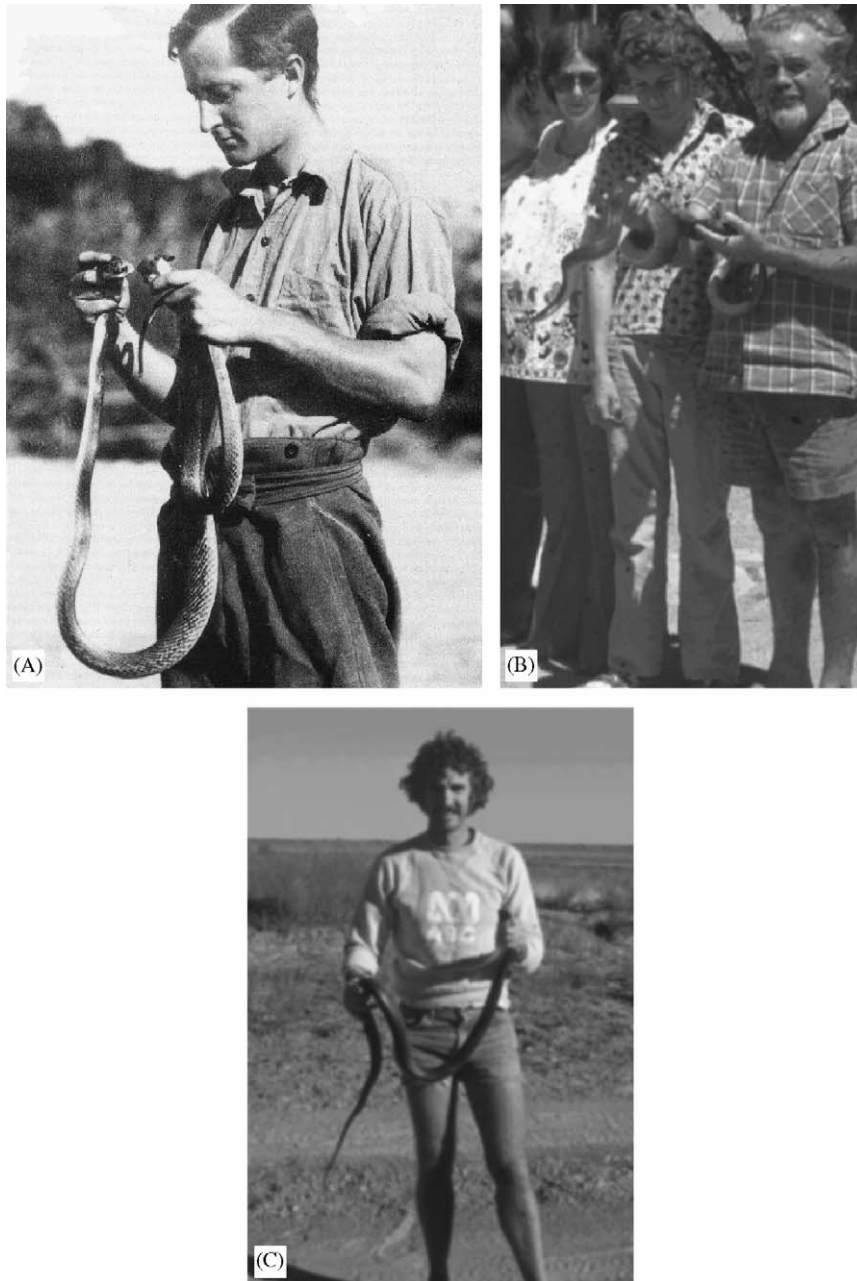


Fig. 6. (A) Donald Thomson milking a Taipan. (B) Joe Bredl (Right) (Peter Mirtschin). (C) Peter Mirtschin at Goyders Lagoon 1980 holding *Oxyuranus microlepidotus*. Taipan antivenom was used for first time on Mirtschin to treat a bite from this species.

stood in great dread. But for months I could obtain no specimen. At length, one evening a dog was bitten by a snake and died within a short time. I secured the snake and carried out a post mortem on the dog.

