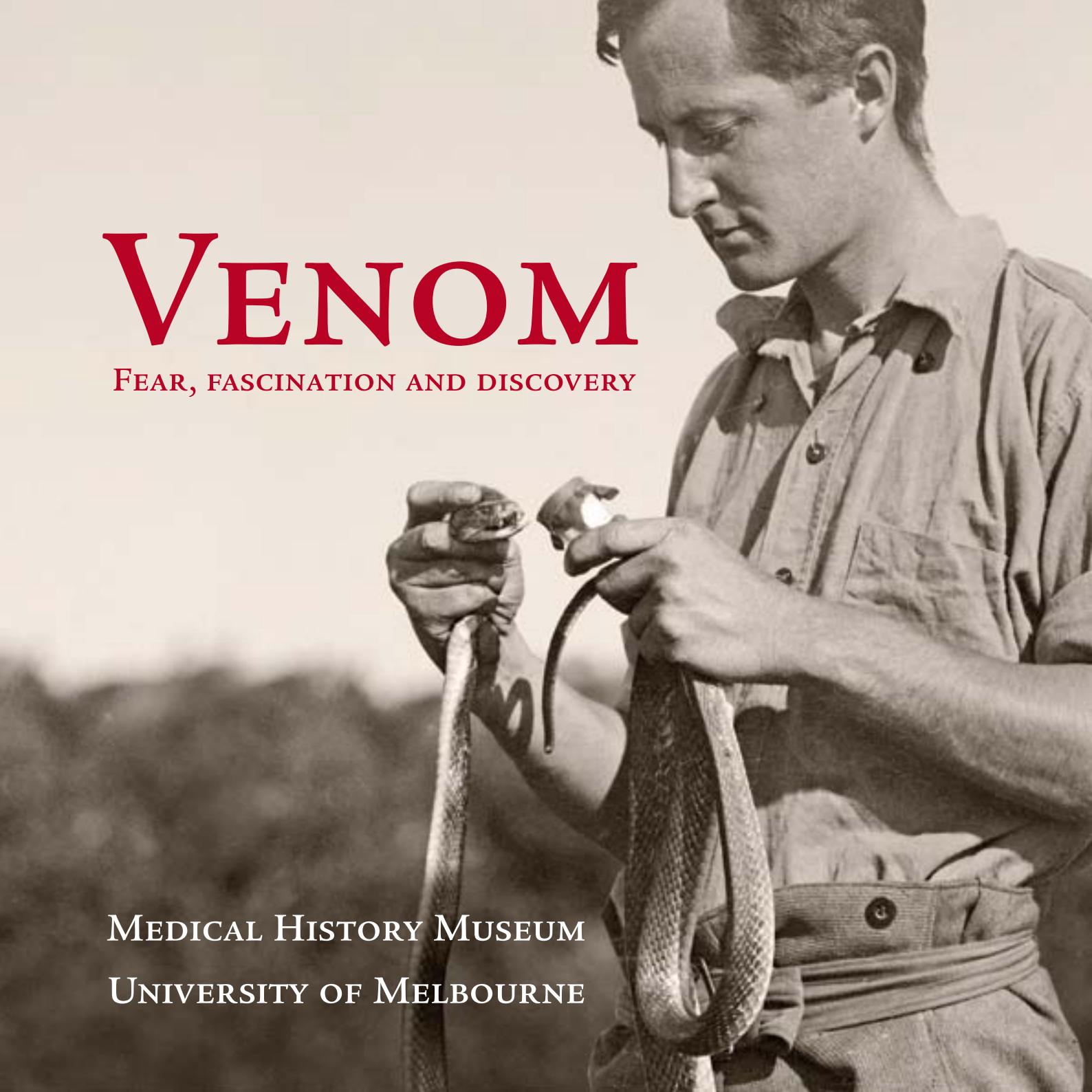
Venom

Fear, fascination and discovery



Medical History Museum
University of Melbourne

This book tells of the fascination with the power of venom and the quest for a universal antidote against this most feared of poisons. Over thousands of years Australian Aboriginal people incorporated ways of understanding and dealing with these venomous creatures in their cultural and healing practices. Since colonial times to the present day the search for an antidote has continued. From the first Professor of Medicine, George Britton Halford, the University of Melbourne has been part of the global debate on the nature of venom. Halford commanded international attention in the 1860s for his controversial 'germ theory' of snake poisoning. Contributions were made through collaboration between major research and cultural institutions: Melbourne Zoo, Museum Victoria, Healesville Sanctuary, Walter and Eliza Hall Institute of Medical Research (WEHI) and the Commonwealth Serum Laboratories (CSL). Struan Sutherland founded the Australian Venom Research Unit (AVRU), in the Department of Pharmacology at the University of Melbourne, upon the privatisation of CSL Ltd, in 1994.

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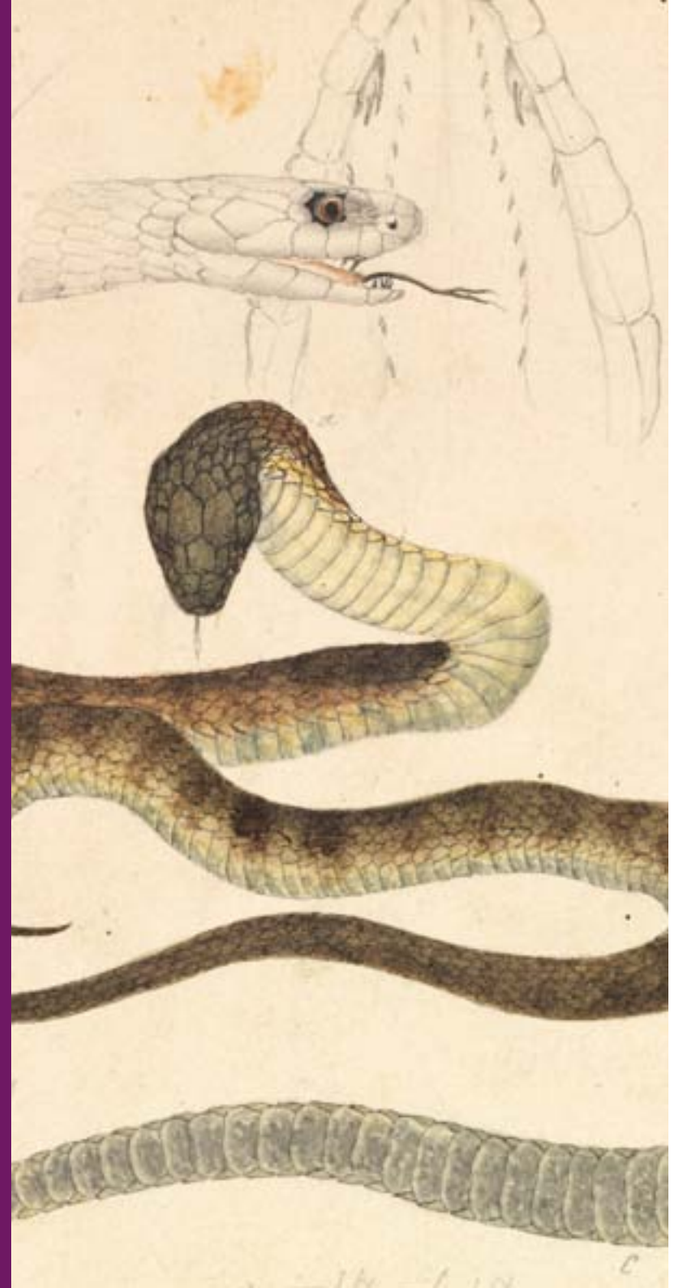

Venom: Fear, fascination and discovery

Medical History Museum
University of Melbourne

Edited by
Jacqueline Healy and Kenneth D Winkel

Medical History Museum, University of Melbourne

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Poisonous snakes—Australia—Venom.
Poisonous snakes—Australia—Venom—Toxicology.
Antivenins.

University of Melbourne. Medical History Museum.

615.942

Cat. 70 CSL, **Black tiger snake venom**,
26 February 1935
venom, glass; 17.0 × 2.5 × 2.8 cm
AVRU Collection, University of Melbourne

Venom: Fear, fascination and discovery is proudly sponsored by bioCSL, a CSL Limited company

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Foreword

Last year was the 150th anniversary of the Medical School at the University of Melbourne, a significant milestone for the Faculty and University. The Melbourne Medical School is committed to its ongoing contribution to research and collaboration with other major Australian and international research facilities. The School's Medical History Museum has partnered with the Australian Venom Research Unit to produce an exhibition and its accompanying catalogue on *Venom: Fear, fascination and discovery* to tell the story of the development of antivenom in Australia and its international connections.

Established by a grant from The Wellcome Trust, the Medical History Museum opened in April 1967. An important collection in the Faculty, it holds over 6000 items covering the history of the Melbourne Medical School and the broader history of medicine in Australia and overseas. Struan Sutherland founded the Australian Venom Research Unit (AVRU) in the Department of Pharmacology in 1994, after Commonwealth Serum Laboratories was privatised (CSL Ltd). The AVRU builds on more than eighty years of CSL expertise, as well as 150 years of venom research at the University of Melbourne.

This publication brings together prominent members of the medical profession, the broader research community and the major research institutions: Walter and Eliza Hall Research Institute (WEHI) and CSL. Contributors include Kerry Arabena, encompassing an Australian Indigenous perspective, Peter Hobbins on early research developments and colonial fears of snakes, Douglas Hilton on the pioneering research of WEHI, and the head of bioCSL, bringing together major threads of the story of venom. Wellcome Trust scholar Kathleen Walker-Meikle writes about medieval practice in snakebite treatment and Michael Slouber presents the power of Garuda in South Asia in the treatment of poisoning, while Nancy Cushing and Kevin Markwell elaborate on the impact of the symbol of the snake in popular culture.

The essays and items in this catalogue represent key aspects of the story of venom. Included are items from the Medical History Museum, Special Collections at the Baillieu Library, the Walter and Eliza Hall Institute Archives, Museum Victoria, the State Library of Victoria and CSL.

I thank all the authors for contributing to this significant publication. I also sincerely thank the support of bioCSL, a company of CSL Ltd, for proudly sponsoring this very significant exhibition and catalogue at the University of Melbourne that celebrates the rich legacy of medical history and our research partners.

Professor James A Angus AO
Dean, The Faculty of Medicine, Dentistry and Health Sciences

Cat. 9 Felton Grimwade & Co., Melbourne, **Chloride of lime antidote for snake bite**, c. 1895; glass, metal, leather and wood; 3.1 × 12.7 × 9.2 cm. Medical History Museum, MHM03933

Sponsor's message: CSL's contribution

On behalf of bioCSL, a CSL Ltd company, I am pleased to be able to present to you *Venom: Fear, fascination and discovery*, an exciting retrospective of the story of venom.

Although antivenoms, the neutralising agents of venom, were available in other regions of the world from the turn of the twentieth century, antivenoms against Australia's most common venomous snakes were not produced until the early 1930s, when CSL developed the first for tiger snake. Since then, CSL has played an important role in Australia by maintaining the most comprehensive range of antivenoms for snakes, spiders and marine animals. In partnership with the Australian Government, these complex medicines are manufactured as part of our service to the community.

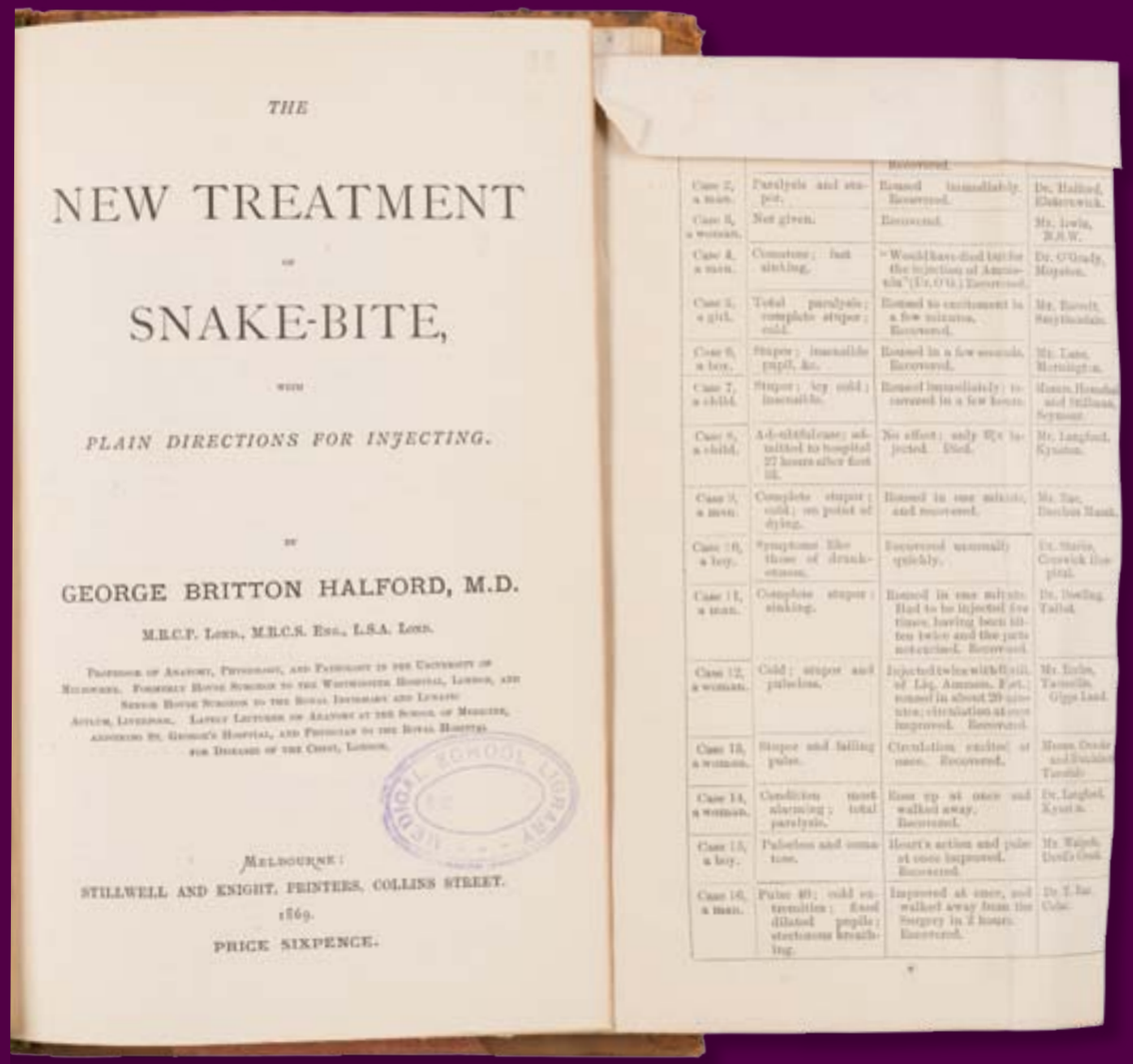
The development of the extensive range of antivenoms available today was brought about through ingenuity and determination. Following collaboration between the Walter and Eliza Hall Institute of Medical Research and CSL to develop the first Australian snake antivenom, CSL scientists continued to expand research and development activities, producing the world's first widely available marine antivenom for stonefish in 1959, the first antivenom for redback spider envenomation in 1956 and the first polyvalent snake antivenom for the bite of Australian and Papua New Guinea venomous snakes in 1962.

Our collaborations continue, working closely with the University of Melbourne and its Australian Venom Research Unit to support snakebite education and access initiatives across Australia and Papua New Guinea.

The fascination and mystery surrounding venomous creatures has created a body of knowledge that now helps to safeguard communities around the world. bioCSL is pleased to be able to partner with the University of Melbourne to bring to you this rich and colourful insight into the story of venom.

Dr John Anderson
Senior Vice President and General Manager
bioCSL Pty Ltd

Cat. 160 CSL, **Tiger snake antivenene**, 19 July 1961; antivenom, glass, cardboard; 2.7 × 10.4 × 2.9 cm. Museum Victoria, CSL Collection, HT003364



THE

NEW TREATMENT

OF

SNAKE-BITE,

WITH

PLAIN DIRECTIONS FOR INJECTING.

BY

GEORGE BRITTON HALFORD, M.D.

M.R.C.P. Lond., M.R.C.S. Eng., L.S.A. Lond.

Professor of Anatomy, Physiology, and Pathology in the University of Melbourne. Formerly House Surgeon to the Westminster Hospital, London, and Senior House Surgeon to the Royal Infirmary and Lunatic Asylum, Liverpool. Lately Lecturer on Anatomy at the School of Medicine, adjoining St. George's Hospital, and Physician to the Royal Hospital for Diseases of the Chest, London.

Melbourne:

STILLWELL AND KNIGHT, PRINTERS, COLLINS STREET.

1869.

PRICE SIXPENCE.

Venom: The University of Melbourne's Research

> The medical profession has a distinct duty to the public in regard to this danger to life [snake bite]. Every medical practitioner should be able to treat snake bite when it occurs, not by applying popular remedies or makeshift procedures, but in accordance with scientific data.
>
> Editorial, *Medical Journal of Australia*, June 15, 1929

The arrival in Melbourne, in April 1867, of a manure merchant and his pet cobra, latterly returned from Ceylon, precipitated the University of Melbourne Medical School's first foray into a significant research program, one that continues to this day. The seminal event brought George Britton Halford (1824–1910), Professor of Anatomy, Physiology and Pathology at the University, into the autopsy room of the Melbourne Hospital the following day. The fatal bite from that cobra stimulated Halford to develop his radical germ theory of snakebite poisoning and subsequently promote the use of ammonia injections as treatment (illustrated here; cat. 143). Although highly controversial, Halford did succeed in igniting an explosion of global interest in the pathology of snakebite. His lasting contribution, however, turned out to be his comparative studies of snake venom toxicity.

Indeed, in less than a year after Halford's original observations, the pioneer US toxinologist, Silas Weir Mitchell (1829–1914) from Philadelphia, had written seeking Australian samples of 'dry venom of your own serpents'. To Halford's great advantage, Mitchell had forwarded him dried rattlesnake venom. These snakes differed in their dentition and venom toxicity from that of Australian snakes. Halford used this valuable venom in his subsequent, and at that time unique, comparative studies of cobra, Australian tiger snake and rattlesnake venoms. Ten years on Halford had not returned the favour to Mitchell.

Halford's correspondence also made waves in a different colony of the Empire. In India, where snakebite was and remains a much greater problem than in Australia, Halford's report stimulated a large series of experiments by the Indian Medical Service. This work, including on the venom of another type of snake, the vipers (illustrated on page 11; cat. 162), was led by Joseph Fayrer (1824–1907), Professor of Surgery at the Medical College of Bengal. Fayrer ultimately secured two dozen Australian snakes in 1873, which helped to debunk the germ theory.

Cat. 143 George Britton Halford, **The new treatment of snake-bite: With plain directions for injecting**, Melbourne: Stillwell and Knight, 1869. Special Collections, Baillieu Library, University of Melbourne

From these beginnings, the University has continued to contribute to the global debate on the nature of venom. Specifically, a succession of internationally significant venom researchers, notably CJ Martin (1898–1903, Department of Physiology), Neil Hamilton Fairley and Charles Kellaway (1928–39, Walter and Eliza Hall Institute), accompanied by William Feldberg (1936–38, WEHI) and ER Trethewie (1938–41, WEHI and, later, the Department of Physiology). Then Saul Wiener (1952–58) and Struan Sutherland (1966–99) both documented their pioneering venom and antivenom research as Melbourne MD candidates working at Commonwealth Serum Laboratories (CSL).

This exhibition also documents the critical contributions to the Australian story of venom which were made by non-physician researchers such as the pioneering Fannie Eleanor Williams (1920–40s, WEHI), zoologists Frederick McCoy (1854–99, Natural Sciences and Melbourne Museum), David Fleay (1927–37, Zoology, Melbourne Zoo and Healesville Sanctuary), Tom 'Pambo' Eades (1920–42, Melbourne Zoo, WEHI and CSL) as well as Donald Thomson (1929–34, WEHI and Zoology). Numerous CSL researchers, led by the microbiologist Frederick Morgan (1928–56), were also instrumental in the successful production of Australia's suite of human antivenoms. This interdisciplinary nexus, within the theme of toxinology at Melbourne, was further strengthened when the late Struan Sutherland founded the Australian Venom Research Unit (AVRU) in the Department of Pharmacology, upon the privatisation of CSL Ltd, in 1994.

This relocation, facilitated by the then departmental head, and subsequently Dean of the Faculty of Medicine, Dentistry and Health Sciences, James Angus, brought the story of venom full circle, in refocusing at Melbourne, the research and education activities previously undertaken at CSL post-Kellaway. To paraphrase Winston Churchill, this exhibition does not document the end, nor the beginning of the end, but it does, perhaps, show us the end of the beginning of the story of venom.

Professor James D Best
Head of the Melbourne Medicine School

Reference: P Hobbins, 'Snake germs and Professor Halford's webs', *University of Melbourne Archives Bulletin*, no. 29, July 2011, pp. 3–5.

Cat. 162 **Viper *viperidae***, c. 1870; skeleton; 3.5 × 4.5 × 17.5 cm. Museum Victoria, D073620

Venom: Fear, fascination and discovery

> We cannot feel sure that the apes do not learn from their own experience or from that of their parents what fruits to select. It is, however, certain, as we shall presently see, that apes have an instinctive dread of serpents ...
>
> Charles Darwin, *Descent of Man*, 1871, p. 61

Human fascination with the power of venom, and the quest for the discovery of a universal antidote against this most feared of poisons, is deeply woven into the history of medicine, society and our confrontation with the human condition. Indeed this triumvirate (fear, fascination and discovery) speaks to us of the broader narrative of human engagement with Nature as it has occurred over millennia and has been expressed in both the arts and sciences in multiple cultures, places and times. This interaction, one facet of which is evident in this exhibition, retains its power and significance even in this age of the ascendency of technology. It is fitting that in the Chinese Year of the Snake we have the opportunity, through this exhibition and its catalogue, to reflect on the place of the University of Melbourne and associated institutions, as the enduring thread that has woven together the Australian story of venom.