The results were interesting and I examined the snake with new interest. It proved to be the first specimen of the giant—still almost a legend, brown

snake—which I had sought for so long. It was the first specimen of the taipan ever captured. And true to description of the natives, the snake had a wicked orange-red eye! We extracted venom from the precious specimen—a pale whitish venom very unlike the orange poison of the giant Mulga snake. The specimen proved to be a female. We handled her often—but we treated her with respect and she

responded by displaying everything that could be asked for—even to laying a clutch of seven eggs. Thus proving the taipan was oviparous.

In the months that followed we made minute observations on her behavior. On this same expedition we captured five or six taipans alive and extracted large quantities of venom, which we dehydrated and preserved for future research. And with each new capture we learned more of the deadly speed and aggressiveness of this snake. Although we had snake sticks especially made for handling reptiles, the taipan had to be picked up by hand for milking—because it fought savagely that it would tear away the muscles of its neck and so a valuable specimen and potential yielder of venom, would be lost” (Thomson, 1950).

3.13. Eric Worrell (1923–1987)

Eric Worrell (Fig. 4C) was one of the best-known pioneers involved with venoms, snakes and other Australian reptiles and animals. Eric was the author of a number of books and was the face of venom production to many Australians. In 1948, Eric Worrell established the Ocean Beach Aquarium at Woy Woy in NSW. From this base, Eric made a substantial contribution to venom production and the development of taipan antivenom. With the advent of tiger snake antivenom in 1930 and the retirement of Tom Eades, CSL employed Eric to collect venom from snakes mostly caught during the summer. On one occasion, Eric, George Cann and Ken Slater collected 250 tiger snakes in the Forbes-Condoblin districts. Eric despised the slaughter of tiger snakes and was told that on one farm, 300 were shot in one day. He believed tiger snakes (Fig. 2E), because they flattened out, hissed and gave plenty of warning, were the most inoffensive snakes and described them as the “gentlemen” of snakes (Worrell, 1958).

In the late 1940s to early 1950s, it was realized the long brown snake with a pale head, named the taipan (*O. scutellatus*) (Fig. 2D) by Donald Thomson in the early part of the twentieth century, had been confused with king brown snakes (*Pseudechis australis*) and common brown snakes (*Pseudonaja textilis*). Despite being described in 1867 by Peters as *Pseudechis scutellatus* and later revised by Kinghorn as *O. scutellatus*, it was not until the 1950s when its true potential became known. It had an inflated reputation but Worrell found it shy and quick to retreat. However, if provoked, it could

attack fearlessly, its large size, long fangs and high venom yield made it a formidable opponent. Its attack was speedy and capable of multiple bites often prior to its victim realizing the snake’s intention (Worrell, 1958). These early observations by Worrell and associates, with wild taipans, were all made without a safety net of antivenom being available, and are still regarded as accurate today by herpetologists. Even today with antivenom being available, deaths occur from taipan bites emphasizing the invaluable contribution these pioneers made. The only treatment available to these pioneers at the time was tiger snake antivenom which only offered very limited protection.

The true danger of this work hit home in July 1950 when an amateur herpetologist from Randwick in Sydney, Kevin Budden (Fig. 2B) went to the Cairns area looking for snakes. He was bitten after catching a taipan and despite the best efforts to save him, he died the next day. Budden’s taipan (Fig. 4A) was sent to Melbourne and milked for its venom by David Fleay. When it was tested, the extent of its toxicity was revealed. The limited first batches of taipan antivenom were supplied to Eric Worrell and also Ram Chandra and Ken Slater who also milked taipans. Taipan antivenom provided a safety factor in case of accidental bites against a strong snake with highly toxic venom, high venom yields, a large head and narrow neck, being the ultimate in evolution for fast striking and making it highly dangerous to catch from its wild state. Pioneers such as Worrell, who often worked at their own personal expense, deserve the utmost praise for their role in antivenom development.