On a larger scale, it is telling of the power of this broader history that the world's first temple site, Göbekli Tepe in Turkey (11 000 years old), that predates Stonehenge by 6000 years, has not angels but dangerous creatures, including snakes, spiders and scorpions, etched in its towering stone pillars.[1] So potent were these creatures that their power was widely adopted in religious iconography and incorporated into many aspects of human culture. In particular, the image of a snake or serpent had multiple roles in the religious and cultural life of ancient Egypt, Mesopotamia and Greece. For example, in ancient Egypt venomous bites and stings represented a major cause of injury and were a religious and cultural preoccupation. Indeed, the God Horus, represented here from a temple in southern upper Egypt from the Ptolemaic period (332 BC–AD 395) was a falcon-headed deity with power over bites and stings. Gift giving was believed to offer protection from these hazards or assist in healing the bitten. Similarly, such was the significance of venomous snakes, that a pictogram of the deadly horned viper (*Cerastes cerastes*) actually formed part of the written ancient Egyptian language. This culture also offers us perhaps the first surviving text on snakebite—the papyrus held at the Brooklyn Museum of Art.

Ptolemaic pharaoh offering incense to Horus, wall relief; credit: Carole Reeves. Wellcome Library, London

Dating from Dynasty XXX or the early Ptolemaic Period (305 BC), among other topics it refers to the treatment of the snakebite wounds by lancing.[2]

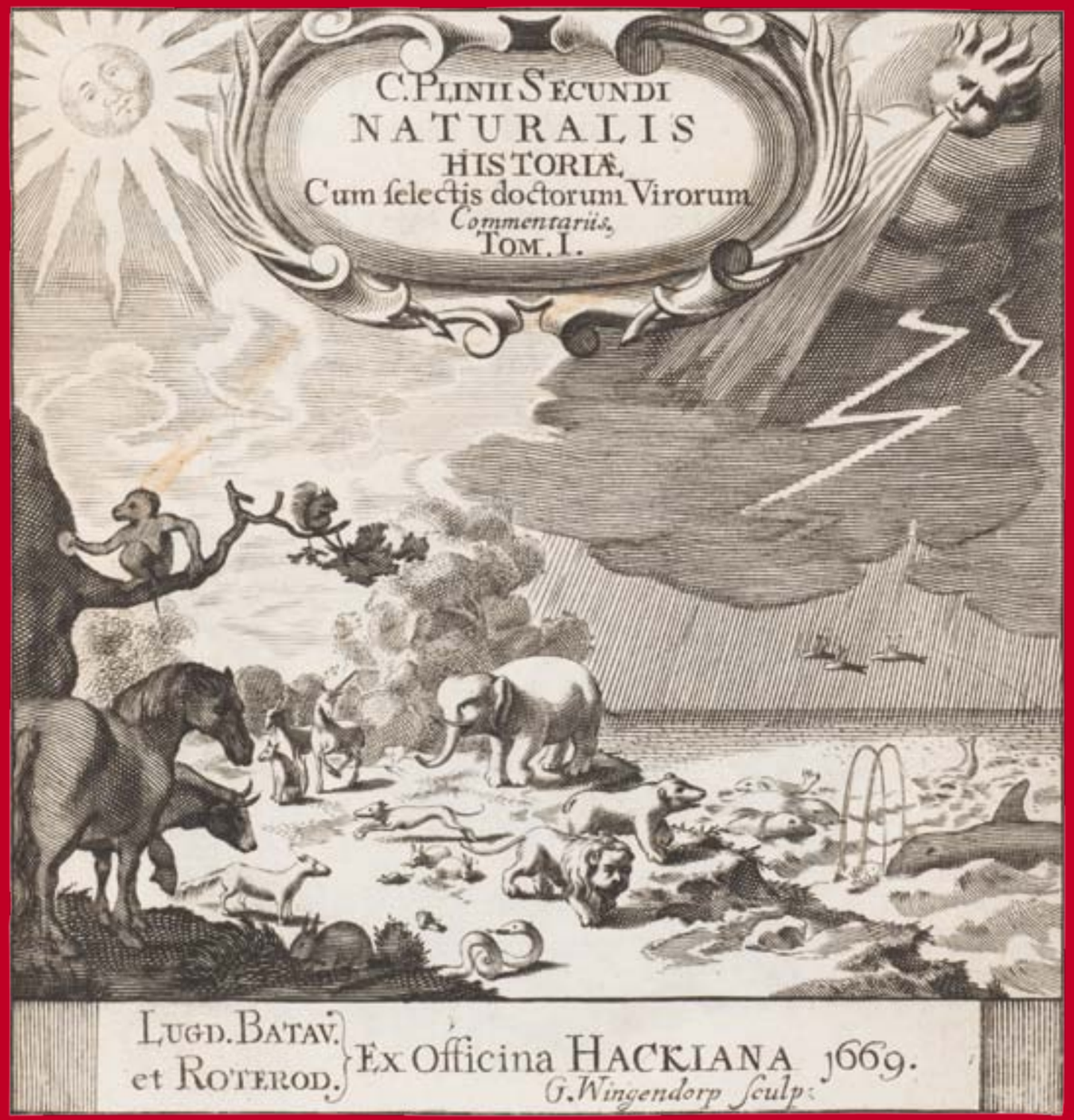
Indeed the cultural imprint of venom in the middle-eastern 'cradle of civilisation' is also evident in early legal imagery. When you visit the University of Melbourne Law School building, you can see in the foyer an ancient Mesopotamian tablet that describes, in Sumerian script, the property rights bestowed by the King on a former soldier, as circumscribed by a boundary line of snakes. Also from Mesopotamia (about 4000 years ago), in one of the oldest recorded human stories, the Epic of Gilgamesh, the eponymously named hero has immortality stolen from him by a snake. Religious and historical scholars recognise the common linkages between the stories of Genesis and Gilgamesh, in part through the semiology of the snake.

Specifically the serpent was used to represent the source of both knowledge as well as evil in the Hebrew and Christian bibles. In addition, in the Abrahamic traditions, the serpent symbolises sexual desire. This seductive power of the serpent, its role in eternal life, and as an agent of evil, endures as evident from medieval Christian art to present day secular and religious stories and imagery. The snake, like Camus, reminds humanity of the futility of the pursuit of immortality, the basis of the human condition. The exhibition and associated essays and illustrated items in this catalogue delve more deeply into some of these fascinating and persistent ideas and their medical resonances.

Turning to ancient Greece, we see that the serpent was appropriated as the very symbol of medicine itself, through the snake-entwined staff of Asklepios, referencing their God of Medicine. Such positive attributes of the serpent may well reflect Asiatic cultural influences. Consider that in Chinese tradition, the snake is imbued with intelligence, subtlety, elegance and portents good fortune. Indeed, in contrast to Genesis, in the story of Buddha and the serpent king Mucalinda, the former is protected, rather than imperiled, by the encircled snake. Nevertheless the Susruta-samhita, written by the Varanasi physician Susruta (c. AD 300), a foundational Ayurvedic medical text, describes scarification, bloodletting, and cupping for the treatment of venomous bites and stings.

Considering the first western medical texts in the form of the Egyptian papyri, through to the ancient Greek and Roman pharmacopoeia, mention was always made of the effects of venom and a multiplicity of treatments proffered. For example, Gaius Plinius Secundus, also known as the Latin naturalist Pliny the Elder (AD 29–79), in his *Naturalis historia*, the most popular natural history text ever written, provided fascinating rhetoric with this wide ranging advice:

Cat. 130 Gaius Plinius Secundus (Pliny, the Elder), **C. Plini Secundi naturalis historiæ** ..., Lugd. Batav. Roterodami: Apud Hackios, 1668–1669. Special Collections, Baillieu Library, University of Melbourne



> For poisonous bites, it is customary to employ a liniment made of fresh sheep-droppings, cooked in wine. Rats cut in two are also applied; these animals possess important properties, especially at the epoch of the ascension of the stars, seeing that the number of a rat's fibres wax and wane with the moon ... Of all birds, those that afford most assistance against snakes are vultures. The black ones are the weaker. The odour of their feathers when burnt puts snakes to flight. Provided with a vulture's heart one need not fear encounters with snakes, and can also defy the wrath of wild beasts, robbers, and princes.

For more than three millennia such interventions also mixed dubious surgical advice (lancing and amputation) with quasi-magical medical options (inculcation of panaceas such as theriac). The uncertain outcome of snakebite meant that much such inculcation persisted for millennia. Remarkably theriac, including the essential ingredients such as bezoar stones and viper, was even included in European pharmacopoeias well into the nineteenth century. Indeed this pharmaceutical concoction is featured within the Savory and Moore Pharmacy of the Medical History Museum, reflecting its place in British and Australian pharmaceutical practice of that late period (cat. 51).

Extracts from snakes, toads, scorpions and hornets' nests remain within the pharmacopoeia of Traditional Chinese Medicine (TCM). One of the earliest records of the use of snakeskin, gallbladder and meat in China was the Ming Yi Bie Lu (Transactions of famous physicians) written by Tao Hongjing (c. AD 520). These ingredients were used, based on TCM theory, to treat pain, skin diseases and intestinal hemorrhage. Such use widened with the influence of Indian and Arabic ideas (and thereby ancient Egyptian and Mesopotamian) during the dynamic Tang Dynasty (AD 618–907). A western echo of some of these ancient ideas is found in contemporary anti-ageing facial creams such as the SYN-AKE® product featured in the exhibition (cat. 125). It purports to contain peptide analogues of alpha-neurotoxins found in temple viper venom (i.e. Botox without the injection).

Paralleling the enduring constraints of Galenic thinking and religious orthodoxy on medical practice, little advancement in understanding the true nature of venomous bites and stings occurred until the seventeenth century. Indeed several bibliographies of toxinology only commence from 1500 with little more than bestiaries, compilations of historical commentaries made since antiquity, and speculations that were published earlier than 1500. Nevertheless some medieval and renaissance medical commentators were more practical than rhetorical in their writings.

For example, the industrious Moses Ben Miamon Ben Joseph (Maimonides in Greek) (AD 1135–1204), physician to Saladin the Great and author of the first toxicology textbook proper, *Treatise on poisons and their antidotes* (1198),[3] wrote that,

> When someone is bitten immediate care should be taken to tie the spot above the wound as fast as possible to prevent the poison from spreading throughout the body; in the meantime, another person should make cuts with a black lancet directly above the wound and suck vigorously with his mouth and spit out. Before doing that it is advisable to disinfect the mouth with olive oil ... care should be taken that the sucking person has no wound in his mouth, or rotten teeth.

It remains a tragedy that some current snakebite victims in the developing tropics will still be subject to these kinds of medieval practices.

Perhaps the first instance of self-experimentation in toxinology, a fashion still extant today, was recorded in *Corona Florida Medicinae sive De Conservatione Sanitatis* in Venice in 1491. The Italian physician Antonio Gazio (c. 1450–1530) tested the toxicity of a certain European fish roe (that of the freshwater fish barbell) by personally eating a small portion, thus precipitating acute gastrointestinal disturbance.[4] Likewise William Harvey (1578–1657), he of *De Motu Cordis*, self-experimented with spider bite as part of his investigations on the nature of the circulation.[5] Similarly in 1933 an Alabama physician forced a black widow spider to bite him as a means of confirming that they were 'dangerously poisonous for man' (this was recorded in the *Archives of Internal Medicine* for posterity!).[6]

More latterly, some north Queensland doctors, notably Jack Barnes (1922–1985), carried on that spirit with multiple occasions of self-stinging with various jellyfish tentacles. Such heroics have, at least in the jellyfish cases, become experimental landmarks cited to this day. Fortunately they resulted in nothing more than brief hospital admissions. However, as described elsewhere in this catalogue, some of our pioneer 'snakemen' proved excessively confident in their own self-promoted snakebite cures and died when they submitted themselves to the ultimate test of efficacy.

As the profession of medicine moved into a difficult adolescence, its proximity to the evolving practice of natural history during the Enlightenment began a new chapter in the story of venom. Observation, dissection, analysis of comparative anatomy, experimentation, informed conjecture and enhanced critical commentary through learned societies and their publications, shed new light on the nature of the venom injection apparatus. For example, William Harvey took an interest in first aid for snakebite. Harvey, who constantly sought to dissect both humans and animals of all kinds, linked the movement of venom to his hypothesis concerning the circulation of the blood, thus promoting ligature use and amputation for snakebite.[7]

In the next generation, the Italian Francisco Redi (1626–1697), a poet physician who also debunked the theory of spontaneous generation, began a re-examination of beliefs about snakebite held since Galen. Redi undertook controlled experiments on snakebite and definitely showed that the venom was injected beneath the skin and was held in sacs under the skin of the snake. Antonie van Leeuwenhoek (1632–1723), a contemporary of Redi, took matters further with his revolutionary examinations of the microscopic world, including reporting, in his first observations to the Royal Society (1673), on the anatomical nature of

Le Docteur Albert CALMETTE

bee stings. More latterly, the polymath Abb. Felice Fontana (1730–1805), based in Tuscany, founded modern toxicology through his quantitative studies of the chemical nature, and pathological effects, of viper venom as published in his 1781 text *Traité sur le Vénin de la Vipère*.

Over the next hundred years the great natural history expeditions gathered a growing corpus of venomous organisms in the burgeoning public and private collections of Europe. Under the binominal classification system popularised by Swedish physician and zoologist Carl Linnaeus (1707–1778), these collections became the formalised common knowledge base for the emerging toxinologists of the Victorian era. Many notable natural historians of the period, including Darwin, Huxley and Haeckel, contributed to our understanding of venomous terrestrial and marine creatures. Such scientific progress, reflecting the titanic shift from natural philosophy to modern experimental science, occurred in the wider political and societal foment of that era.

More locally, over thousands of years Australian Aboriginal people had incorporated ways of understanding and dealing with these venomous creatures in their cultural and healing practices. Unfortunately, European Australia remains profoundly ignorant of these 60 000 years of learning from our national 'book of nature'. However in the exhibition we see glimpses of how Indigenous and non-indigenous Australians have collaborated in the quest to prevent and offer better treatments for venomous bite and sting victims. We need to renew and learn from our collective shared knowledge about our 'place' and all its creatures, large and small. Indeed one of the enduring challenges the toxinology research community faces is a jellyfish sting that is itself named after an Aboriginal tribe found in north Queensland, the Yirrganydji people. More about this later in the catalogue, but suffice to say that the name recognises the traditional custodians of the place where the sting was originally described—where people, rainforest and reef meet.

It is important to note that from the beginning of colonial Australian toxinology, much of which was based here in Victoria, our reach and ambition was global. This intercontinental discourse went beyond the British colonies, particularly India and the United Kingdom, to engage Australian doctors and scientists with contemporaries in Brazil, the USA, France and Germany. The exhibition and catalogue provide many intriguing examples of how Australia contributed, not always productively, to cutting edge debate on venom, particularly snakebite and its treatment. This was not always the fault of the colonists—consider the case of the enigmatic venomous platypus, initially proclaimed a hoax in Britain. Despite the limited facilities, by Federation the studies of this venom were underway, and pioneered, at the University of Melbourne.

Then there was Charles Darwin's potentially fatal misclassification, in 1836, of a Tasmanian elapid (front-fanged) snake whilst in Hobart. Indeed it is interesting to

Albert Calmette, 1909. Wellcome Library, London, L0027273

contemplate how different the world would be had he been bitten by this presumed black tiger snake that he, the former Edinburgh University medical student and ambitious young naturalist, collected and misidentified as a harmless *Coluber*, during a ramble up Mount Wellington. This taxonomic category refers to the family 'Colubridae', mostly featuring minimally dangerous snakes that are, collectively, more common amongst European than Australian snakes. It is notable that tiger snakes remain the leading cause of death from snakebite in Victoria and Tasmania.

In some cases our early practitioners of 'evidence-based medicine' fearlessly debunked the mistaken ideas promoted by some Australians. For example, statistics published in 1893 by Sydney physician Louis Huxtable positively condemned the recommendation of injections of strychnine made by Dr Augustus Mueller of Yackandandah, Victoria. Huxtable's studies showed that strychnine-treated snakebites had fatality rates of 13.2 per cent whereas those not treated with strychnine had a mortality rate of 4.1 per cent. Yet only three years earlier the editor of the *Australasian Medical Gazette*, asserted, 'No medical man in Australia now can treat a case of snake-bite other than by his method [Mueller's intravenous injection of strychnine] without incurring the charge of culpable ignorance.'

Unfortunately, despite the evidence of Huxtable and others, in the absence of a specific local antivenom, such 'worse than useless' treatments persisted in Australia well into the twentieth century. Indeed as late as 1912, a strychnine-induced death of a child suffering from snakebite was reported in Melbourne. The tragedy of Semmelweis (1818–1865) had not been learnt. It is a recurrent lesson of history that the translation of research discoveries, especially those that challenge conventional medical paradigms, cannot be taken for granted.

Nevertheless these definitive early snakebite statistics found their way to France and were reproduced in the foundation document of modern toxinology, *Venoms, venomous animals and anti-venomous serum therapeutics*, by Albert Calmette.[8] It was Calmette, one of Pasteur's disciples, who transformed snakebite management through the first commercial production of snake antivenom. Calmette, shown here in a contemporary cartoon, was but one of the giants of modern toxinology who also straddled the emergent dominions of immunology, microbiology, neurology, physiology and pharmacology. Many such discoveries were precipitated by academic industry collaborations as public health driven serotherapy and industrial chemistry underwrote fundamental mechanistic observations of the inner workings of the immune and nervous systems.

Elsewhere in this collection details are provided of the many scientific and medical characters in this ongoing story. Some, such as our first Dean of Medicine George Halford, remain as much infamous as famous for their contributions to the annals of toxinology. Others such as CJ Martin have been lauded more for their academic and administrative successes outside of their venom researches. Yet others such as former Walter and Eliza Hall Institute director Charles Kellaway have been largely overshadowed by their proteges and the tide of subsequent medical advances, or, in the case of the Commonwealth Serum Laboratories' Saul Wiener, by their own modest nature. In the singular case of Eleanor Williams, Kellaway's 'right-hand woman', her story is that of the neglected role of female nurse-scientists in developing modern Australian medical research.

This history also reminds us that, beyond the Academy, our understanding of venom derives, in part, from a lifetime of contributions from many amateur and professional men and women who collected and milked these potentially deadly creatures. The story of Kevin Budden and the snake that was literally responsible for his death, forms but one vignette of such deeply personal sacrifices. The critical work of Tom 'Pambo' Eades, David Fleay, Eric Worrell and others, mostly in the era before the mantle of safety provided by specific antivenoms, are also described in the exhibition.

Scientifically speaking, venoms have directly contributed to the history of the discipline of pharmacology in a myriad of positive ways, including being instrumental tools in a number of Nobel Prize winning discoveries. For example, Kellaway's work on the 'slow-reacting substance of anaphylaxis' (1938), through the study of cobra venom action, in collaboration with Nazi refugee Wilhelm Feldberg and biochemist Everton Trethewie, provided the nascent definition of what are now known as the leukotrienes. This later led Bengt Samuelsson and others to the 1982 Nobel Prize for their work on leukotrienes and prostaglandins.

Finally and consequently, if nothing else, this exhibition returns us to the ancients who understood that enduring truth of the human condition: the illusion of complete knowledge. It is salient to contemplate, as we reflect on the tide of history, the mistake of our recent medical contemporaries who wrote the editorial in the June 15, 1929 *Medical Journal of Australia*: 'The story is complete and there is no longer any room for the astonishing differences of opinion that have characterised some of the communications on the subject [of snakebite] in the pages of this journal.' We invite you to join us in writing the next chapter in this never-ending, and always thrilling, 'story of venom'.

Dr Kenneth D Winkel

1 CC Mann, 'Göbekli Tepe: The birth of religion', *National Geographic*, June 2011.
2 S Sauneron, *Un traite´ Egyptien d'ophiologie: Papyrus du Brooklyn Museum*, no. 47.218.48 et .85, 1989, located at Cairo, Egypt.
3 F Rosner, 'The life of Moses Maimonides, a prominent medieval physician', *Einstein Quarterly Journal of Biological Medicine*, vol. 19, 2001, pp. 125–8.
4 BW Halstead, *Poisonous and venomous marine animals of the world*, 2nd rev. ed., London: Darwin Press, 1988, p. 8.
5 G Keynes, *The life of William Harvey*, Oxford, UK: Clarendon Press, 1966.
6 AW Blair, 'Spider poisoning: Experimental study of the effects of the bite of the female *Latrodectus mactans* in man', *Archives of Internal Medicine*, vol. 6, 1934, pp. 831–4.
7 DA Warrell, 'To search and study out the secret of tropical diseases by way of experiment', *Lancet*, vol. 358, 2001, pp. 198–8.
8 A Calmette, *Venoms, venomous animals and antivenomous serum-therapeutics,* EE Austen, trans., London, UK: John Bale, 1908, p. 259.

Sixty thousand years of stories

> A fully developed Aboriginal has, in his own way, a vast amount of knowledge. Although it may not be strictly scientific learning, still it is a very exact knowledge, and his powers of physical observation are developed to the utmost.
>
> David Unaipon (1872–1967)

Aboriginal and Torres Strait Islander peoples have for centuries lived on country in profoundly intimate ways. Of course humans encountered venom and venomous creatures, but knowledge holders would understand where to go and look for medicine, sometimes from within the creature itself. This knowledge, honed over 60 000 years, has recently been sought after, invested in, seen as legitimate and life giving. This respect enhances wellbeing and dignity of First Peoples, and creates rich opportunities for sharing and exchange. As with systems of knowledge around the world, there are laws that govern how knowledge is passed between and referenced within communities and the State. Adherence to these laws creates opportunities to locate country into society itself, transforming knowledges and building new practices in both nature and community. We are, after all, willing new-knowledge seekers who recognise the complexity of life. It is from this point that we might start to think about venom differently, not as an injectable substance that causes paralysis, but perhaps as an assertion that needs to be properly placed lest it overtake us all.

There is a venom that soaks into our skin, our hearts, our minds and lives; makes weak that which was strong and replaces certainty with vulnerability. This venom is injected into our relationships within ourselves, between each other and with Country. This venom negatively impacts on the creativity inherent in living systems that have reproduced and multiplied in self-organising freedom since time out of mind. This powerful venom encloses the interior spaces of the bodies of women, erases our men, denies our extensive knowledge, our cultures, our lands and restricts our intellectual creativity. We have no medicine for this. There does not appear to be an antidote.

I have grown up among people who live in multiple realms, who understand what it means to be present in physical and non-physical realities at the same time. I know our peoples see venom and the vectors of venom differently—venom as that which seeps into our lives as retribution, as a pervasive illness across an entire community, as that which causes harm and death, as a punishment, as an inescapable song. Venom indicates that a balance had been disturbed, a quest is needed, a tradition needs to be observed, that someone needs to go home. The vectors of venom are simultaneously a strong totem, a sign of power, a creator of

Cat. 167 Dennis Nona (Badu, Torres Strait Islands, b. 1973), **Uzu Pui (Stonefish medicine)**, 2005; etching, edition of 99; 66.0 × 35.5 cm. Courtesy of the artist and The Australian Art Print Network

lands and rivers, as a guide or a sign of the sacred. People who could work with venom, and heal those under its influence, not only dealt in the physical reality of venom; but in an additional way which directed people back to a path which led to a more tribal and spiritual existence.

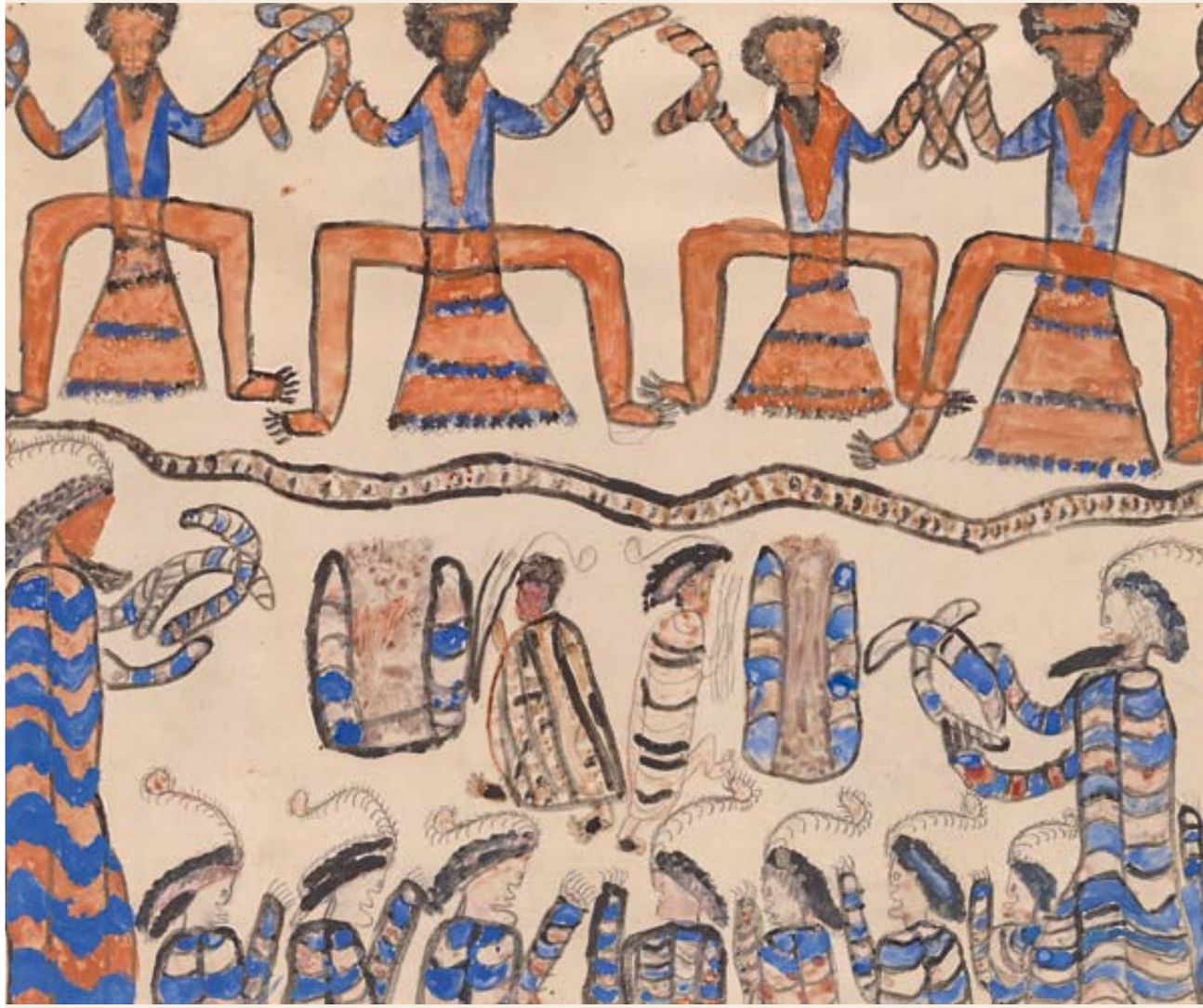
We imagine humans are incapable of being venomous, but ask any Aboriginal or Torres Strait Islander person, who is accountable for their conduct in physical and non-physical realms, 60 000 years on, about which stings hurt the most, which venom stays in our bodies, in our families and communities the longest, which venom leaves a wound that does not heal? We have had snakebite healers and stonefish medicine for many, many years; this new malaise is harder to cure.

All historical and cultural accounts from which I am born suggest the most powerful venom in contemporary times has a springwell deep in the colonial psyche—a knowledge system saturated by reductionism and fragmentation. A view of the world not equipped to take the complexity of interrelationships that make up the ecosystems in which we live, fully into account. Our collective healing requires the co-creation of new ways in which we deal with what venom is, or why venoms are, rather than thinking about what venoms produce, and how venom is produced. If you take venom as a toxin that is directly injected from an animal, then the antidote is well understood, valued and respected. If you take it that venom causes something to become or appear fragmented, then the only antidote is the drive to reconnect and make it whole.

We know that venom causes humans harm; we do not think about how humans harm others, or disrupt the ecosystems in which we live. This was not always the case. We have lost our ability to respect or tolerate those that are different. Our fear of all sources of venom, of difference, of harm and of vulnerability requires us all to work in different and uncommon ways of addressing the challenges of venom—ways which value and honour the drive of every living thing to realise itself with increasing intensity and extensity. The cultural, religious and political shifts that legitimise traditional healers as being equipped with antivenom and the knowledge to administer it will be aided by formalising this expertise by working together, documenting and infiltrating different knowledge systems about medicine, and legitimising the non-western intellectual tradition. This work is revolutionary, as by harnessing the collective thinking and action and transcending fear of uncertainty or vulnerability, we may finally face the questions of social and political transformation that happens through sharing and fusing knowledge systems that seek to broaden discussions of ecological issues to include the oldest knowledge tradition and the widest revolutionary vision possible; the eradication of venom and participation in healing processes through which all of us might reclaim the political power to create a rational, ecological and desirable society to which we all belong.

Professor Kerry Arabena

William Barak, Wurundjeri (c. 1824–1903), **Ceremony with rainbow serpent**, c. 1880; pencil, gouache, earth pigments, charcoal on paper; 48.5 × 58.5 cm (image and sheet). National Gallery of Victoria, Melbourne; purchased through The Art Foundation of Victoria with the assistance of the Alcoa Foundation, Governor, 1994



Bites and stings: A medieval perspective

Venomous creatures and their poisons loom large in the medieval medical European imagination. Physicians and surgeons, drawing on and adapting ancient and Arabic medical lore, wrote copiously on venomous animals and how to treat their bites. Nearly all of the sources focus on animal bites, and few venomous animals with poisonous skin or hairs are mentioned. Rabid dogs were considered to be venomous animals, as it was believed that their saliva was poisonous.

Texts from classical antiquity whose views on venomous beasts were influential in the Middle Ages included Pliny the Elder's *Natural history*, Lucan's *Pharsalia*,[1] Dioscorides' *De materia medica* and assorted treatises by Galen.[2] In Pseudo-Apuleius' widely circulated fifth-century herbal, *De herbis*, out of 131 herbs, twenty-seven of them are recommended for treating venomous bites, mostly from snakes, but also rabid dogs, spiders and scorpions. The two snakes identified by name are the viper (*Vipera berus*) and the asp.[3]

Medical treatises translated from Arabic in between the eleventh and fourteenth centuries AD would have been highly influential, in particular those by Haly Abbas, Rhasis, Averroes, Serapion, Avenzoar and Maimonides. Avicenna's primacy in the medieval medical curriculum would ensure that his comments on venomous beasts would have been highly significant for medieval physicians and surgeons. A huge variety of venomous beasts are presented in Avicenna's *Canon of medicine*, from vipers to 'the snake that makes blood come out of all pores' or 'the animal with forty-four feet'.[4]

When medieval scholars adopted and adapted the Graeco-Arabic discourse on poisons, it would often reflect the different environmental reality, as western Europe had distinctly fewer venomous snakes, spiders, scorpions and other beasts. Many authors would limit the animals covered to those that abound in their broad geographical area. However, if an encyclopaedic coverage was desired, then a huge multitude of both local and foreign venomous fauna could be present. Albertus Magnus, the great thirteenth-century Dominican author, lists sixty-one serpents in his huge treatise *On animals*, although he notes that the snakes of Nubia and India are larger and with more deadly

A basilisk with other snakes, Bestiary, England, thirteenth century. British Library Harley Ms 4751 f. 59r

Man with a serpent and a scorpion, Medical and herbal compendia, including Pseudo-Apueleius's herbal, late twelfth century. British Library Sloane MS 1975 f. 13r

A man is bitten on the ankle by a large snake, Pharmacopeia, including Pseudo-Apuleius and Sextus Placitus, late twelfth century. British Library Harley Ms 5294 f. 42r

venom than those found in colder climes (and the lack of snakes in Ireland is due to the cold climate).[5] Similarly Sante Arduino of Pisa, in his *On poisons*, composed in the 1420s, covers a huge variety of venomous animals, from horned serpents to 'the little poisonous beast born in beans'.[6]

Bernard of Gordon, a professor of medicine in Montpellier in the late thirteenth and early fourteenth century, would note that the most deadly snakes such as the tyrus, dragon, asp, or basilisk, did not live in his region and thus one would only need to concern oneself with small scorpions and serpents that were not highly venomous and would only strike if attacked.[7]

Similarly, the French surgeon Henri de Mondeville in his early fourteenth-century treatise on surgery, *Chirurgia*, noted that despite the profusion of very venomous animals such as dragons, basilisks and the deadly *rutela* spider in medical texts, they were not seen in France and the only venomous animals of concern were the rabid dogs and vipers. Mondeville called by the name of serpent the common European grass snake, *natrix natrix*, which would only bite if put in sacks, annoyed or challenged and its bites were hardly venomous, while all the spiders he knew were not venomous. For Mondeville, when treating a venomous bite, the animal should be made available for inspection so it could be identified. If this was not possible, the bite site would be examined. For example, in the case of a viper's bite, apart from the possibility of a patient's skin turning green and great pain at the site of the bite, the male viper's bite would have only two punctures while that of a female viper would involve many more.[8] Apart from species identification, accidental factors such as whether the animal was angry, the time of year or the animal's age and sex or diet also had to be ascertained in order to determine the course of treatment.

A fascinating account of the treatment of a patient, dated between the 1320s and 1340s, is the *Consilium ad morsum aspidis surdi* (an account of medical practice regarding the bite of the deaf adder) of Gentile de Foligno, professor at the University of Perugia.[9] The patient was a young man who was bitten on his ankle by a snake on a mountain near Perugia at the end of July. Summer was important, as venom supposedly increased in potency with heat. The patient had tried to treat himself by making a ligature about the bite. When Foligno first saw the patient, seven or eight hours after the initial bite, the young man was motionless with an 'ugly' countenance. Following the custom of identifying the animal to direct the course of treatment, the snake was brought in.[10] Foligno noted that the snake was a cubit in length with a broad head and short tail. It was black all over and spattered with grey spots. He identified it as a 'short deaf asp' (almost certainly an asp viper, *Vipera aspis*, which has quite toxic venom).[11]

Foligno immediately went to work, applying the 'great theriac' on the heart, then cupping and scarifying the wound location and making the patient ingest stale butter.[12] Foligno noted that sucking the wound, which was a usual treatment, was not done due to the lack of volunteers on observing the patient's symptoms. Foligno then had the patient drink (with strong wine) theriac (made from ground gentian, balsam seed, rue and anise). The next morning the patient was prostrate, with a heightened pulse and a face 'foul in colour and form' and closed eyes. Citing Avicenna, Avenzoar and Maimonides as authorities, the patient was given at frequent intervals emerald powder along with citrus seeds infused in wine, despite his difficulty in swallowing. By the early afternoon the patient had not improved and his urine was livid. Foligno sent him to other colleagues for second opinions, but on his return, the patient's pulse was even higher. Foligno decided to administer the theriac of Haly Abbas, whereupon the patient spoke for the first time.[13] By that evening, the patient was conscious and recognised the doctors despite a still livid urine and rapid pulse. Foligno prescribed for the night massage and more emerald powder, citrus seeds and Haly Abbas theriac.

Early in the morning of the third day, Foligno received a message that the patient's pulse and countenance had taken a turn for the worse and that his livid urine was full of 'scaly' solutions. Foligno blamed this situation on the patient sleeping and failing to take the medicines and ordered the forcible administration of all three medicines. When Foligno visited his patient in the late morning, he found him much improved and ordered a diet of chicken soup and fat (with emerald powder and citrus seeds sprinkled on top for good measure). That evening theriac was administered twice, cupping glasses were applied again on the bite, and arrangements made so that the patient did not sleep soundly.

In the morning of the fourth day, Foligno visited his patient, who mentioned pain in his stomach and kidneys, although his urine was much improved (better colour and without sediment). Foligno prescribed a clyster of either milk or a decoction of mallows, followed by the patient being washed with a decoction of round aristologia leaf, to make him sweat, along with drinking some more Haly Abbas theriac. By the fifth day, the patient did not appear to have any serious symptoms and a diet of good food and wine was prescribed, without the need to ingest any more theriac. Foligno finished his account by noting that many people bitten by 'deaf asps' do not open their eyelids for months.

The treatment of animal bites involved a wide variety of cures. Unguents, plasters, syrups, simple medicines, assorted theriacs and other compound medicines, purgatives, and special diets were all prescribed, along with the use of ligatures, scarification, opening of wounds, use of caustics, cupping, use of cauteries, sucking the wound, applying pigeons or roosters to the bite site, leeches, evacuants such as clysters, special diets and, usually as a final resort, amputation. In addition, in order to direct the correct specialist treatment, the animal would have to be identified. Animal bites of all kinds were believed to contain noxious poisons that needed swift attention and medieval physicians and surgeons rose to the task as best they could.

Dr Kathleen Walker-Meikle

1 Book 9 of the *Pharsalia* contains numerous descriptions of venomous snakes including the flying *iaculus* and the tiny mortal *dipsa*, which are all encountered by Cato the Younger as he marches through North Africa.
2 In particular Galen's *Megatechni, De theriaca ad Pisonem* and *De theriaca*, and *Pamphilianum* [spurious], and *De simplicibus medicinis*.
3 Similarly, in Sextus Placitus' *Medicina ex animalibus*, a fourth-century text on medical uses of animals that often travels with Pseudo-Apuleius' herbal, a third of all the animal entries (eleven out of thirty-two animals) contain remedies against animal bites. E Howald and HE Sigerist, *Antonii Musae De herba Vettonica liber, Pseudoapulei Herbarius, Anonymi De taxone liber, Sexti Placiti Liber medicinae ex animalibus*, Leipzig/Berlin, 1927. The asp is likely a reference to *Vipera aspis* (found in Europe) rather than *Cerastes vipera*.
4 Avicenna (Abū Ali al-īusayn ibn Abd Allāh ibn Sīnā, late tenth/early eleventh century AD) covers the bites of animals in ninety-eight chapters in his *Canon of medicine*, book 4, fen 6. He divides them into 'crawling things' (covering a huge multitude of snakes, scorpions, beetles, ants, bees, wasps, spiders, lizards, newts, frogs and assorted venomous marine animals) and 'quadrupeds' (covering everything from crocodiles to cats). See *Liber canonis medicinae*, Hildesheim: G Olms, 1964, reprint.
5 KF Kitchell Jr and IM Resnick, trans., *Albertus Magnus on animals*, Baltimore and London: Johns Hopkins University Press, 1999. Serpents are covered in book 25 (pp. 1708–38) and many venomous animals that bite are also covered in book 26 which treats vermin (pp. 1739–64). The reference to temperature affecting venom is on page 1710.
6 Venomous bites are covered from books 5 to 8. Book 6 details huge venomous serpents and related animals (forty-five in all, from the viper to the torpedo-fish), while book 7 concerns itself with men and qaudrupeds and book 8 details the bites of 'small venomous animals' such as assorted scorpions, spiders, wasps, centipedes, bed-bugs and Spanish flies. See *De venenis*, Venice, 1492.
7 Bernard of Gordon, *Lilium medicinae* (book 1, chapters 14–17). See Venice, 1496.
8 When writing his *Chirurgia*, Mondeville made extensive use of the Jewish scholar Maimonides' hugely influential late twelfth-century treatise *On poisons*, which had been translated from Arabic into Latin in the early fourteenth century, along with relevant chapters from Avicenna's Canon. An English translation of Mondeville's work is LD Rosenman, trans., *The surgery of Henri de Mondeville*, vol. 2, pp. 602–24. Cf. G Bos and M McVaugh, *Maimonides: On poisons and protections against lethal drugs*, Provo, Utah: Brigham Young University Press, 2009.
9 *Questiones et Tractatus Extravagantes Clarissimi Domini Gentilis de Fulgineo: noviter cum summo labore collecti: et cum magna diligentia emendati ac impressi*, Venice: heirs of Octavian Scot, 1520, ff. 95r–95v. A transcription and translation of the text from one manuscript (Munich: Bayerische Staatsbibliothek, CLM 77, ff. 79ra–80ra) appears in L Thorndike, 'A case of snake-bite from the consilia of Gentile de Foligno', *Medical History*, vol. 5, 1961, pp. 90–5. 'Deaf asps' were considered to be very venomous types of asps. The name is a reference from Psalm 58:5–6: 'they are like the deaf adder that stops her ear; which will not hearken to the voice of charmers, charming never so wisely'.
10 The same advice appears in the current edition of J White and J Meier, *Handbook of clinical toxicology of animal venoms and poisons*, Boca Raton: CRC Press, 1995.
11 At a cubit in length it would have been a young specimen, as asp vipers average sixty centimetres in length, but the description of the short tail and broad head fits. The other possible identification is Orsini's viper (*Vipera ursinii*) which is a smaller snake. Cf. A Kwet, *New Holland guide to the reptiles and amphibians of Europe*, London: New Holland, 2009.
12 The word theriac was attached to compound medicines efficacious against venoms and poisons. The term 'great theriac' usually meant a very complicated recipe involving viper's flesh, opium, ginger and myrrh among dozens of other ingredients and allegedly first concocted by Mithridates IV of Pontus (*mithridatium*). See G Watson, *Theriac and mithridatium: A study in therapeutics*, London: Wellcome Historical Medical Library, 1966, and LMV Totelin, 'Mithradates' antidote: A pharmacological ghost', *Early Science and Medicine*, vol. 9, 2000, pp. 1–19. There were numerous theriac recipes apart from the 'great theriac', such as a 'walnut theriac'. The word comes from the Greek *theriakós* (wild or poisonous beasts).
13 The 'theriac of Haly Abbas ('Ali ibn al-'Abbas al-Majusi)' consisted of half a dram each of castor oil, cassia wood, and round aristologia leaf and two drams each of anise seed and pepper, drunk with wine.

Physician going to meet two men who have been bitten by snakes, Persian manuscript, 13th century. Wellcome Library, London, M0007306

The power of Garuda

The story of venom in South Asia must begin with one word: diversity. With a population of over 1.6 billion people, coupled with a 3500-year literary history, South Asia defies simple classification. India and her neighbours are home to some of the world's deadliest snakes and arachnids—cobras, kraits, vipers, the Indian red scorpion, and numerous venomous spiders—and conservative estimates count at least 14 000 annual snakebite deaths in the region.[1] Such statistics, shocking as they may be, obscure the many more victims who survive permanently disabled by severe organ and tissue damage, or amputated limbs. Not surprisingly, people of the region have long sought ways to counter envenomation.

Healing snakebite has been a common theme throughout the region's written history. Arrian's *Indica* (fourth century BC) describes how Alexander the Great was impressed by the abilities of Indian doctors to cure his troops' snakebites where his own Greek physicians had failed.[2] The classics of Ayurvedic medicine are the earliest surviving written texts to systemise treatment of venom; they classify it as one of the eight branches of medicine. The earliest Vedic hymns invoked deities to cure envenomation, and while classical Ayurveda acknowledged the efficacy of such religious methods by the first century AD, it tended to present them as the domain of Brahman priests. Ayurvedic doctors instead emphasised treating envenomation with traditional antivenoms prepared with plant, animal and mineral ingredients.

Despite the suppositions of modern public health literature, Indians have long been aware that many snakebites do not result in envenomation—the so-called 'dry bite' (*nirviṣadaṃśa*). They even recognised a condition where symptoms of envenomation occurred in people who had an extreme phobia of snakes (*śaṅkāviṣa*, literally 'fear-poison'). The prescribed cure was reassurance. Ayurveda had an intricate typology of snakes, bites and symptom-based stages of envenomation varying by type of snake, which they correlated with the spread of venom through seven 'tissues' of the body. Starting with the skin, considered the easiest to heal, the venom spreads 'like oil on water' throughout the body and finally settles in the bone marrow where it is thought to be beyond treatment.

Ayurveda has been the mainstream of learned medicine for 2000 years, but in the latter half of the first millennium, a new system arose that rapidly grew in popularity. The Garudam tradition originated as numerous divinely-revealed medical manuals for treating snakebite and a host of related medical issues. It incorporated some of the typologies

Gandharan region, Afghanistan or Pakistan, **Garuda and nagini**, 3rd century; schist stone; 40.6 × 23.4 × 7.5 cm. National Gallery of Australia, Canberra; purchased 1978

and vocabulary of early Ayurveda, but improvised an elaborate system of religious healing focused on the bird-deity Garuda. While Garuda is today ubiquitously associated with the Hindu god Vishnu, these texts considered him to be an alternative manifestation of Shiva. Shiva's connection with poison and healing goes back to the early hymns of the Rig Veda, and becomes famous in the epic *Mahabharata* where the story is told of how he became Nilakantha ('blue-throat') by drinking a terrible poison that threatened to destroy the universe. Pairing Shiva with the avian archenemy of snakes and incorporating their medical teachings into the then-popular tantric ritual framework created a system that quickly became the de facto standard for snakebite treatment in South Asia.