Worrell made a number of expeditions to the Bass Strait islands between Victoria and Tasmania to collect giant black tiger snakes (*Notechis ater serventyi*) required for venom used in tiger snake antivenom production. His account of mutton bird harvesting on Chappell Island is one of the first documented accounts of this industry. During one of his visits to Chappell Island, he treated 2 tiger snake bites, to one of his colleagues and one to a mutton birder, with tiger snake antivenom prepared from venom produced earlier (Worrell, 1958).

Together with his accomplices George Cann (Senior), John Dwyer, Ken Slater, Wal Lorking, John McLoughlin Charles Tanner and Eric West, Worrell was one of a number of pioneering herpetologists who all contributed in many ways to making antivenoms. With his books and television appearances, Eric Worrell was one who

inspired many herpetologists. In the 1960s to the early 1980s most Australian herpetologists owned a copy of Australia's reptile bible, the book "Reptiles of Australia" by Eric Worrell (Worrell, 1963). I used to carry my copy around on field trips and sleep with it under my pillow—nothing like resting on my Worrell's. Eric was bitten six times by deadly snakes during his career, received an MBE in 1970 in recognition of his venom production work and, in 1981, with the release of funnel web spider antivenom, Eric and Robyn (his wife) jointly received a humanitarian award from National Australia Bank for their many years of supplying funnel web spider venom to Struan Sutherland from the Commonwealth Serum Laboratories. He was born in 1923 died in 1987 of a heart attack, aged 63.

3.14. Other snake handlers

There were a number of other snake handlers who contributed in some way to the collection of snakes, education of the public and collection of venom. These people usually worked with other mainstream suppliers or in some way complemented the work of such people. Men such as Berkley Cook, Bob Humphries, Joe Bredl (Fig. 6B) and Gary Zielfliesch carried out important functions in support of venom collection or supply of snakes at some stage of their lives and assisted others to supply important venom for antivenom production or for venom research.

4. Discovery of Australia's most deadly snake species

By 1962 Australia had polyvalent antivenom and specific antivenoms which were effective against the venoms of all the deadly snake species. The rediscovery of a little known snake occurred in 1967, in a bizarre set of circumstances when Athol Compton, who worked occasionally for Eric Worrell, was bitten by what he thought was a western brown snake whilst leading a party of tourists through the channel country in south-eastern Queensland. He was retrieved to Broken Hill by the Flying Doctor then relocated to Adelaide. He was given brown snake antivenom and suffered a long critical illness before recovering (Trinca, 1969). The snake turned out to be the hardly known inland taipan, *O. microlepidotus* (Fig. 4B) only previously known by a handful of specimens collected by McCoy in 1879 (at the junction of the Murray and Darling rivers), McCleay in 1882 (at Bourke NSW)

and a few specimens in the South Australian Museum. The incident led to the capture of further specimens by Wombey, Covacevich and Tanner (Covacevich and Wombey, 1976; Covacevich et al., 1980) and the venom appeared to be the most potent of any snake venom known and appeared to be similar to that of *O. scutellatus* (Fohlman, 1979; Broad et al., 1979a; Sutherland et al., 1978) and thus not expected to require further antivenom development.

Peter Mirtschin (Fig. 6C) established a captive breeding colony in South Australia from snakes caught at Goyders Lagoon South Australia between the Diamantina and Warburton rivers and experienced an accidental bite from one of the offspring. An uneventful recovery occurred after rapid first aid and treatment with taipan antivenom, which was the first time Taipian antivenom, had been used to treat a bite from this species (Mirtschin et al., 1984). The species main population appeared to be in South Western Queensland and in South Australia, Houston (1973) thought it would be "encountered only along the major watercourses of the Far North East of South Australia following rat plagues". Since then it has been found well south of the South Australian Queensland border and is found in a range of desert habitats (Mirtschin and Reid, 1982; Read, 1994).

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