The Garuda Tantras teach both mantra-based 'religious' cures for snakebite as well as plant-based medicines. Faith in the utility of mantras to treat snakebite envenomation was widespread, even among highly-educated scholars of the day. Mantras were considered to be more effective than plant-based antivenoms, but also more dangerous in that if the practitioner made a mistake in the ritual, disastrous effects would ensue. The basic ritual consisted of a complex routine of visualisation and sacralisation of the body of the practitioner. The result would be a spiritual transformation of the practitioner into the deity in question—usually Garuda, but also Shiva as Nilakantha or a host of different goddesses. The most popular mantra was a group of five syllables sacred to Garuda, variously arranged to form different words and effect different actions on the venom.

The herbal antidotes of the Garuda Tantras ranged in complexity from a single herb to complex formulas made from dozens of herbal, animal, and mineral ingredients. Correlating the Sanskrit names of these herbs with Latin equivalents is a desideratum, but the task is difficult because many plants have various names, some may no longer be in use, and some names may refer to more than one plant, depending on the region.

With its popularity, the Shiva-focused texts could not contain the Garudam tradition for long. We see influence of the Garuda Tantras on mainstream Ayurveda starting in the seventh century. We soon also see Jain Tantras, Vishnu-focused Tantras, and Buddhist Tantras all developing their own systems of snakebite medicine on the model of the Garuda Tantras. Whereas the two former groups appear to have copied directly, making only minor changes, the treatment of snakebite in Buddhism was more complex and goes back to the Pali canon. The Buddha was said to have taught his disciples a particular spell for curing snakebite after one of them was bitten while meditating in a cave.

After the tenth century, the production of new snakebite manuals in Sanskrit slowed dramatically. Sanskrit compilations and vernacular literature became the locus for disseminating knowledge of snakebite healing, and therefore the tradition became somewhat fragmented by language and region. The south Indian state of Kerala developed a widely-respected tradition known as Vishavaidya that drew on both Ayurvedic and Garudam sources.

During the colonial period, the British pioneered empirical studies of snakebite medicine, but with inherent biases against indigenous healing systems, and in particular against religious modes of healing such as mantras. This bias was convenient for the colonial agenda because it supported the rhetoric of paternalism. In other words, the more superstitious the natives of India were perceived to be, the easier it was for the British to justify their economic and political dominance in the region. British doctors and scientists did not view their own system as one among many; rather they upheld science as the only true basis of valid medicine and spurned the rest as superstition. This sort of universalist claim was uncommon in the history of Indian medicine. Before colonialism, there was no clear dividing line between religion and medicine, for example, or between faith-based and evidence-based medicine. In short, the colonial period witnessed a great deal of complex interactions between people approaching medical treatment from vastly different perspectives.

The use of mantras for treating snakebite remains popular at the village level in South Asia. Sceptics point to the fact that only a small percentage of bites lead to potentially deadly envenomation, thus creating apparent effectiveness where recovery would have occurred without treatment. Proponents of mantras, on the other hand, speculate on the possibility of their having a placebo-like effect on the immune system. The government of India has recently promoted scientific evaluation of plant-based traditional antivenoms via studies sponsored by the Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy (AYUSH). Numerous articles published in international peer-reviewed scientific journals suggest that some indigenous plants are effective at reducing mortality from snakebite.[3]

Modern snake antivenom is now widely distributed in South Asia. It is often subsidised, though quality varies and many rural people prefer to rely on their own traditional healers who do not charge a fee for life-threatening conditions like snakebite. The future of venom in South Asia is difficult to predict. The top-down approach of the World Health Organization with its condescending rhetoric against traditional medicine does not appear to be working particularly well. I suggest more dialogue with traditional doctors and more funding for scientific studies of traditional remedies attending to how they are prepared and administered by local experts.

Dr Michael Slouber

1 www.toxinology.org/GSI-epidemiology2.htm, accessed 31 March 2013.
2 *Indica*, vol. 15, no. 11–12, translation of JW McCrindle, *Ancient India as described by Megasthenes and Arrian*, Calcutta: Thacker, Spink & Co., 1877, pp. 218–19.
3 See, for example: M Mahanta, et al., 'Neutralisation of lethality, myotoxicity and toxic enzymes of *Naja kaouthia* venom by mimosa pudica root extracts', *Journal of Ethnopharmacology*, vol. 75, no. 1, 2001, pp. 55–60; M Alam, et al., 'Snake venom neutralization by Indian medicinal plants (*Vitex negundo* and *Emblica officinalis*) root extracts', *Journal of Ethnopharmacology*, vol. 86, no. 1, 2003, pp. 75–80; A Shirwaikar, et al., 'Neutralization potential of *Viper russelli russelli* (Russell's viper) venom by ethanol leaf extract of *Acalypha indica*', *Journal of Ethnopharmacology*, vol. 94, no. 2–3, 2004, pp. 267–73; K Chandrashekara, et al., 'Neutralization of local and systemic toxicity of *Daboia russelii* venom by *Morus alba* plant leaf extract', *Phytotherapy Research*, vol. 23, no. 8, 2009, pp. 1082–7.

Spectacular serpents: Snakebite in colonial Australia

If one episode could encapsulate the rich science of snakebite in colonial Australia, it might be the events of 9 April 1869. Appearing together at Melbourne's packed Polytechnic Hall were its proprietor, obstetrician Louis Smith, and roving snake-showman, Joseph Shires. Performing his typical 'experiment', Shires caused venomous snakes to bite two stray dogs, before applying his antidote to one. This animal seemingly recovered, whilst the untreated dog drooped and apparently died. When the surgeon commenced lecturing on the medical benefits of electricity, his companion urged a practical test:

> Mr. Smith, after some hesitation, consented; galvanism was applied, and, just as he was referring with unction to his successful application of galvanism to a Chinaman [sic] who was bitten by a snake and recovered by means of the treatment used, the dog came to life, and with a convulsive snap caught hold of *the* fleshy part of Mr. Smith's hand and hung there for a few seconds. In an instant the room was in an uproar ...[1]

The show was far from over. Believing that snake venom had passed into the dog's saliva, the doctor followed standard protocol: ligaturing his wrist, he sucked the wound then dabbed on Shires' Antidote. Nevertheless experiencing 'all the symptoms of snake-poisoning', he 'took stimulants in the shape of brandy and champagne plentifully at intervals, and for some time they were partially vomited as fast as they were swallowed'. If this spectacle were not edifying enough, Smith continued applying galvanic current until both he and the poisoned dog were 'restored to life and health'.[2]

Given these dramatic proofs, how could colonists doubt the potency of local snake venoms—or the 'cures' effected before their eyes? While it is easy from such examples to view colonial Australia as a 'paradise of quacks', peddling false hope and nostrums to credulous crowds, Smith and Shires embodied procedures entirely typical of snakebite studies up to Federation in 1901.[3]

Museums, zoos and classrooms

Although European loathing of serpents had deep cultural and scriptural roots, fear that Australian snakes might prove dangerous did not emerge until the 1810s. Concern was roused as much by observing snakebite in imported animals—cattle, sheep, poultry and especially dogs—as from fatal human cases. Such folk knowledge, informing what I have

Cat. 163 Samuel Calvert, **A group of Australian snakes**, *The Illustrated Melbourne Post*, 1868; engraving; 9.2 × 11.5 cm. State Library of Victoria, IMP22/05/68/65

elsewhere described as a 'colonial animal matrix', underwrote the credibility of staged antidote 'experiments'.[4] Only in the late 1860s did European models of toxicology, describing the harmful effects of agents introduced into animals, intersect with these popular commercial demonstrations.

Echoing the Smith-Shires spectacle, taxonomic 'expertise' was also constantly negotiated between medical, zoological and lay authorities. In 1869 Gerard Krefft, Director of Sydney's Australian Museum, published *The snakes of Australia*, the first monograph devoted to the subject. He was immediately embroiled in controversy when a 'diamond snake' bite at Talbot, Victoria, was treated with ammonia injection, as recommended by Melbourne University's professor of medicine, George Halford. Halford suggested that the assailant was a tiger snake (*Notechis scutatus*) which, Krefft had recently noted, Tasmanians knew as the 'diamond snake'. But, countered a medical critic, Krefft had declared the 'diamond snake' harmless. He had, but in reference to the New South Wales 'diamond snake', the non-venomous diamond python (*Morelia spilotes*). Although Joseph Shires attested that these constrictors ranged well south of the border, Krefft himself believed the culprit was a copperhead (*Austrelaps superbus*). Frederick McCoy disagreed. As Professor of Natural History at Melbourne University and Director of the National Museum of Victoria, he blamed the common brown snake (*Pseudonaja textilis*). An exasperated Talbot resident, Frederick Dallimore, likewise dismissed Krefft's expertise, favouring his own twenty-five-year experience 'dissecting the heads of different snakes, endeavouring to form an approximate estimate at what period of the year the poison arrived at its maximum'.[5]

Most settlers were less obsessed with formal taxonomy. A 'black snake' may have implied the species now known as the red-bellied black snake (*Pseudechis porphyriacus*), a black tiger snake, or simply any serpent seen in poor light. Black was indeed the commonest hue, but colonists also described yellow, brown, blue, green, grey, silvery or coppery snakes; a settler complained in 1847 that 'you scarcely pass a summer without seeing several new sorts'.[6] Appearing from 1862, zoological gardens offered little assistance. Before 1914 there were no snakes at Hobart's Beaumaris Zoo, while in Adelaide the Indian cobras (*Naja* species) attracted most attention. The exception was Melbourne Zoo, which by 1881 displayed Australian serpents 'in such a way as to inform about the venomous characteristics of each one'.[7] Although growing in popularity by Federation, zoos always trailed natural history museums as authoritative centres for classifying animals. By the 1860s museums attracted good crowds, but few visitors recorded what they actually *learned* about venomous animals. With specimens ranging from articulated skeletons to painted plaster casts, or fading coils floating in jars of spirit, rudimentary labels merely described the systematic and common name, perhaps adding whether or not the species was 'venomous'.[8]

But how did zoologists discern the *deadly* species? Krefft was rare in testing venoms in dogs, goats, echidnas, lizards and frogs, although by 1890 James Bray also staged snakebite experiments in cats and rats at his Museum of Curios in Sydney. Curators might invoke their own painful experience or consult European experts, but most sources were local and anecdotal: field collectors, Aboriginal informants, newspaper stories and medical cases. Once a snake was established as dangerous—often from a single incident—information circulated well beyond museum walls. Krefft's monograph proved a strong seller, as did its 1898 replacement, *A popular account of Australian snakes*, by Australian Museum zoologist, Edgar Waite. Venomous serpents were the first animals appearing in McCoy's magnificent *Prodromus of the zoology of Victoria* (1885–90). Resembling contemporary 'wanted' posters, his 1877 wall chart—'Dangerous Snakes of Victoria'—was widely displayed at state schools, railway stops and police stations. In 1895 a Sydney publisher issued another popular series of educational posters, 'Venomous Snakes of Australia', embellished with the New South Wales Board of Health's recommended first aid measures.

Seeking for some great specific

If identifying dangerous snakes was vexatious in nineteenth-century Australia, establishing effective treatments proved vitriolic. Excepting the germ theory of disease, there was no more contentious arena for new-fangled ideas of 'scientific medicine' than snakebite. Moreover, not just 'facts' were on trial, but the very means of knowing what constituted proof: the epistemology of colonial science.

Before the 1890s, little separated 'amateurs' from 'professionals'; indeed, showmen like Shires pioneered live experiments in domestic animals. Until 1870, extracting evidence from such vivisections was as alien to surgeons qualified through apprenticeship, such as Smith, as it was to clinicians trained in Britain's new medical schools. Thereafter, British practitioners accepted knowledge generated via experimental physiology, but most colonial doctors continued following classical or clinical traditions, or dissecting their truths via comparative anatomy and morbid pathology.[9]

When colonial doctors did take to animal testing, their snakebite studies remained largely public. Presided over by a magistrate, coroner or government medical officer, many experiments occurred in authoritative institutions: hospitals, museums and police depots. Charged both with controlling stray animals and investigating violent deaths—including snakebites—policemen regularly provided the animal participants. In 1861, 'troops of noisy curs, a quantity of fowls, a fine calf, and ... about a dozen snakes of all ages, sizes, and description' were incarcerated at Melbourne's Richmond Police Barracks; in 1876 another thirty-one serpents were sent there by Swan Hill's sergeant.[10] Evidence from such trials was weighed not just by legal or medical adjudicators: 'juries' of citizens often voted with their wallets. As laboratories began peppering colonial universities, government bureaux and private houses, snakebite studies slowly receded from plebeian scrutiny; only in the late 1870s could reporters suggest that '[a] detailed account of the experiments would be uninteresting to the general public'.[11]

Sometimes, as at Hobarton General Hospital in 1850, or Melbourne Gaol in 1877, animal studies were designed to discredit lay antidotes.[12] Conversely, into the 1880s, museum directors publicly sought to endorse lay remedies brought before them.[13] As late as 1897, it was neither a doctor nor a scientist who tested an expensive new French antivenene (antivenom) in dogs at Melbourne Veterinary College. Rather, 'Professor' William Davis was another showman, who himself succumbed to snakebite onstage in 1903.[14] Little wonder that in 'Johnson's Antidote', from his phenomenally successful 1895 collection, *The man from Snowy River*, poet 'Banjo' Paterson satirised a rural entrepreneur who sacrificed his sheepdog in 'Seeking for some great specific that would cure the serpent's bite.'[15]

Statistics and scientific medicine

In one sense, such industry is difficult to apprehend. By World War I, only two years—1887 and 1914—had seen more than twenty snakebite deaths reported across the continent. Although notoriously rubbery, such statistics paled against the scarlet fever epidemic which despatched over 5000 colonists in 1875–76.[16] Compiling the most thorough survey of snakebite before Federation, Sydney Hospital physician Louis Ralston Huxtable concluded in 1893 that 'in the great majority of cases strong and healthy adults recover from the bite of even our most venomous Australian species without the aid of treatment', although children remained another matter.[17] Concurrently, Melbourne University's demonstrator in physiology, James Barrett, asserted to the Royal Society of Victoria that in killing one per 17 886 colonists—comprising 0.5 per cent of *violent* demises—snakebite represented 'one of the most insignificant causes of death in our midst'.[18]

Yet as with epidemics, fluctuating fascination with serpents was never just about numbers. Almost every medical or 'scientific' periodical published in the Australian colonies from 1821 to 1914 included, within its first volume, at least one article on venomous local fauna. Most extreme was the *Australian Medical Gazette* which in its first year, 1869, dedicated almost a quarter of its 280 pages to snakebite. Across its entire three-volume run, the proportion averaged nearly 17 per cent. Yet the competing *Australian Medical Journal* barely commented, remaining similarly taciturn over 1890–93 while the *Australasian Medical Gazette* allotted up to 10 per cent of its content to envenomation. Similar disparities were evident in pharmacy, natural history and science journals, reflecting clinical fads, personal obsessions or vigorous rivalries.

The twin poles of contention were the nature of venom—and hence how to counteract it—and what counted as appropriate evidence. Smith and Shires illustrated that professionals and 'amateurs' could happily coexist. Indeed, in 1867 Shires demonstrated

Cat. 44 **Snakebite kit arranged by Dr Randle, instructions from Dr A Mueller for his antidote of strychnia**, 1892; wood, metal, cardboard and glass; 2.7 × 11.2 × 8.2 cm. Gift of Dr Robert G Sim; Medical History Museum, MHM02691

his antidote before George Halford.[19] Although most of the twenty dogs bitten by Shires' tiger snakes died, Melbourne University's professor of medicine went on to stake his reputation, in Victoria and across the Empire, upon theories and remedies for snakebite. Convinced that venom drained blood corpuscles of 'animal heat', Halford imagined that it comprised living 'germinal matter'.[20] Fierce local and international rebuttals led him to eschew this theory, championing instead ammonia injections to stimulate the heart and reinvigorate the blood. Inspired by experiments in dogs, his suggestion to intravenously dose snakebitten patients with an acknowledged poison was certainly controversial. The prevailing treatments, for doctors and laity, were ligature, cutting and sucking the wound, rest (or vigorous exercise), and prodigious quantities of alcohol.

Support for 'Halford's injection' nevertheless grew: Victorian doctors, chemists and citizens extolled its effectiveness in both human and animal patients. Conversely, sustained opposition in Australia and British India culminated in 1874, when two dozen Victorian snakes were shipped to Calcutta and pitted against Indian serpents by a government-appointed medical commission. When their experiments in snakebitten animals were confirmed by a similar study conducted by Halford's Melbourne colleagues in 1876, his goose seemed cooked. Yet after bitter and prolonged debates, the Medical Society of Victoria officially endorsed Halford's method.[21] Although it was a pyrrhic victory—ammonia injection soon faded into disuse—this episode confirmed that professorial authority and clinical testimony formally trumped animal experimentation.

A sense of déjà vu reigned in the early 1890s when Prussian-born Augustus Mueller proposed subcutaneous injections of strychnine, another notorious poison, to physiologically counteract snakebite. A general practitioner from rural Yackandandah, Mueller argued that venom targeted the nervous system, not the blood, but the Medical Society of Victoria dismissed his limited clinical evidence. Berating their conservatism, he courted the *Australasian Medical Gazette's* editor, John Mildred Creed, who commenced an energetic publishing and political campaign.[22] By 1894, Mueller had garnered testimonials across the Australian colonies and India, where Queen Victoria herself demanded an official trial of strychnine injection.[23] Claiming a moral abhorrence of vivisection, Mueller's first condition for the Indian authorities was that '[e]xperiment on the lower animals be dispensed with as misleading'.[24]

By 1895, however, clinical testimony was wavering in Britain, India and Australia. Since the 1850s, observers had mused whether snake charmers acquired resistance to snakebite, much as prior cowpox or smallpox episodes appeared to prevent re-infection. As practitioners embraced the new science of immunology, especially its diphtheria anti-toxin, medical investigators in America, French Indo-China, Brazil and Australia began experimenting with antivenenes for snakebite. Inoculating venom into guinea pigs, rabbits and especially horses, the blood serum from these animals seemingly neutralised snakebites—at least in animals.

Over 1892–95, Sydney University physiologist Charles Martin characterised Australian snake venoms in unprecedented detail via chemical tests and vivisections. Moving to Melbourne University, he created an experimental antivenene against *Pseudechis porphyriacus* venom in 1897.[25] Comparing his agent with the Pasteur Institute's 'universal' *Serum Antivenimeux*—raised against East Asian snake venoms—Martin asserted that antivenenes only counteracted the venoms used to generate them. Having immunised a horse against *Notechis scutatus* venom, in 1901 Martin's colleague Frank Tidswell found his antivenene effective in rabbits.[26] Yet aside from a single patient treated with *Serum Antivenimeux* in 1900, none of these technical triumphs entered Australian clinical practice.[27]

Thus by Federation, a half-century of 'scientific medicine' left Australians in a quandary. Martin and Tidswell's research had ranked Australian snakes among the world's deadliest, whilst demonstrating that each venom comprised a complex of bioactive chemicals. The corollary was that each variety of snakebite required a specific antivenene. But unlike chemicals such as ammonia or strychnine, serums did not keep well, and the new Commonwealth lacked sufficient production, distribution and storage infrastructure to disseminate them. Ironically, having demolished the certainties of clinical testimony, the experimentalists could offer only time-honoured practices: ligature, scarification and suction. Furthermore, unlike the universal efficacy claimed for older antidotes, the very specificity of antivenenes required snakebitten Australians to accurately identify their assailant. History—natural or otherwise—was not on their side.

Peter Hobbins

1 *Argus*, 12 April 1869, p. 5.
2 *Argus*, 12 April 1869, p. 5; Kevin J. Fraser, 'Dr. L.L. Smith's entrepreneurial medical practice in Victorian Melbourne', in H Attwood, R Gillespie, and M Lewis, eds, *New perspectives on the history of medicine*, Melbourne: University of Melbourne and the Australian Society of the History of Medicine, 1989, pp. 143–62; John Cann, *Snakes alive! Snake experts and antidote sellers of Australia*, Kenthurst: Kangaroo Press, 1986, pp. 20–33; WELH Crowther, 'Mr. Charles Underwood and his antidote, with some observations on snake bite in Tasmania', *Medical Journal of Australia*, vol. 1, 1956, pp. 83–90.
3 Philippa Martyr, *Paradise of quacks: An alternative history of medicine in Australia*, Sydney: MacLeay Press, 2002, pp. 63–9.
4 Peter Hobbins, 'Imperial science or the republic of poison letters? Venomous animals, intercolonial exchange and colonial identities', in Robert Aldrich and Kirsten McKenzie, eds, *Routledge history of western empires*, London: Routledge, 2013, forthcoming.
5 'The late case of snake bite at Talbot', *Australian Medical Gazette*, vol. 1, 1869, p. 276; George B Halford, 'The treatment of snake-bite in Victoria', *Australian Medical Journal*, vol. 15, 1870, p. 171; Gerard Krefft, *Australian vertebrata, fossil and recent*, Sydney: Thomas Richards, 1871, pp. 50–2; FW Dallimore, 'Professor Halford's ammoniacal injection, *The Age*, 22 December 1869, n.p.
6 An Emigrant Mechanic, *Settlers and convicts: Or recollections of sixteen years' labour in the Australian backwoods*, Carlton: Melbourne University Press, 1969 [original 1847], p. 146.
7 Catherine de Courcy, *Evolution of a zoo: A history of Melbourne Zoological Gardens, 1857–1900*, Melbourne: Quiddlers Press, 2003, p. 61.
8 K Gregg, 'The exhibits', in Ronald Strahan, ed. *Rare and curious specimens: An illustrated history of the Australian Museum,* 1827–1979, Sydney: The Australian Museum, 1979, pp. 120–2.
9 WF Bynum, *Science and the practice of medicine in the nineteenth century*, Cambridge: Cambridge University Press, 1994, pp. 92–106.

10 'Snake poison and its antidotes', *Argus*, 8 November 1861, p. 3; Ann Tovell Archives, Brownless Biomedical Library, University of Melbourne, Folder 928: 'Vouchers in the experiments in snake-poisoning, 1876', Leonard Fawssett to Tharp Girdlestone, 25 January 1876.
11 'Snake experiments', *Gippsland Times*, 7 February 1877, p. 3.
12 'Proceedings for July 1850', *Papers and Proceedings of the Royal Society of Van Diemen's Land*, vol. 1, 1851, pp. 283–9; Anonymous, 'Sketches of snake-bite experiments in the Melbourne Gaol', *The Australasian Sketcher with Pen and Pencil*, 17 February 1877, pp. 182–4.
13 'A snake-bite antidote', *Illustrated Sydney News*, 15 May 1880, pp. 7, 13; 'Alleged antidote for snake poison', *Australasian Medical Gazette*, vol. 4, 1885, p. 98; Maree Ring, 'Charles Underwood and his snake bite antidote', *Tasmanian Historical Research Association Papers and Proceedings*, vol. 43, 1996, p. 139.
14 'Snakebite and antidote', *Queenslander*, 20 February 1897, p. 421.
15 AB Paterson, *The man from Snowy River and other verses*, 4th ed., London: Macmillan and Co., 1896, p. 143.
16 PH Curson, *Times of crisis: Epidemics in Sydney, 1788–1900*, Sydney: Sydney University Press, 1985, p. 74.
17 L Ralston Huxtable, 'Snake-bite in Australia: Recent statistics and a review of recent observations', in L Ralston Huxtable, ed., *Intercolonial Medical Congress of Australasia. Transactions of the third session*, Sydney: Charles Potter, 1893, p. 144.
18 James W Barrett, 'The present position of the snake-bite controversy', *Proceedings of the Royal Society of Victoria*, vol. 5, 1893, pp. 183–5.
19 George B Halford, *Thoughts, observations, and experiments on the action of snake venom on the blood*, Melbourne: Stillwell and Co., 1894, p. 29.
20 George B Halford, 'On the condition of the blood after death from snake-bite, as a probable clue to the further study of zymotic diseases, and of cholera especially', *Transactions and Proceedings of the Royal Society of Victoria*, vol. 8, 1868, pp. 73–94; CH Campbell, 'Professor Halford's germ theory of snake poisoning', *Medical Journal of Australia*, vol. 1, 1966, pp. 552–5; Peter Hobbins, 'Snake germs and Professor Halford's webs', *University of Melbourne Archives Bulletin*, vol. 29, 2011, pp. 3–5.
21 'Ammonia in snake-bite', *Australian Medical Journal*, vol. 21, 1876, pp. 241–2; CH Campbell, 'Professor Halford's new treatment of snake bite with the injection of ammonia into the veins', *Medical Journal of Australia*, vol. 1, 1966, pp. 1008–15; Sharon Louise Wallace, 'Treatment of snakebite from Halford to Sutherland', Bachelor of Medical Science thesis, University of Melbourne, 1983, pp. 17–39.
22 State Library of New South Wales, John Mildred Creed, papers 1882–1911, A 694: 'Snakebite, being correspondence and newscuttings, 1884–1895', Augustus Mueller to John Mildred Creed, 8 January 1892, p. 1.
23 'Strychnine in snake bite', *British Medical Journal*, vol. 1, 1893, p. 723.
24 Joshua Duke, 'The symptoms and treatment of snake-bite in India, with special mention of Dr. A. Mueller's subcutaneous injection of strychnine, based on the consideration of 37 cases', *Indian Medical Gazette*, vol. 30, 1895, p. 209; CH Campbell, 'Dr. Mueller's strychnine cure of snake-bite', *Medical Journal of Australia*, vol. 2, 1968, pp. 1–8.
25 CJ Martin, 'The curative value of Calmette's anti-venomous serum in the treatment of inoculations with the poisons of Australian snakes', *Intercolonial Medical Journal of Australasia*, vol. 2, 1897, p. 533.
26 Frank Tidswell, 'A preliminary note on the serum-therapy of snake-bite', *Australasian Medical Gazette*, vol. 31, 1902, pp. 178–9.
27 G Bill, 'Notes on a case of snake-bite, treated with antivenine', *Intercolonial Medical Journal of Australasia*, vol. 7, 1902, p. 348.

All AVRU Collection, University of Melbourne, except Cat. 157 CSL Collection, Museum Victoria, HT003515
Clockwise: Cat. 112 CSL, **Snake venom detection apparatus**, expiry September 1991; mixed media; 4.6 × 2.5 × 14.5 cm
Cat. 74 CSL, **Brown snake antivenene**, 22 March 1960; antivenom, glass, cardboard; 6.5 × 3.0 × 3.0 cm
Cat. 98 CSL, **Milking vial, brown snake venom collected by Charles Tanner, channel country and Cape York**, 11 August 1978; venom, glass, plastic; 7.2 × 5.5 cm
Cat. 75 CSL, **Brown snake antivenene**, 29 August 1963; antivenom, glass, cardboard; 6.5 × 3.0 × 3.3 cm
Cat. 122 CSL, **Tiger snake antivenene**, 6 October 1964; antivenom, glass, cardboard; 6.5 × 3.5 × 3.5 cm
Cat. 77 CSL, **Brown snake venom collected by Charles Tanner**, n.d.; venom, glass; 3.0 × 16.0 × 2.5 cm
Cat. 70 CSL, **Black tiger snake venom**, 26 February 1935; venom, glass; 17.0 × 2.5 × 2.8 cm
Cat. 117 CSL, **Taipan venom**, 24 November 1961; venom, glass; 3.0 × 16.0 × 2.5 cm
Cat. 157 CSL, **Tiger snake antivenene**, 1953; antivenom, glass, cardboard; 3.0 × 12.0 × 3.5 cm
Cat. 82 CSL Ltd, **Death adder antivenene**, 22 March 1960; antivenom, glass, cardboard; 3.2 × 12.0 × 3.5 cm
Cat. 106 CSL, **Rough scale snake venom collected by David Fleay**, 3 February 1961; venom, glass; 2.5 × 16.0 × 2.5 cm
Cat. 124 **Tiger snake venom**, Baw Baw, 3 September 1955; venom, glass; 3.0 × 16.0 × 2.5 cm

Made in Australia: The legacy of antivenom research

In the 1920s, snakebite was a constant threat for Australians living and working in rural areas, as well as for city dwellers living on the rapidly expanding urban fringes or close to parks, waterways and bushland reserves.

Research in other countries had established that snakebite was a medical problem with the clear potential to be solved. As early as 1894, cobra antivenom was made commercially available as a result of French research.[1] To the disappointment of many Australians, this antivenom was not effective against common Australian snake species. The need for antidotes to the venoms of Australian snakes proved to be a uniquely Australian research problem.

Early Australian antivenom research in the 1890s was led by Charles J Martin at the University of Melbourne, and Frank Tidswell in the New South Wales Department of Health. By 1903, Tidswell had generated tiger snake antivenom, but with a lack of support and infrastructure for the project the antivenom was never moved into commercial production.

It was not until 1927 that the Walter and Eliza Hall Institute (WEHI) and the Commonwealth Serum Laboratories (CSL) joined forces to continue the project. Writing in the Walter and Eliza Hall Institute's 1927–1928 *Annual Report*, the institute's director, Charles Kellaway, named Neil Hamilton Fairley as the driver behind the research.

> On returning to Australia last year, Dr. N. Hamilton Fairley, who has had considerable experience with snake bite in India, drew attention to the fact that during the past two decades little work has been done on the Australian venomous snakes, and that despite serum therapy, Tidswell's experimental work on the production of antivenine in this country had not been followed up. The low death rate has no doubt been a factor in this inertia, but many deaths could and would have been prevented had antiserum been available for general use.

To support the new program, Kellaway lobbied the Commonwealth Government to consider medical research into snakebite, as well as polio and hydatid research, to be national concerns, and received £2,500 to support the institute's research programs. This grant was the first funding of a program of medical research by the Australian Government Department of Health, paving the way for the formation of the National Health and Medical Research Council in 1936.

Photographer unknown, **Charles Kellaway in his laboratory at the Walter and Eliza Hall Institute of Research in Pathology and Medicine during World War II**, c. late 1930s; photograph; 23.3 cm × 19.5 cm. Reproduced with permission from Walter and Eliza Hall Institute

Fairley and Kellaway, working with Fannie Eleanor Williams, Henry Holden and Donald Thomson from WEHI, and the director of CSL Frederick Morgan, initiated a program of research into how Australian snake venoms act, and how the effects of snakebite could be mitigated.

The research into snakebite was initially a broad program, with Fairley conducting epidemiological studies of the frequency and outcomes of snakebite in Australians, and detailed studies of the biting mouthparts of Australian snakes. Some work on snakebite mitigation addressed the efficacy of standard first aid responses to snakebite, ligature and excision, and found them to be an inadequate treatment for snakebite. This justified the development of antivenoms, a project that had long-term and widespread benefits for Australia.

The research team's production of antivenom required large quantities of snake venom that could be injected into experimental animals (predominantly horses) in minute, sub-lethal doses, to generate serum that had venom-neutralising, antivenom properties. Venom from significant Australian snake species was sourced from the Melbourne Zoo snake house—which was, for a time, taken over by the Walter and Eliza Hall Institute, with the reptile curator Tom Eades being an employee of the institute. The demand for venom was high, with more than 800 snakes, including tiger snakes, death adders, copperheads and black snakes, being milked in the period between 1928 and 1930. The institute's annual reports from the period include accounts of snake-hunting trips to many locations around Australia.

By late 1930, the research team's efforts had come to fruition, with CSL releasing tiger snake antivenom for clinical use. On 30 April 1931, soon after the first 'official' tiger snakebite was successfully treated with the new antivenom at the Royal Melbourne Hospital, *The Sun* newspaper summarised the work of Kellaway and his team fittingly as 'Men who play with death so that others may live'. In 1931, Kellaway himself was a direct beneficiary of his own research, being treated with the antivenom after he was accidentally bitten by a tiger snake during a milking session.

By 1934, CSL formed its own antivenom research department, headed by Tom Eades, which still worked closely with researchers at WEHI. CSL produced antivenoms to other Australian snakes, culminating in the production in 1962 of the 'polyvalent snake antivenene (Australia-New Guinea)' that is effective against bites of all the major venomous snakes of Australia. The production of antivenoms for other toxic animals also progressed, and today CSL produces antivenoms for redback spiders (*Latrodectus hasselti*), stonefish (*Synanceia spp*), box jellyfish (*Chironex fleckeri*) and funnel-web spiders (*Atrax robustus*). These products have undoubtedly saved the lives of many people and domestic animals in Australia.

While CSL continued the antivenom research program, by the late 1930s Kellaway's interest in snake venom moved towards understanding the biological effects of venom. This interest stemmed from earlier research into tissue damage that Kellaway had undertaken in London under the eminent pharmacologist Sir Henry Dale.

Kellaway recognised that venoms could be useful research tools for understanding human physiology and, as early as 1929, had begun to diversify his research into venoms from organisms other than snakes. Ultimately his studies included venoms from bees, spiders, mussels, and platypus, as well as bacterial toxins.

With colleagues including Fannie Eleanor Williams and Henry Holden, Kellaway identified that venoms are a complex mixture with different components having different effects: in the case of snake venoms, some components could destroy red blood cells or disable muscle cells, while others caused anaphylaxis, an extreme and life-threatening immune response.

Through work on the anaphylactic effects of snake venom, Kellaway and Wilhelm Feldberg identified the 'slow reacting substance of anaphylaxis' (SRS-A), a substance that causes the body's smooth muscle cells to contract, and plays a major role in inflammatory diseases such as asthma. SRS-A remained enigmatic for many years after Kellaway's work, finally being identified in the 1980s as a mixture of cell signaling molecules called leukotrienes. Kellaway's work also ventured into the burgeoning field of immunology research, investigating how immunity to venom develops.

Many considered Kellaway's venom research to be one of the highlights of his research career, with his 1940 citation for Fellowship of the Royal Society stating that his contributions 'on the physiological actions and immunology of snake venoms has made him pre-eminent amongst investigators of this subject'.

The collaborative research into snake venoms carried out by the Walter and Eliza Hall Institute and Commonwealth Serum Laboratories scientists was an important era in Australian medical research, yielding direct therapeutic benefits for many Australians who had unfortunate encounters with venomous native fauna, as well as spawning broader fields of research. Australian venom research continues today, and Australian researchers are using components of venoms to guide the development of new pharmaceuticals for a range of conditions.

The support of the Commonwealth Government in snake venom research was also a landmark in the history of Australian medical research, and may well have been used to justify the establishment of the National Health and Medical Research Council. Within four years of receiving government funding, WEHI and CSL researchers had produced an antivenom that was saving the lives of snakebite victims. To many Australians, this exemplified the promise of medical research, and the hope that research offers the community.

Professor Douglas Hilton

1 Antivenin or antivenene, the terminology originally used to describe the antitoxin developed against snake venom by Albert Calmette in 1894, was derived from the French venin, meaning venom, that itself came from the Latin venenum, meaning poison. As it was developed in France, the term antivenin was used, however in 1981, the World Health Organization determined that the preferred English nomenclature was antivenom, although antivenin remains in common use in francophone countries.

Snakes in the twentieth-century Australian imagination

At the time of writing, the federal Labor government had just undergone one of its regular periods of internal upheaval. The centrefold of the newly shrunken *Sydney Morning Herald* captured the turmoil with a large photoshopped image of the heads of the protagonists on the bodies of entangled snakes. The prime minister's head was just visible at the centre of the writhing reptiles, over the headline, 'PM in snake pit with no antivenom'.[1] This image epitomises the place of snakes in the Australian imagination now and throughout the previous century: snakes are untrustworthy, repulsive and potentially dangerous. Possibly even more so than politicians.

In the early decades of the twentieth century, contact between Australians and the snakes with which they shared their newly federated country was more frequent than it became in later, more urbanised decades. About half of the Australian population lived in capital cities, but with the exception of Sydney, Hobart and Brisbane, these were sprawling oversized country towns where much of the population lived in suburban areas which provided good habitat for snakes. Ongoing encounters fuelled the anxiety surrounding snakes that had developed in the colonial period and it was reinforced in the press, oral storytelling and children's books like May Gibbs' Snugglepot and Cuddlepie series.

Snakes had relatively few defenders in this period. They did derive some benefit from the steadily growing interest in Australian animals and plants, which was manifested in nature study in schools, the craze for bushwalking and participation in societies such as the Wild Life Preservation Society of Australia (est. 1909).[2] Scientists did what they could to advance understandings of Australian snakes but it was popular naturalists like Charles Barrett, Donald Macdonald and Philip Crosbie Morrison in Melbourne and Vincent Serventy in Perth who through their newspaper columns and, from the late 1930s, radio shows did most to persuade the general public that all of nature was valuable and of great interest, even snakes. Under their guidance, a minority were persuaded that their general terror of snakes could be replaced with cautious appreciation.

One of the leaders in the attempted redemption of snakes was New South Wales naturalist and self-educated herpetologist Eric Worrell (1924–1987). Worrell had admired reptiles from a young age and must have been one of very few children of the 1930s to ask for a blue-tongued lizard ('blotched or with pink spots') in his letter to Father Christmas.[3] Worrell's ease with snakes created a demand for his services as a snake catcher. Although Worrell evangelised on behalf of snakes in his writing and public demonstrations, reassuring

Michael Mucci, **PM in snake pit with no antivenom**, *Sydney Morning Herald*, 25 March 2013, pp. 32–3

people that they were generally timid, only a few were dangerous and snakebite could be treated, he could not shift the commonly held view that the only good snake was a dead snake.

The fear of snakes gave them an entertainment value which was capitalised upon by newspaper and book publishers. Australian newspapers abounded with reports of snakes found in unlikely places: the shock of seeing them, the response of fear and panic and most often, their speedy dispatch by the nearest male with a broom handle, a cricket bat, clothes prop, boiling water or any other means at hand.[4] Although the species of snake, and therefore the actual danger it posed, was often not provided in these accounts, a confident statement of its length was almost always given because the longer a snake was, the more terrifying and the more impressive the human triumph over it.

Snakes also appeared in fiction, as in the short story 'Snake' by Noel Vincent published in 1945.[5] A tough bushman felling trees in the Karri forest of Western Australia felt a sharp bite on his arm and saw two fang marks appear. In a 'frenzy of terror', he beat the snake until its head was a bloody pulp before making the split second decision to chop off his own arm to stop the venom from spreading. When the snake was sent to a museum for identification, it was found to be a whip snake, with a bite no more harmful than that of a bee. Although the snake lost more from the encounter, it was doubly duplicitous—firstly, biting the man by stealth and then tricking him into causing himself even greater harm. More typically, in news and fiction, the disproportionate fear of snakes allowed Australian men, and occasionally women and children, to demonstrate their bravery in the face of a sinister enemy.

The expanding ownership of the private car in the 1950s brought about greater suburbanisation and more travel to holiday centres, both of which potentially brought more people into contact with snakes. One of the attractions for holiday makers was a visit to a wildlife park such as Worrell's Australian Reptile Park near Gosford on the NSW central coast, David Fleay's Fauna Reserve, opened on the Gold Coast in 1952, or Fleay's previous home, the Healesville Sanctuary east of Melbourne. Photographs taken of visitors to these parks as they watched a snake handling demonstration or the process of milking a snake for venom capture the combination of fear, revulsion and fascination that snakes held for them. They were uncomfortable in looking at snakes, but they couldn't look away.[6]

By the 1970s, there was a rising sense of environmental peril, leading to community activism around habitat and species loss and the passage of legislation to protect endangered species. It was not unexpected that negative views of snakes began to soften somewhat, a shift also encouraged by the availability of effective antivenoms. Snakes were brought under acts passed for the protection of native animal species and small but growing numbers of people began to keep snakes as pets, an interest viewed with suspicion by many. In NSW, where anyone could own a dog, a cat or a bird, aspiring reptile keepers had to be licensed, were restricted to specific species and numbers of animals and were occasionally subject to home inspections.

Photographer unknown, **Eric Worrell milking a snake for an attentive audience, Australian Reptile Park, Wyoming, NSW**, c. 1965. Australian Reptile Park collection

The growing awareness and appreciation of Aboriginal culture brought out another side of imaginings of snakes. In the beliefs of many culture groups, especially those of central and northern Australia, a snake known as a rainbow serpent was prominent in creation stories.[7] The snake was respected as a powerful ancestor and was often portrayed in contemporary art. This positive snake-as-life-force was present as a parallel, but in the broader society it never displaced the negative image of the snake based in western creation myths, including the Biblical snake in the Garden of Eden.

Television programs did much to educate the Australian public about snakes, reaching a much wider audience than specialist magazines or public lectures. They varied in approach and tone, from the *Boy's Own* adventures of the Leyland Brothers from the early 1960s to the more educational *Nature Walkabout* by the Serventy family later in the decade. The genre became more sophisticated in the 1970s and 1980s, but was still most often constructed as serial adventures by iconic Australian characters such as Harry Butler and Bush Tucker Man, Les Hiddens. These shows combined a serious message about the ecological role of a variety of species, including snakes, with the frisson of close encounters with them.[8]

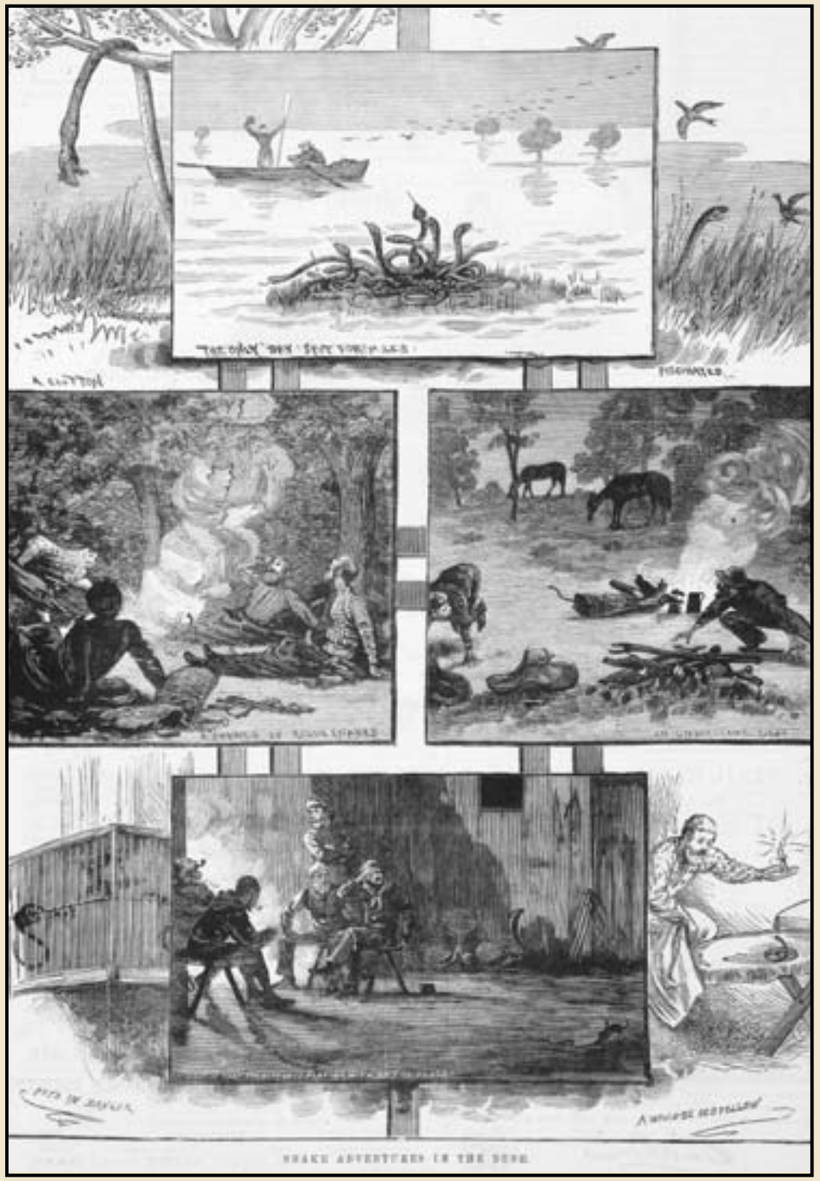
Entertainment value again rose to the fore in Steve Irwin's *Crocodile Hunter* series from 1996. Irwin had grown up in the Queensland Reptile and Fauna Park on the Sunshine Coast. His deep-felt appreciation of snakes was paired with an emphasis on their dangerousness and fed, rather than defused, the fear of them in his audience. In another tourist area, the NSW south coast, the Taipan-themed waterslide ride at Jambaroo Action Park, opened in 2007, captures the continuing image of snakes as thrilling and potentially dangerous.

Throughout the transformations in Australian society in the twentieth century, imaginings of snakes have been largely consistent. The fear of snakes is so deep-seated in European-derived Australian culture and so often reinforced in the media, that the dedicated work of naturalists, the new appreciation of Indigenous perspectives and official protection have had a limited impact on how they are viewed. Only the recent increased popularity of keeping snakes and other reptiles as pets holds some promise of at last bringing about the deep knowledge and affective ties which will allow a reimagining of the Australian snake.

Dr Nancy Cushing and Dr Kevin Markwell

1 Michael Mucci.com image, *Sydney Morning Herald*, 25 March 2013, pp. 32–3.
2 David G Stead, 'The naturalist in Australia and an outline of the fauna of Australia', *The Australian Naturalist*, vol. 10, no. 2, 1937, p. 50.
3 Eric Worrell's letter to Santa, c. 1934, reprinted in Kevin Markwell and Nancy Cushing, *Snake-bitten: Eric Worrell and the Australian Reptile Park*, Sydney: UNSW Press, 2010, plates after page 112.
4 See as just one example in thousands, 'Snake!', *Sunday Times*, 12 November 1950, p. 3.
5 Noel Vincent, 'Snake', *Western Mail*, 8 March 1945, p. 24.
6 Nancy Cushing and Kevin Markwell, 'I can't look: Disgust as a factor in the zoo experience', in Warwick Frost, ed., *Zoos and tourism: Conservation, education, entertainment?*, Bristol: Channel View Publications, 2011.
7 'Rainbow serpent', in Melissa Harper and Richard White, eds, *Symbols of Australia*, Sydney: UNSW Press, 2010.
8 M Mulligan and S Hill, *Ecological pioneers*, Melbourne: Cambridge University Press, 2001, pp. 133–4.

Cat.165 **Snake adventures in the bush**, *The Illustrated Australian News*, 16 May 1883, p. 76; wood engraving; 25.4 × 18.4 cm. State Library of Victoria, IAN16/05/83/76



From snake handlers to wildlife entrepreneurs

The process of obtaining raw venom for research purposes and for the production of life-saving antivenoms is a highly skilled undertaking that carries with it considerable risk for the individuals involved. An error in judgement or a lapse of concentration could result in a bite with serious consequences including death. The production of antivenoms has not been possible without a small number of individuals willing to risk their health, and sometimes their lives, to milk highly venomous snakes of their precious venom. The 'milking' procedure most commonly employed involves holding the snake's head against a beaker over which a membrane of rubber or latex has been stretched. The snake's fangs penetrate the membrane and venom collects in the beaker. Bill Haast, the charismatic owner/director of the Miami Serpentarium Laboratories which opened to the public in 1947, popularised snake milking to an American audience, milking tens of thousands of snakes in front of rapt audiences throughout the life of this facility. The public interest in such performances proved to be just as strong in Australia, when snake expert, Eric Worrell, milked dangerous snakes for an appreciative audience at his Australian Reptile Park from the late 1950s.

The venom needs of pioneering venom researchers Charles Kellaway and Neil Hamilton Fairley at the Walter and Eliza Hall Institute, Melbourne, in the late 1920s and early 1930s, were met largely by former snake showman, Tom 'Pambo' Eades, who was by that time in charge of the reptile collection at Melbourne Zoo.[1] Other snake collectors provided snakes to Kellaway and his team, including a young 'snake man' from Tasmania, Jimmy Murray, who supplied him with hundreds of black tiger snakes. Eades ultimately left the zoo to work for Kellaway, for whom he collected snakes such as tigers, browns, copperheads and death adders and extracted their venom.[2] Following the completion of Kellaway's project, Eades went to work for the Commonwealth Serum Laboratories (CSL) where he was responsible for collecting, maintaining and milking the venomous snakes used to supply venom for the production of antivenoms.[3] After Eades' retirement in 1941, another CSL employee, Charles Ricardo, replaced him and milked mostly tiger snakes held at Melbourne Zoo on behalf of the CSL.[4] During the early 1940s, additional quantities of tiger snake and copperhead venom were provided to the CSL by David Fleay, who worked at Melbourne Zoo before being appointed as director of the Sir Colin MacKenzie Sanctuary at Healesville.[5]

Cat. 155 **Snake catching stick**, c. 1920; wood; 16.5 × 181.5 × 3.0 cm. Museum Victoria, HT002827

Up until this point, the milking of venomous snakes had been undertaken largely outside of the public gaze. This, however, was to change and one man was to make the milking of dangerous snakes an important part of his identity, an identity which became famous across the country as Australia's 'snake man'. Eric Worrell was born in Sydney's Paddington in 1924 and reptiles were the focus of much of his childhood. Regular visits to watch the 'Snake Man of La Perouse', George Cann, only heightened his determination to build a career involving their study. By the age of twenty-six, he achieved the first stage of his childhood ambition by owning a facility where he could keep and study Australian reptiles. Located near Woy Woy on the NSW central coast, he called it Ocean Beach Aquarium and it was opened to the public in 1950.[6]

Worrell had established a reputation as a writer of Australiana and natural history (particularly about reptiles) through his many articles published in magazines such as *Walkabout, Outdoors and Fishing* and *Australian Country* and by the late 1940s he had decided to write a handbook that would enable Australians to identify the country's dangerously venomous snakes. His research for this book took him to the CSL so he could better understand the composition and nature of snake venoms, as well as include the most up-to-date first aid advice for snakebite. The project was very good for Worrell, resulting in a book, *Dangerous snakes of Australia*, which ran to five editions and the decision by the director of the CSL, Dr Frederick Morgan, in 1951, to offer Worrell the job of working at the CSL in the role that Eades and Ricardo had previously filled. As tempting as the offer undoubtedly was, Worrell declined, but proposed an alternative arrangement: that the CSL engage him as an 'agent' supplying venoms from his base at Ocean Beach Aquarium.

At this stage, the overwhelming bulk of venom required by the CSL was from the tiger snake, necessitating that Worrell collect and maintain large numbers of this species. Luckily, his friend and mentor, George Cann, knew of many locations along the Murray, Lachlan and Murrumbidgee Rivers where tiger snakes could be found in great quantities. Another mutual friend, Ken Slater (who later made important contributions of venom from species of snakes he found in New Guinea), joined him on some of these early trips, as did his friends, the acclaimed photographer and photojournalist, Jeff Carter and his writer wife, Mare. These hauls of tiger snakes were kept in a pit at Ocean Beach Aquarium while surplus snakes were kept in pits at Cann's home in Sydney, where he would milk them on Worrell's behalf.[7]

In 1952 Worrell supplied nearly fifty grams of dried tiger snake venom obtained from almost 2000 milkings. He exceeded this the following year with sixty-four grams. The early 1950s saw Worrell perform around 3000 milking events each year to satisfy the CSL's need for venom, which occasionally resulted in a bite requiring medical treatment. Many of these milkings took place in front of an audience of visitors to the aquarium. Although he had a quiet personality and was softly spoken, Worrell nevertheless had a flair for showmanship. Dressed in his trademark safari jacket and slacks, Worrell milked tiger snakes for audiences of 1950s Australian families who stood in awe as he massaged the venom glands of venomous snakes to promote the flow of the toxic stream into the glass beaker. They gazed with a mixture of fascination, disgust, concentration and quiet admiration. When Worrell worked with his snakes, milking them for the crowd, he melded modern science and medical research into his presentation along with an entertaining and engaging style.[8]

Worrell's reputation as a 'snake man' and producer of snake venom was enhanced considerably through his involvement in the supply of taipan venom. The bite of the coastal taipan was, up until the advent of a specific antivenom in 1955, almost always fatal. In July of 1950, a young Sydney snake collector, Kevin Budden, mounted his own expedition to Cairns in search of this snake, which he intended to make available to the CSL for venom research purposes. After some weeks of searching, Budden found what he was looking for, but his quarry came with a hefty price: the young man's life. While attempting to 'bag' the snake, the taipan managed to bite him on the hand. Bravely he persevered and secured the enraged snake before seeking assurance from his friends that regardless of the outcome, the snake would be sent, unharmed, to the CSL in Melbourne. Budden was rushed to Cairns Base Hospital, but died the following day, far from his family and friends in Sydney.[9]

Respecting Budden's wishes, the taipan was flown to Melbourne where Morgan asked Fleay to milk it.[10] Fleay considered the request carefully overnight as he had never even seen a taipan, let alone handled one that was a proven killer. As he wrote, 'That night did not pass at all quickly. I kept thinking that a young, alert and expert snake catcher had been killed by this very reptile and that I had no experience with taipans whatever.'[11] However, the fact that Budden had given his life to provide the specimen for scientific study tipped the scales for him, and Fleay accepted the dangerous assignment the next day, milking the taipan without incident at the National Museum of Victoria. Research into the production of a specific antivenom for the taipan could now commence, thanks to the bravery of Kevin Budden and David Fleay.

In 1952 CSL asked Worrell whether he would collect and milk taipans on their behalf. Worrell agreed and over the next few years mounted a number of trips to the Cairns area to search for these large, dangerous snakes. His first trip, organised by his friend, John Dwyer, resulted in three taipans being caught but only one was brought back alive to Sydney where it was sold to Sir Edward Hallstrom, president of the Taronga Zoo Trust. Hallstrom had offered fifty pounds for a live taipan that he could display at Taronga Zoo, and was pleased to be able to hand over the money to Dwyer (being the expedition leader) in exchange for this snake. The highly-prized snake was maintained at the zoo by Cann, who by this stage was in charge of its reptile collection. Hallstrom allowed Worrell to regularly milk this snake and it was the venom from this taipan and that of Budden's, together with some venom supplied by Mackay-based snake handler, Ram Chandra, which formed the basis of the first batch of taipan antivenom. This antivenom became commercially available in 1955 and was used soon after to save the life of a young boy, Bruce Stringer. Worrell continued to make annual trips to North Queensland in order to collect enough taipans to satisfy the venom requirements of the CSL.

These trips were arduous and extremely risky for Worrell and his friends and associates, who put their lives in danger in order to collect these highly dangerous snakes.

By the late 1950s, Worrell's ambitions had outstripped his small aquarium, and in 1958 he bought land at Wyoming, a couple of kilometres north of Gosford, where he established his iconic Australian Reptile Park (ARP), opening it to the public in October 1959. By doing so he was fulfilling his childhood ambition of developing a 'reptile research centre' where he could keep and study reptiles. In particular, Worrell was keen to expand on the venom production work and he envisaged the ARP playing a major role in helping to understand the medical applications of snake venoms.[12] He built a comprehensive collection of Australian and overseas venomous snakes and other reptiles (as well as a range of native mammals and birds) and continued to provide venoms to CSL, and later other institutions and researchers both within and outside Australia. He forged a strong and enduring friendship with the CSL's Dr Struan Sutherland, who in the late 1960s began an ambitious research program into the venoms of Australian snakes. During these early days of the park's existence, Worrell provided venoms of taipan, tiger snake, death adder, brown snake and king brown, as well as Papuan black snake, to the CSL. By the mid-1960s, Worrell established a network of men such as Eric West and Roy Reynolds, who supplied him with venomous snakes so that he could focus on other aspects of his operations and leave the collecting of most of the snakes to others.

The public milking of highly venomous snakes became an important aspect of the park's array of visitor experiences, and large crowds gathered on Sunday afternoons to stand in awe of Worrell or one of his other staff, as they effortlessly milked the dangerous snakes of their venom. In the early 1970s, Worrell trained two of his female staff, Lyn Abra and Robyn Innes (who would later become Worrell's second wife), to milk the snakes as well, their gender adding an extra dimension to the dangerous performance.

Although Worrell maintained his reputation as the chief supplier of snake venom to the CSL, continuing to feature snake milking demonstrations at the reptile park, by the late 1960s the bulk of the snake milking was not carried out at the park, but in Kuranda on the Atherton Tableland by John McLoughlin, Worrell's 'North Queensland agent'. Worrell had initially shifted the milking of taipans to McLoughlin in 1965 as it was easier to maintain these tropical snakes in the area in which they naturally occurred, and the two had come to an agreement a couple of years later that McLoughlin would maintain and milk the other species of snakes that CSL was interested in on Worrell's behalf.[13] McLoughlin was a skilled keeper and handler of snakes and in the several decades of him supplying venoms from a broad range of dangerous snakes he was never bitten. Unlike Worrell, however, McLoughlin was not a showman and was more than happy to tend to his snakes and extract their venom away from the public gaze.

Mutton-birder Roy Goss, bitten by a tiger snake, receives an injection of antivenom from Eric Worrell, Flinders Island, 1955, in Eric Worrell, *Song of the snake*, Sydney: Angus and Robertson, 1958, p. 197

By the mid-1960s, Worrell shared the supply of snake venoms to CSL with a friend of his, Charles Tanner. Tanner, originally from Melbourne, had moved to Cooktown in the early 1960s and established a snake venom supply business, providing venom mostly from taipan, king brown, brown snake and death adder. He also provided sample venoms from a wide range of venomous Australian snakes which form part of the national collection of venoms held by the Australian Venom Research Unit,[14] and his expertise in venoms and snake natural history was appreciated by scientists such as Struan Sutherland at the CSL and Jeanette Covacevich at the Queensland Museum. Tanner was the first to milk venom from the inland taipan, which had been 'rediscovered' in the early 1970s, and he contributed to several scientific and medical papers on this species. Tanner retired from the snake venom business in the mid-1980s and McLoughlin continued as the major venom supplier with additional quantities provided by Peter Mirtschin of Venom Supplies, based near Adelaide. Today, the Australian Reptile Park, under the directorship of John and Robyn Weigel, oversees a large venom supply operation, and continues the relationship with CSL that Worrell commenced in 1951. In addition to supplying snake venoms, the park continues to be the sole supplier of Sydney funnel-web spider venom, which it began providing in the late 1960s.

The story of Australian venom research and the application of this research to the development of life-saving antivenoms would not be complete without recognising the bravery, skill and ingenuity of those men and women who have willingly risked their lives to extract the venom from an array of dangerous snakes. The dried, purified crystals of venom contained in pristine glassware on the laboratory bench is the outcome of the courage, physical effort and determination of this group of unusual people who searched for the snakes in the field, collected them unharmed, maintained them in captivity, and carefully and skilfully extracted their venom.

Dr Kevin Markwell and Dr Nancy Cushing

1 John Cann, *Snakes alive! Snake experts and antidote sellers of Australia*, rev. ed., Kenthurst, NSW: Kangaroo Press, 2001, p. 158.
2 AH Brogan, *Committed to saving lives: A history of the Commonwealth Serum Laboratories*, Melbourne: Hyland House, 1990, pp. 44–5.
3 Brogan, *Committed to saving lives*, pp. 44–5.
4 Kevin Markwell and Nancy Cushing, *Snake-bitten: Eric Worrell and the Australian Reptile Park*, Sydney: UNSW Press, 2010, p. 41.
5 Rosemary Fleay-Thomson, *Animals first: The story of pioneer Australian conservationist and zoologist, Dr David Fleay*, Nerang: Petaurus Publishing, 2007, p. 112.
6 Markwell and Cushing, *Snake-bitten*, p. 33.
7 Cann, *Snakes alive*, p. 139.
8 Markwell and Cushing, *Snake-bitten*, p. 137.
9 Markwell and Cushing, *Snake-bitten*, pp. 53–5.
10 Fleay-Thomson, *Animals first*, p. 166.
11 Fleay-Thomson, *Animals first*, p. 166.
12 Markwell and Cushing, *Snake-bitten*, p. 77.
13 Markwell and Cushing, *Snake-bitten*, p. 148.
14 Peter Mirtschin, 'The pioneers of venom production for Australian antivenoms', *Toxicon*, vol. 48, 2006, pp. 899–918.

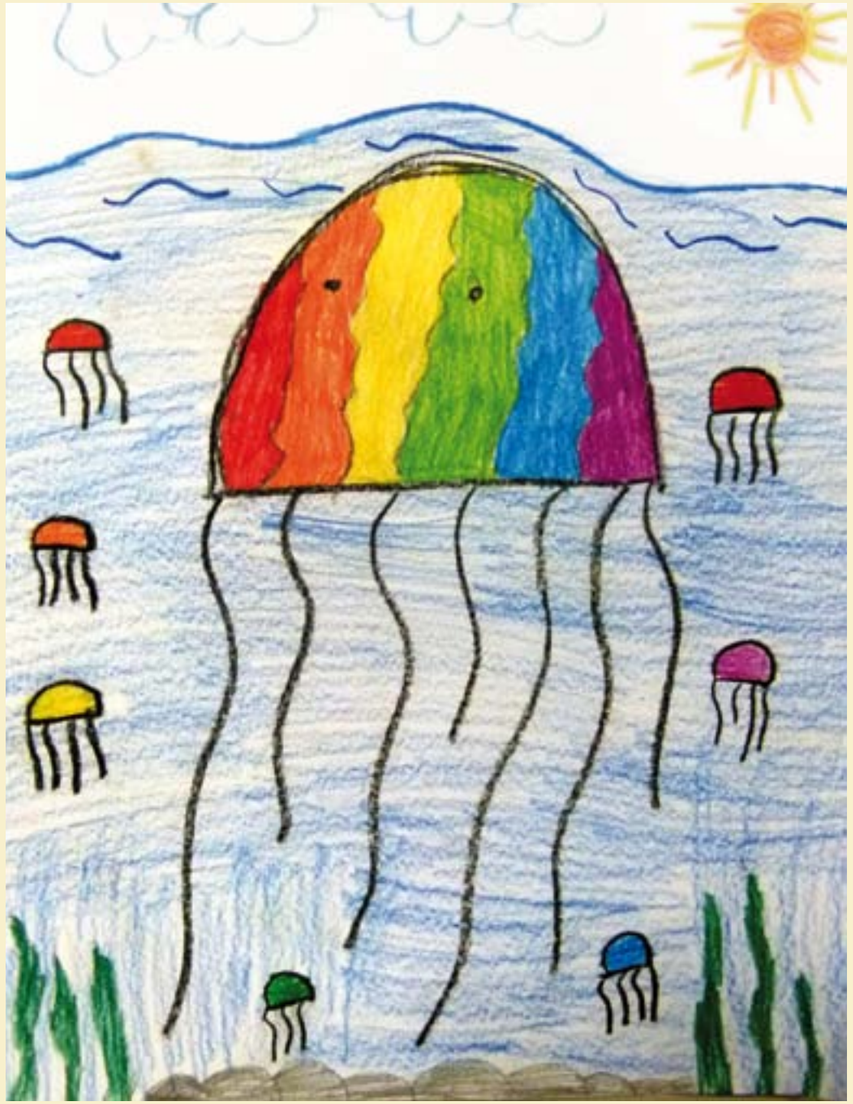
Cat. 15 **Endura car first aid kit including Trafalgar snake bite outfit**, c. 1950s; vinyl, glass, print on paper; 4.7 × 13.4 × 21.0 cm. Gift of Dr John Paull, 2013; Medical History Museum, MHM02013.58

Morning glory vine and sand

The box jellyfish is always venomous. It is delicate and vulnerable to hawksbill turtle and other predators. Box jellyfish come down into the mangroves in the estuary with the westerly trade winds when the water is warm, and this is the most dangerous time because their tentacles are dangling down trying to catch fish or shrimp, and sometimes we get stung by these tentacles. When we draw a box jellyfish as Rickisha has done, the colours on the tentacles represent the venom. The box jellyfish go back to the open ocean (Indian-Pacific) with the easterly trade winds.

Our treatment: With a handful of sand, run it along the part of the body that has the tentacles on it. This sand will protect your finger as you remove the tentacles. You use cold saltwater to wash the wound and kill the bacteria in the wound. Next, you need to make a bit of a fire with sticks. Heat the leaf on the fire and then place a leaf from the morning glory vine on the wound with one hand in the shape of a cup pressed over the leaf. You will feel the warmth from the leaf and this helps with the pain. You keep doing this with the morning glory leaf until the pain goes. To get rid of the scar, you rub dugong oil gently into the scar. Sometimes you need to heat this oil to rub on bad scars.

Heleana Wauchope-Gulwa



Cat. 193 Rickisha Redford-Bohme (Maningrida, b. 1999), Kriol, Rembarrnga, **Jellyfish**, 2012; pencil on paper; 21.0 × 19.0 cm. Artist's collection

Wadi Wadi cure of snake poisoning

[The Wadi Wadi] people are singularly successful in the cure of snake poisoning. [An Aboriginal person] dying from snakebite is an unknown occurrence, although there are great numbers of them bitten from time to time by these reptiles.

Their method of extracting the poison is by severely pinching the bitten part between the thumbs, after which they suck the wound for five minutes, or until a piece of opossum skin which is being heated is deemed sufficiently warm for their purpose. When it is so they cease sucking, and place the heated opossum skin on the wound, holding it tightly pressed against the bitten part with the palm of the hand. When the skin becomes comparatively cool sucking is again had resource to and continued until the skin is again heated to the required degree, when sucking is again discontinued, and the warm skin applied, and so on until the patient is deemed out of danger.

We once saw [an Aboriginal person] bitten on the shin by a black snake. When it occurred we were shooting ducks on a Murray lagoon ... after being bitten, [he] got a stick and killed the snake. He then squatted on the ground, and pinched the bitten part very hard between his thumb nails. The blood, as a matter of course under this treatment, oozed from the punctures pretty freely, and as long as the slightest indication of blood was visible, so long did [he] continue the pinching. However, the whole operation did not occupy more than ten minutes. After that lapse of time [he] got up, said it was all right, and there was an end of the matter.

Peter Beveridge, c. 1860

Peter Beveridge (1829–1885), *The Aborigines of Victoria and the Riverina*, 1889. Beveridge's writings are still the major written source of information about the mid-Murray Aboriginal people, the Wadi Wadi people who were his friends and employees. He lived in that area from the 1840s and began writing in the 1860s.

Cat. 154 Arthur Bartholomew, **Red-bellied black snake *Pseudechis porphyriacus***, in Frederick McCoy, *Prodromus of the zoology of Victoria, vol. 1*, Melbourne: Govt Printer, 1878, plate 1. Museum Victoria, LIB059658

Venetian Treacle

Theriac (θηριακή (thēriakē), the feminine of the Greek θηριακός (thēriakos), signifying 'pertaining to animals', was a famed compound remedy, promoted as a universal panacea since at least the first century AD. This jar held the nineteenth-century version of this concoction. The huge list of ingredients (up to eighty different simples), added with the difficulty in sourcing them and the long time needed to prepare this medicament (up to forty days) made it a very expensive but much valued, even central, part of medieval and early modern pharmaceutica. Moreover, concern for the standardisation and quality of this product ultimately drove the development of Pharmacopoeia texts and the earliest concepts of modern drug manufacture, regulation and safety.

Theriac, also known in England as 'Venetian treacle' due to its monopolistic site of production, was subject to controls in its manufacture, frequently enforced by royal decree. By the Renaissance it was often prepared in public, to ensure its purity. Its legendary origins were traced to a recipe prepared by Mithridates IV of Pontus, to protect himself from poisoning. The recipe was improved by Andromachus (Emperor Nero's physician) who added mashed and roasted vipers (following the principle of 'like curing like'). Similarly Galen prepared his own variant for the Roman Emperor Marcus Aurelius.

The *Antidotarium Nicolai*, a medieval pharmaceutical book, lists seventy ingredients needed to prepare the Great Theriac of Galen (originally detailed in Galens 'Antidotes 1' and '11'): including opium, viper's flesh, squills, long pepper, balsam wood, cinnamon, rhubarb, cassia wood, myrrh, gum arabic, asphalt, St John's wort, nasturtium, terra sigillata (medicinal clay from Lemnos), castoreum (secretion from a male beaver's castor sacs) and mummia (powder from ground-up Egyptian mummies), all ground up and mixed with wine and honey to form a thick paste.

It was prescribed for a huge variety of ailments from epilepsy, apoplexy, dropsy, the stone, leprosy, and smallpox, to poisons, the bites of snakes and plague. It could be taken as a pill or diluted in wine or vinegar. It could also be applied externally, such as on the location of a snakebite to draw out the venom. The formulation appeared as late as the 1884 French Pharmacopoeia.

Dr Kathleen Walker-Meikle

Reference: JP Griffin, 'Venetian treacle and the foundation of medicines regulation', *British Journal of Clinical Pharmacology*, vol. 58, 2004, pp. 317–25.

Cat. 51 **Theriaca jar**, c. 1880; ceramic; 25.8 × 14.2 × 15.0 cm. Medical History Museum, MHM01235

A mortal poison lurks in the bile

Francesco Redi (1626–1697), a gifted doctor, naturalist and linguist, entered the court of Ferdinando, Grand Duke of Tuscany, in Florence, Italy in 1660. Ferdinando enjoyed disputation followed by experimentation in his ducal court and provided ample funds for this purpose. At the time of the annual preparation of theriac, a universal panacea containing viper flesh amongst its components, Redi took up the challenge of showing that the poison of the viper was in the yellow liquor coming from glands at the base of two teeth and not from the gall bladder (medical convention had held that 'a mortal poison lurks in the bile'), nor in the saliva containing the snake's 'enraged spirits'. His findings were published in Italy in 1664 and reported in the first volume of *Philosophical Transactions*, 1665–6, where his use of controls was noted:

> Whereof he gives this proof that he hath rubbed the wound of many animals with the gall of vipers, and pricked them with their teeth, and yet no considerable ill accident followed upon it, but that as often as he rubbed the wounds with the said yellow liquor, not one of them escaped.

Francesco Redi's great contribution to the history of science was to show, experimentally for the first time, that insects do not spontaneously generate from decaying matter, a widely and long-held belief. From his observations he believed that worms found in decaying meat came from the droppings of flies. To prove this he set up a series of flasks containing various types of flesh; some flasks were covered with fine voile to prevent the entry of flies but to allow in air, whilst others were left open to act as controls. As the flesh decayed, worms and flies appeared in the open flasks but none were observed in the closed flasks. The finding was confirmed in many experiments from which he concluded that 'if living causes be excluded, no living things arise'. *Experiments on the generation of insects* ran to five Italian editions from 1668 to 1688 and a Latin version was published in Amsterdam in 1671. Francesco Redi's poem, *Bacchus in Tuscany* (translated by Leigh Hunt) is still known for its comments on Tuscan wines.

Dr Barbara Hawgood

References: BJ Hawgood, 'Francesco Redi (1626–1697): Tuscan philosopher, physician and poet', *Journal of Medical Biography*, vol. 11, 2003, pp. 28–34. PK Knoefel, trans., *Francesco Redi on vipers*, Leiden: EJ Brill, 1988, pp. 4–5. F Redi, 'Some observations on vipers', *Philosophical Transactions*, 1665–6, pp. 160–2.

Cat. 132 Francesco Redi, **Francisci Redi patritii Aretini Experimenta circa generationem insectorum ...**, Amstelodami: Sumptibus Andreae Frisii, 1671; 3.7 × 13.7 × 8.1 cm. Special Collections, Baillieu Library, University of Melbourne


FRANCISCI REDI
Patritii Aretini
EXPERIMENTA
circa generationem
INSECTORVM
AD
Nobilissimum Virum
CAROLVM DATI.

OPTIMI CONSVLTORES MORTVI.

AMSTELODAMI,
Sumptibus ANDREÆ FRISII.
M. DC. LXXI.

The healing art and the serpent

On 24 July 1948, the first meeting of the World Health Organization Assembly adopted as its emblem the United Nations symbol surmounted by a staff with an entwined snake. This act codified the ancient affinity between the healing art and the serpent. Whilst snake-related mythology is near universal amongst human cultures, starting with the Paleolithic, western medicine's use of this imagery is most deeply rooted in Babylonian, Egyptian, Greek and Roman culture. Most commonly the imagery used as the 'universal metonym for curative medicine' is that of the staff of Asklepios, referencing the ancient Greek God of Medicine. In this context the serpent was possessed of benevolent properties—believed to be able to cure a patient by touch.

This iconography has antecedents back to the serpent-worshipping Accadians of Babylon in the third millennium BC, and builds on the classical Greek idea of the 'Agathos Daimon', 'a personal companion spirit ensuring good health and fortune'.By contrast the caduceus, a double-snake motif, with its symbolic connections to the Greek Hermes (the Roman Mercury), messenger of the gods, and 'god of business, travellers and thieves', has a more contested position within medicine.It began to be used in the Renaissance and is more associated with business, alchemy and 'those ignorant of history'.

More than 10 000 different medals have been struck in the post-Renaissance era featuring the Asklepian staff. This includes the Beaney medal that celebrates the achievement of Charles J Trood in the field of surgery in 1878 for his achievements as a student at the Melbourne Hospital. Dr James George Beaney (1828–1891) was a controversial figure of his time due to his flamboyant manner. He instructed medical students in clinical skills in surgery at the Melbourne Hospital usually annually. Beaney presented gold and silver medals to the top students in surgery at events that were advertised in the local newspapers. He made a major bequest to the University of Melbourne in 1892 for scholarships in pathology and surgery which still exists today—continuing the legacy of Asklepios.

Professor James D Best

References: J Pearn, 'Agathos Daimon and the Asklepian serpent', *Vesalius*, vol. 17, no. 1, 2011, pp. 4–9. SA Antoniou, et al., 'The rod and the serpent: History's ultimate healing symbol', *World Journal of Surgery*, vol. 35, no. 1, 2011, pp. 217–21.

Cat. 50 Denis Brothers & Co., **The James Beaney Medal for Surgery awarded to Dr Charles J Trood**, 1877; gold, fabric; 16.0 × 5.0 × 0.5 cm. Medical History Museum, MHM02417

All the experiments seem to have been futile

> The material was first rate, the quality of the medical student was superior to what I had been accustomed to teach in London. They all meant business and the experimental method of approach came naturally to them.
>
> Charles James Martin, on Australian medical students

In 1892, Charles J Martin (1866–1955) arrived in Sydney as a dynamic new force in Australian medicine. As a former apprentice of Carl Ludwig, the author of the first modern textbook in physiology, and as a classmate of Ernest Starling, he represented the new experimental face of medicine. This engendered great enthusiasm from his colonial students, some of which are shown in the photograph here from his 1897–1903 professorship at the University of Melbourne.

Mindful of developments in understanding venom, emanating from investigators in Philadelphia, Calcutta and Rio de Janeiro, Martin saw an opportunity to secure a place in a great global debate. This was the era of Emil von Behring and Paul Ehrlich, who were redrawing medical paradigms with immediate therapeutic implications. By 1901 Martin was awarded his Fellowship of the Royal Society for papers that 'deal with the chemistry and physiology action of snake venom, and with the action and reaction of toxins and antitoxins'.

Martin not only defined the chemistry and actions of several Australian snake venoms, he also developed a novel ultrafiltration device for these studies that was reused by Charles Kellaway and Henry Holden. Of even greater significance was his debunking of Albert Calmette's 'universal antivenom' concept. Although his findings had immediate practical significance for serotherapy, on his 1903 return to England, the *Argus* lamented, 'Thus tiger snake serum is of no use in the case of a patient bitten by a black snake or by an Indian cobra. This is virtually an admission that there is no antidote to snake poison ... All the experiments ... seem to have been futile.' The solution to this problem awaited a new era and a new institute.

In his history of the Melbourne Medical School, 1862–1962, KF Russell wrote 'that Martin was responsible for the introduction of modern biological experimentation in relation to research in this Medical School.' In 1951 the NHMRC created a travelling postdoctoral fellowship named after CJ Martin and I was a most grateful recipient in 1977–79.

Professor James A Angus

Cat. 52 Sears Studios, Melbourne, **Third year medical students with Professors CJ Martin and Harry Brookes Allen**, 1903; photograph; 24.3 × 34.1 cm. Medical History Museum, MHM00303

Dangerous snakes of Victoria

Throughout the nineteenth century, the Australian colonists learned little about local animals. In the early decades, the predominant question was whether indigenous fauna made for good eating. As European occupation expanded through pastoralism, agriculture and squatting, new concerns emerged: dingoes and thylacines were blamed for killing sheep, while kangaroos competed for grasslands.

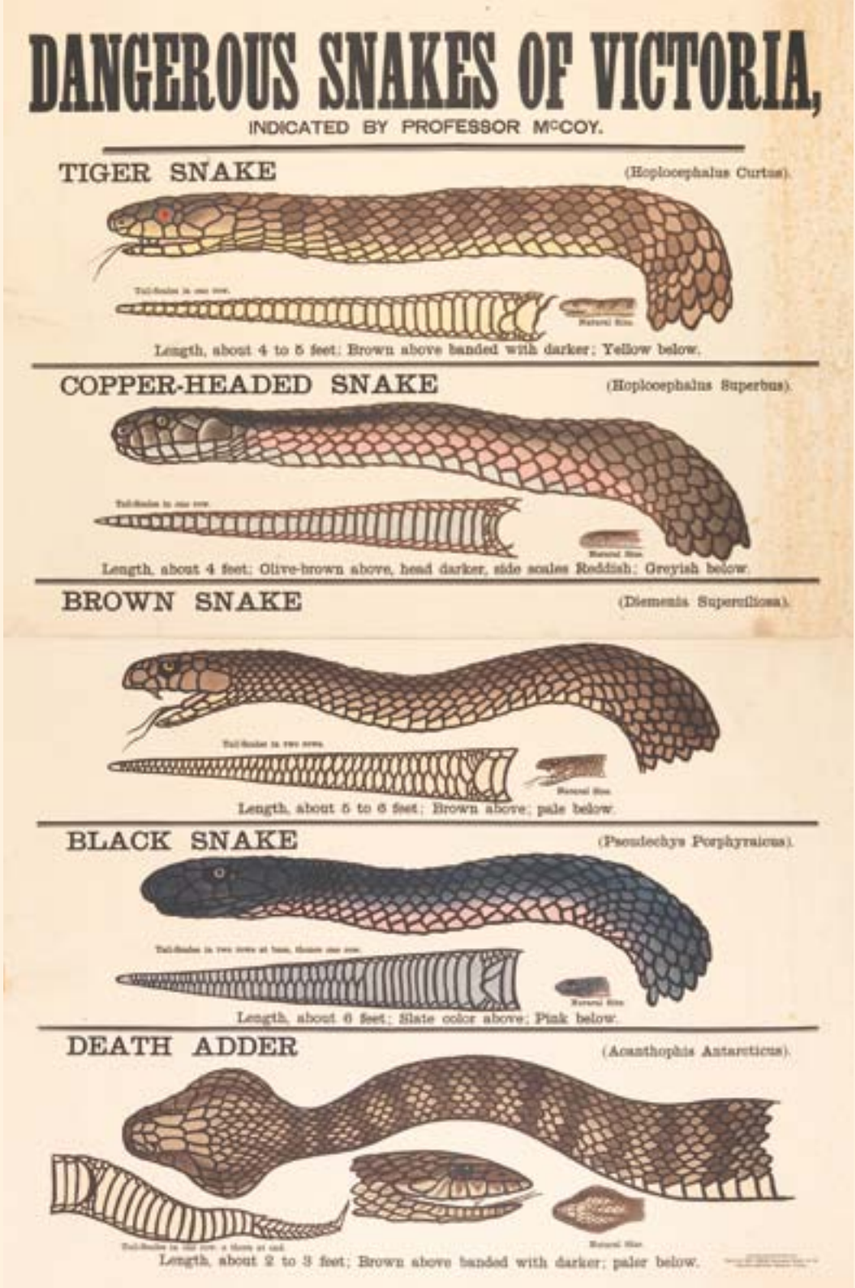
Such knowledge circulated through neighbourly exchanges, frequent movement of settlers between colonies, in newspapers and via advice books for 'new chums'. In the cities, natural history museums became enormously popular through the second half of the century. Here, literate colonists learned the common name, taxonomic classification and distribution of indigenous animals via small cards accompanying specimens. Rarely, however, were the habits or habitats of Australian species presented systematically.

In the 1870s, circumstances began changing. Compulsory primary schooling was introduced across most of the colonies, while railways and later tramways provided common travel networks for ever-expanding urban populations. With medical interest in snakebite peaking over the same decade—especially in Victoria—a new phenomenon appeared: a poster illustrating the 'Dangerous snakes of Victoria'. Authored by Frederick McCoy, Director of the National Museum of Victoria and Professor of Natural History at Melbourne University, this bill sketched out the visual characteristics of the five serpents widely regarded as life-threatening. Pinned up in schoolrooms, railway stops and police stations across the colony, it echoed the era's 'wanted' posters targeted at capturing bushrangers such as Ned Kelly. The analogy was clear: these reptiles must be avoided or executed as purveyors of violent death.

McCoy's pioneering poster proved both popular and persistent, with a new edition issued in the 1890s. By then, other publishers were working with local education departments to prepare rival charts. By Federation, nature study—including snake identification and snakebite treatment—had become a standard part of every Australian child's education.

Peter Hobbins

Cat. 150 Education Department of Victoria, **Dangerous snakes of Victoria, indicated by Professor McCoy**, 1877; print on paper; 109. 0 × 70.0 cm. Museum Victoria, PZ287



Prodromus, tiger snake fatalities

The number of deaths of human beings in the colony from snake-bite in a year is very small; but some of the cases given in the *Australian Medical Journal* for March 1875 are interesting from the bites being publicly given in Melbourne, and the precise times noted both of the bite and the death of the man.

One, a police magistrate bitten on the arm by a Tiger Snake, died in 24 hours; a man named Underwood, a well known vendor of a supposed antidote, was bitten in public by one of this species and was dead within an hour; another man named Cartwright, exhibiting some of these snakes, was bitten and also died within an hour.

Dr. Casey, of Brighton, reported a case in which a man died within a half hour of the bite; and a man named Griffiths, handling some of these snakes as an exhibition at the Port Phillip Club Hotel, was bitten by a Tiger Snake, and died in less than half an hour.

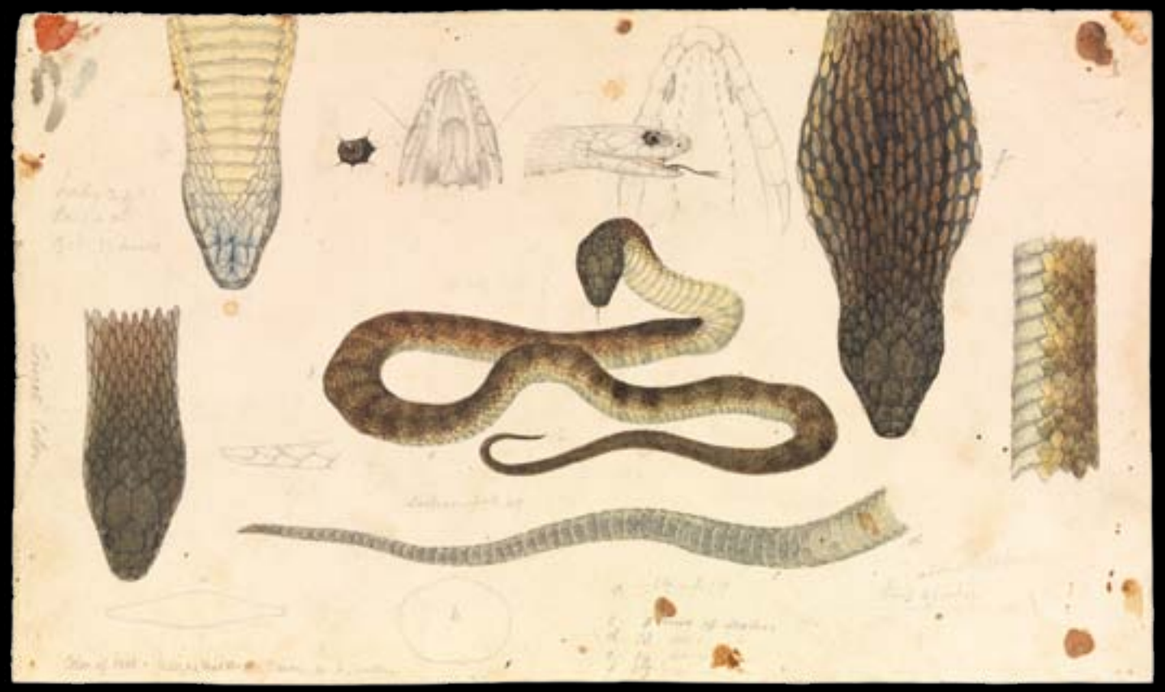
The symptoms seem to be much alike in all cases if snake-bite, viz.:– At first faintness and slight convulsions, then sickness of the stomach (probably a reflex action from the brain), with trembling and weakness in the limbs; the pupils of the eyes dilated, a tendency to sleep, and then total paralysis and coma immediately preceding death.

The young of the Tiger Snake are about thirty in number, like the adult in all respects, and brought forth in January.

The general food of the Tiger Snake is composed of frogs, lizards, and mice, &c. On one occasion, however, I put a live mouse into a box in which I had a Tiger Snake, to feed it, and was astonished to find the next morning that the mouse had killed the snake by biting the back of its neck, and had eaten some of its flesh.

Frederick McCoy (1817–1899)

Extract from Fredrick McCoy, *Prodromus of the zoology of Victoria, vol. 1*, Melbourne: Govt Printer 1878, pp. 13–14.



Cat. 161 Arthur Bartholomew, **Tiger snake *Notechis scutatus***, c. 1870; watercolour, pencil and ink on paper; 26.0 × 15.0 cm; drawing for plate 3 in Frederick McCoy, *Prodromus of the zoology of Victoria, vol. 1*, Melbourne: Govt Printer, 1878 (cat. 154). Museum Victoria, PZ3.1

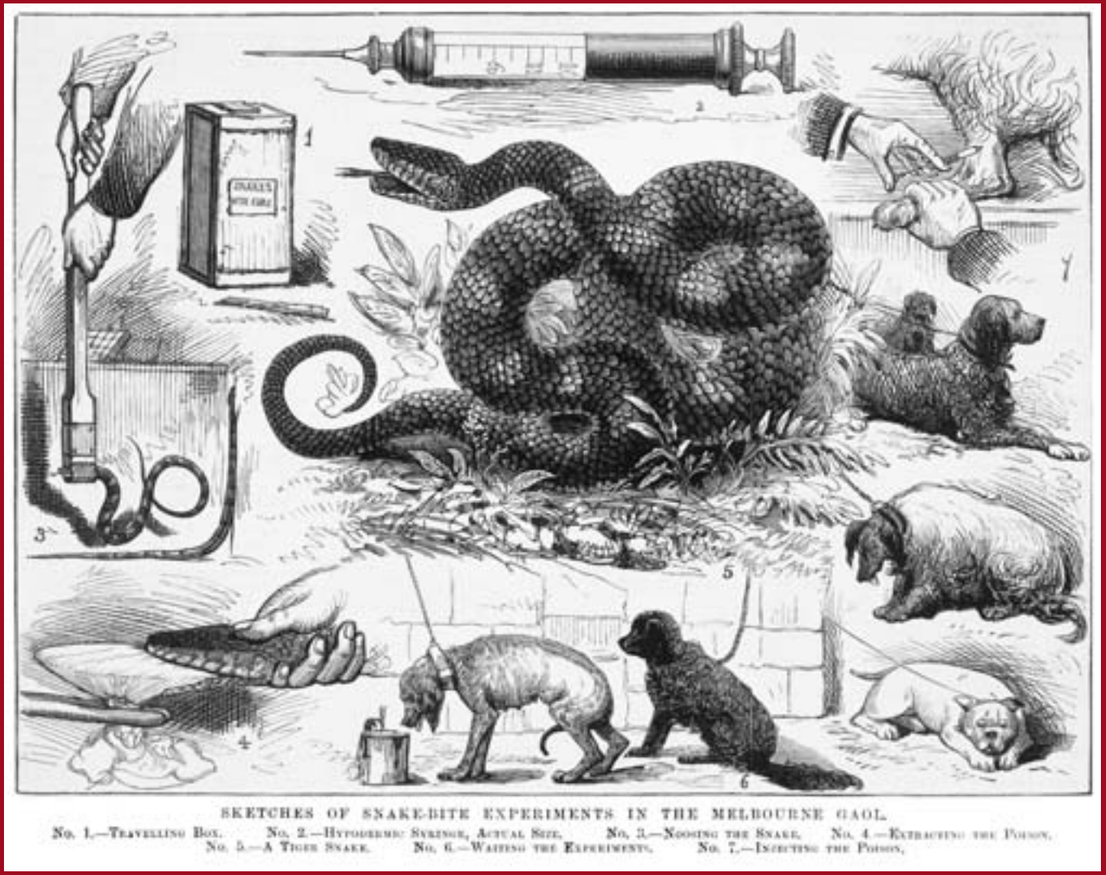
Snakebite experiments in the Melbourne Gaol

This remarkable illustration signalled a significant shift in the understanding of snakebite and snake venom in the Australian colonies. Throughout the preceding century, settlers gleaned which Australian snakes were dangerous via direct observation. Certainly, there were many dramatic human cases, but as early as 1793 the effects of snakebite in familiar animals proved equally important. Envenomation of dogs, cats, pigs, goats, cattle, horses and chickens was soon observed to follow a regular pattern: vomiting, progressive paralysis, difficulty breathing, collapse, convulsions—then death. As surveyor William Govett exclaimed in 1837, 'how must this horror be redoubled to witness the effects of the venom upon a human being!'

From the late 1840s, snake charmers and antidote sellers encouraged snakes to bite such domesticates, especially dogs and fowls, in public shows. Their audiences judged these demonstrations for themselves: when two animals were bitten, but only the treated one recovered, the evidence seemed clear. By the 1860s, senior doctors adopted similar practices—which in Europe would have been deemed 'vivisection'—to test their own pet theories and remedies.

In 1868 a major dispute erupted between doctors in Victoria, India and the United States. At stake was whether clinical observation in human victims was as reliable as data derived from experimental animals. As the latter technique became medical orthodoxy, direct contact between snakes and dogs was avoided. By the late 1870s, as this sketch encapsulates, artificial devices became necessary to contain, capture and milk snakes of their venom, and to inject it into the unfortunate subject. Note that the experimenter is absent from these—only his hands appear. The conduct of this experiment in the Melbourne Gaol is also symbolic: all at once it excluded the public, condemned the 'culprits' and confirmed the authoritative control of knowledge by the colonial medical elite.

Peter Hobbins



Cat. 164 **Sketches of snake-bite experiments in the Melbourne Gaol**, *The Australasian Sketcher*, 17 February 1877; wood engraving; 41.0 × 30.5 cm. State Library of Victoria, A/S17/02/77/184

You killed my boy

If one feature has characterised snakebite in Australia since European arrival, it is the ceaseless disputes over mortality. The early settlers did not fear indigenous reptiles; not until March 1802 was a white man, Samuel Allgate, recorded as being 'killed by a snake' in Sydney. With fatal snakebites reported approximately once every two years thereafter, in 1827 naval surgeon Peter Cunningham expressed surprise that 'comparatively few deaths [have] taken place from this cause since the foundation of the colony'.

Formal mortality statistics were not gathered until the 1850s, whereupon snakebite was categorised under 'violent deaths'. While this classification ostensibly brought cases under police attention and into statisticians' tables, wide discrepancies persisted between government reports, police returns, newspaper accounts and medical cases. Various Victorian sources suggest approximately two snakebite deaths per year over 1854–74, in a population expanding from 284 000 to 786 000. By 1893, when Sydney physician Louis Ralston Huxtable compiled data on over 500 snakebites throughout the preceding decade, the average annual death toll across the entire continent was thirteen souls. For 1910–26, the equivalent number was fourteen. None of these figures, however, can be considered anywhere near definitive. Little wonder, then, that doctors, naturalists and laypeople frequently disputed which serpents were truly 'deadly'.

At an individual level, none of these discrepancies counted. The headstone for eleven-year-old John Howorth, who died following 'a subtle surpents bite' in 1804, recorded that 'He was his Fathers glorey. And Mothers pride' [sic]. Indeed, over 1868–1924, Australians under twenty represented half of all snakebite cases but 60 per cent of deaths. For snakebitten children aged under ten years, case mortality exceeded 40 per cent—more than double that for older patients. But however unreliable such statistics proved, one cannot miss the pathos in a mother's cry to a black snake in 1932: 'You killed my boy'.

Peter Hobbins

Cat. 166 Photographer unknown, **Woman by grave**, c. 1880; glass negative; 12.2 × 16.6 cm; inscription on headstone: Erected by The Companions & Friends of Mark Marston who departed this life on March 4th 1880 Aged 19 years. Death caused from snake bite. State Library of Victoria, H85.106/3

Professor George Britton Halford

The first teaching professor of medicine in Australia, George Halford (1824–1910), was truly a foundational figure for Melbourne University's medical school. Arriving from Britain in 1863 he took command of the University's unprecedented five-year medical course, himself undertaking much of the instruction in anatomy, pathology and his specialty: physiology. Halford immediately proved a controversial figure in colonial society. A regular—almost obsessive—correspondent in the local press, the professor was regularly censured for his public pronouncements. Halford's opposition to Charles Darwin's theory of evolution proved as contentious as his support for admitting women into the university.

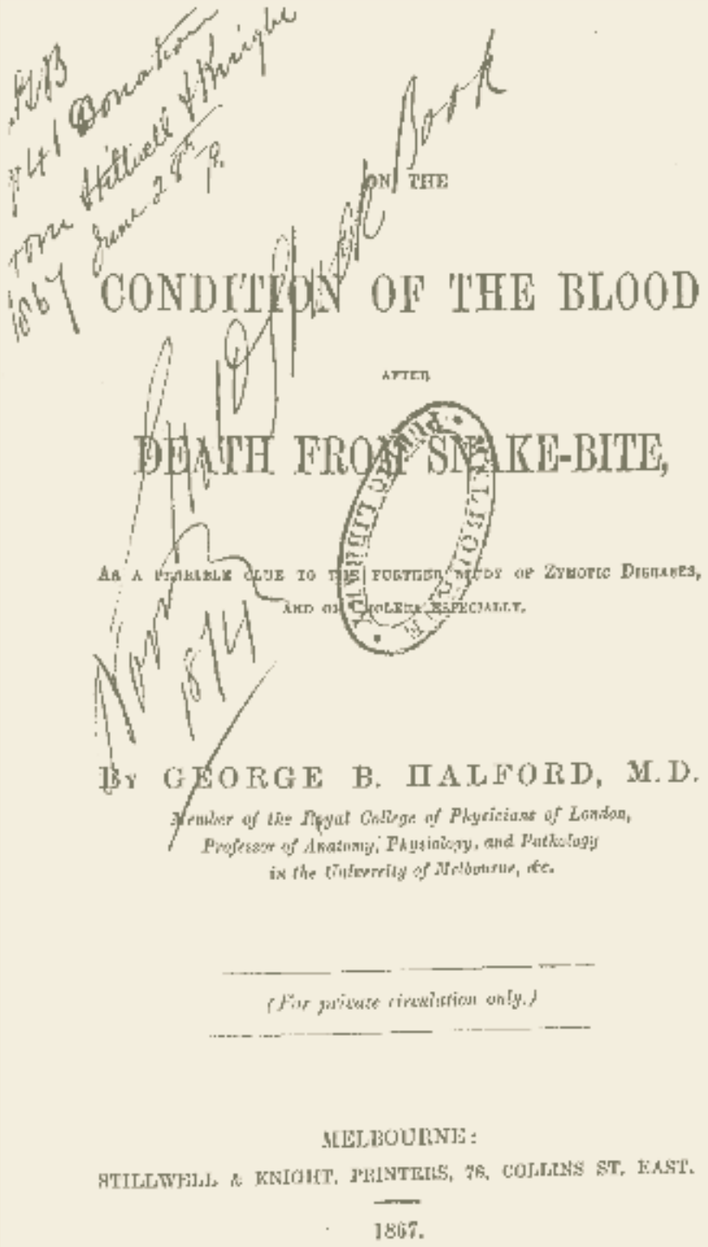
Halford was convinced that scientific research should form part of every medical student's education; he had himself undertaken well-regarded studies on heart function before his Australian appointment. Having treated an adder bite in 1852—a rare event in England, although a keeper at the London Zoo famously died from a cobra bite the same year—Halford soon took up snakebite research in Melbourne. From 1866 he commenced studies of venoms by encouraging Australian snakes to bite dogs, cats and pigeons. His inquiries reached the world stage the following year after an imported Indian cobra bit its owner in Melbourne.

Seeking to connect his experiments with new theories of disease, Halford hypothesised that snake venom was not chemical in nature, but comprised living 'germinal matter' which drained 'animal heat' from its victims. Whilst his proposal was hotly debated in Britain, India and the United States, by 1868 Halford had moved to a new project: intravenously injecting ammonia to counteract snakebite. First collaborating with local snake charmers, the professor soon gathered a loyal following amongst Victorian doctors. However, he also garnered aggressive opponents across the Australian colonies, and especially in India. This led in 1873 to the export of Australian serpents to Calcutta, with comparative studies against cobra venom suggesting his method was useless. A similar investigation conducted by his Victorian colleagues in 1876 declared the remedy downright dangerous—at least in their unfortunate dogs. Thereafter, Halford undertook little further research, but continued promoting the germinal matter theory almost until his final retirement in 1903.

Peter Hobbins

Cat. 34 Photographer unknown, **Professor George Britton Halford**, c. 1880; photograph; 17.8 × 12.7 cm. Medical History Museum, MHM00874

George Britton Halford, **On the condition of the blood after death from snake-bite**, Melbourne: Stillwell & Knight, 1867. State Library of Victoria, 10381/114320



ON THE

CONDITION OF THE BLOOD

AFTER

DEATH FROM SNAKE-BITE,

AS A PROBABLE CLUE TO THE FURTHER STUDY OF ZYMOTIC DISEASES, AND OF CHOLERA ESPECIALLY.

BY GEORGE B. HALFORD, M.D.

Member of the Royal College of Physicians of London, Professor of Anatomy, Physiology, and Pathology in the University of Melbourne, &c.

(For private circulation only.)

MELBOURNE:

STILLWELL & KNIGHT, PRINTERS, 76, COLLINS ST. EAST.

1867.

The antidote must be taken quickly

August Eichorn (1858–1944) was a bush pharmaceutist or folk-medicine practitioner. After an article in the *Sydney Mail* in 1913 detailed his theories, his fame leapt from regional to national. Eichorn's theory of action of snake venom was highly original, even if his belief that venom was not a poison was a direct contradiction to the findings of Weir Mitchell (some thirty-one years earlier) that had led to the development of antivenom. 'If kept cool', Eichorn ventured, 'the venom will stay liquified, subject it to heat and it turns into hard crystals. When bitten, the heat of the blood turns the venom into crystals, and they are carried to the heart and to the small corpuscles of the brain; they cannot be forced through and the patient dies of paralysis of the brain, whilst the heart becomes clogged with blood. An antidote therefore, must be such as will counteract the venom—something that will so cool the blood that there will not be sufficient heat to cause the venom to crystallise.' There were certain provisos: 'The antidote must be taken quickly but it can also be taken internally later.' But Eichorn realised that the greatest problem he faced was in marketing his antidote and getting the public to overcome its belief that snake charmers are immune to the action of venom. Numerous photographs show him accepting the bites of tigers, browns and blacks on his arms, hands and face, and he boasted that he could accept a bite of three tiger snakes simultaneously, apply his remedy and show no ill effects.

The Eichorn remedy itself had a dramatic impact that would have impressed all who used it and that worked as word-of-mouth publicity. There were two types, excluding the balms: the red and the black. When you put on the red it would sting like blazes, put on the black and your hair would stand on end.

John Cann

Edited extract from John Cann, *Snakes alive! Snake experts and antidote sellers of Australia*, Kenthurst: Kangaroo Press, 1986, pp. 150–4.

Photographer unknown, **August Eichorn takes a bite from one of the world's deadliest snakes, an eastern brown held by Joseph Rechka (1886–1963)**, n.d.; photograph. Batlow Historical Society

Useless, useless!

The Australian quest to provide 'scientific' advice on snakebite stretches back to the dissections and animal experiments of James Agnew in 1843. Unlike his medical predecessors, Agnew, later Premier of Tasmania, explored both the dental anatomy and venom of local snakes. Others erratically addressed the topic thereafter, notably Sydney surgeon Alfred Roberts in the late 1850s and Melbourne's Professor George Halford a decade later. Some, like Agnew, were diverted by natural history; others focused on devising 'rational' remedies.

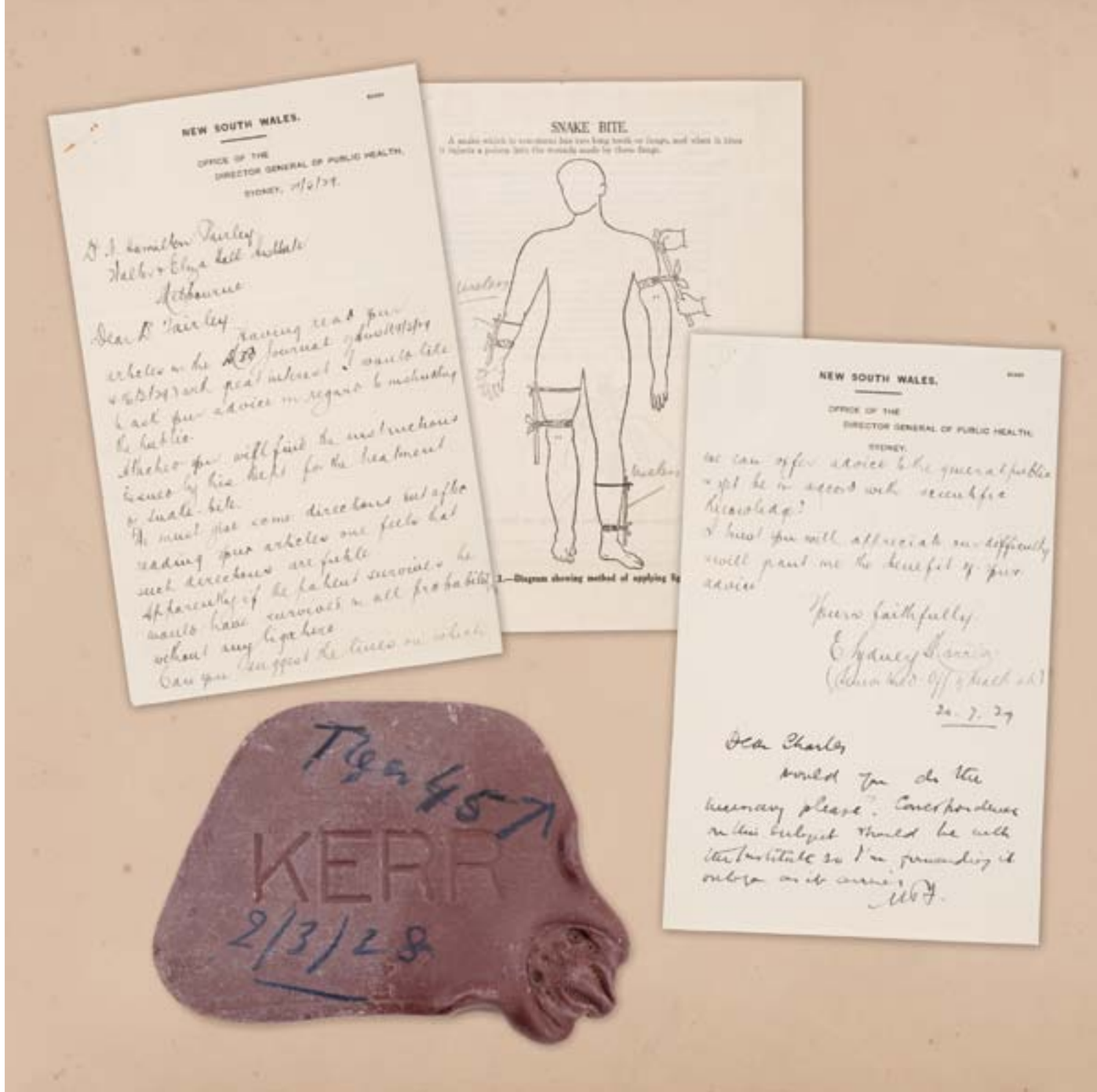
However curious they appeared later, many treatments were underpinned by contemporary logic. Dosing a snakebitten child with half a bottle of brandy made sense in 1860: it was considered both a stimulant to counter paralysis and a specific directly neutralising venom. Intravenous ammonia, championed by Halford from 1868, was believed to reinvigorate the blood and heart against venom's deleterious effects. Another notorious poison, strychnine, was recommended twenty years later to pharmacologically antagonise venom toxicity in nerves. Many such treatments boasted large numbers of apparently successful outcomes—and hence loyal converts.

Although immunologically generated antivenenes (antivenoms) against local snakebites were successfully tested by Federation, their wide-scale production proved problematic. Indeed, having discounted other pharmacological remedies, medical scientists Charles Martin and Frank Tidswell ultimately recommended the ancient European (and Aboriginal) practices of ligature, cutting and sucking the wound. This advice was promulgated by state boards of health for decades: the diagram attached to this 1929 letter dates to the 1890s. Australian investigators Neil Hamilton Fairley and Charles Kellaway were thus disappointed when their late 1920s experiments in snakebitten sheep implied that even these simple measures were ineffectual unless applied immediately. Although Kellaway helped drive the clinical introduction of tiger snake antivenene in 1930, it was not until the late 1950s that 'scientific knowledge' provided a truly effective range of remedies for most Australian snakebites.

Peter Hobbins

Cat. 172 **Letter from the NSW Office of the Director General of Public Health, to Dr Hamilton Fairley, Walter and Eliza Hall Institute on treatment of snakebite, referred to Director, Charles Kellaway for reply**, 21 May 1929; ink on paper; 21.0 × 13.0 cm. Walter and Eliza Hall Institute Archives

Cat. 100 **Mould of tiger snake fangs collected by Neil Hamilton Fairley**, 2 March 1928; plastic; 1.7 × 5.8 × 8.6 cm. AVRU Collection, University of Melbourne



Charles Halliley Kellaway

Born in Melbourne, Charles Kellaway (1889–1952) completed medical and scientific studies at the University of Melbourne before serving as a medical officer in World War I. From 1918 Kellaway worked in London with some of the era's most prominent medical researchers before being recruited as the second director of the Walter and Eliza Hall Institute in 1923.

Under Kellaway's leadership the institute was transformed from a small pathology department into a research centre equipped, funded and staffed to tackle the major medical problems of the era. Talented medical researchers from around the world were recruited, and Kellaway expanded the institute's revenue base. His success in obtaining Commonwealth Government funding for venom, hydatid and polio research in 1927 was an early step towards the establishment of the National Health and Medical Research Council in 1936.

Kellaway played an important role in building community support for medical research. The work of Kellaway and colleagues at the Walter and Eliza Hall Institute and Commonwealth Serum Laboratories led to the first commercial antivenom for tiger snakebite in 1930, which saved the lives of many Australians. Kellaway himself was an early beneficiary of the antivenom, with newspaper reports describing how he had been bitten during the course of his research. He subsequently made many important discoveries through his studies of venoms, especially to the understanding of anaphylaxis and inflammation.

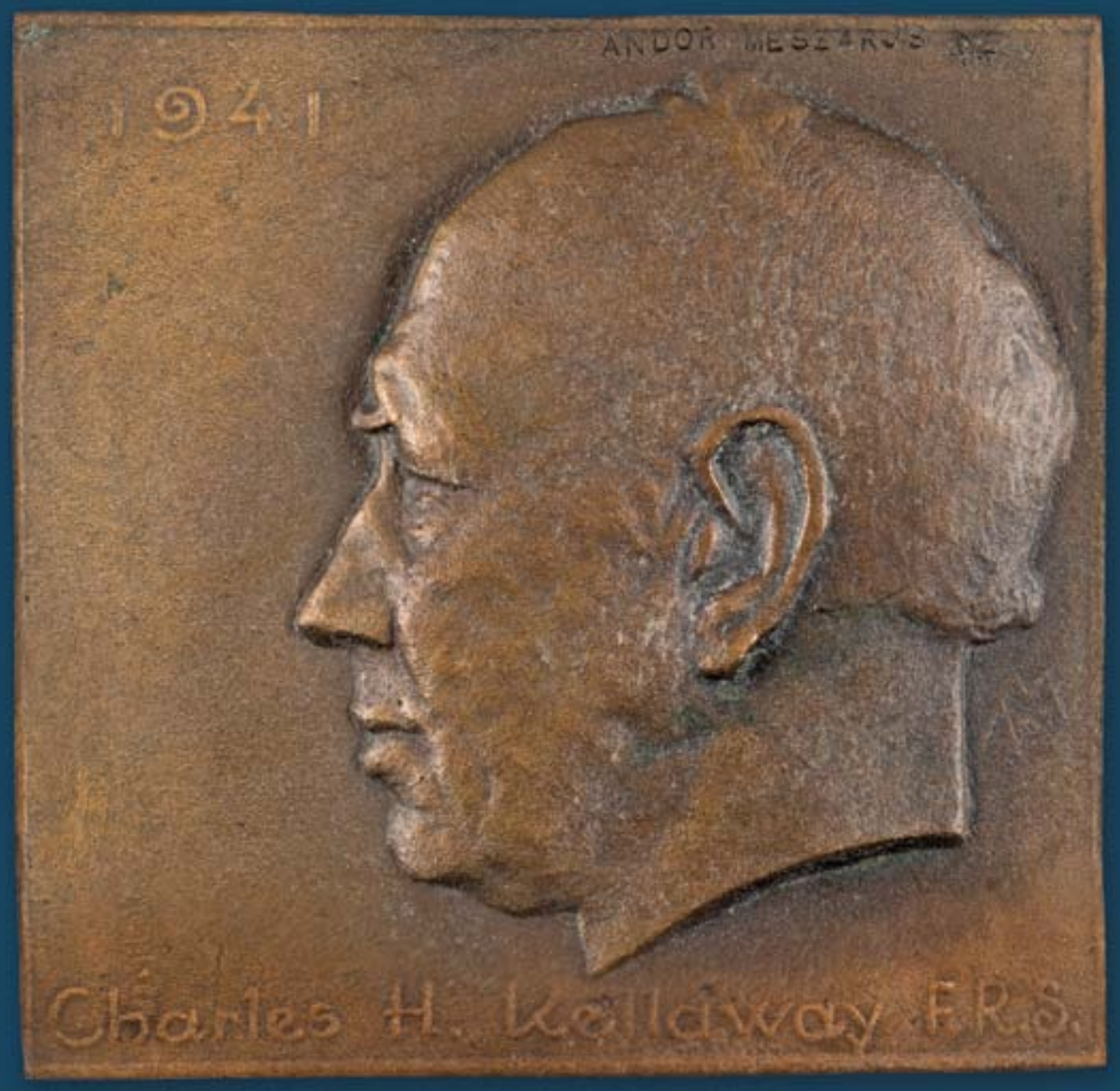
In the public eye Kellaway was most recognisable as chair of the Royal Commission into the 1928 'Bundaberg Tragedy', in which twelve children died after diphtheria immunisation. Kellaway's rigorous scientific investigation highlighted the importance of medical research to the community.

Kellaway steered the institute through difficult financial times in the Great Depression, brokering a pioneering deal between the Commonwealth Government and the American Rockefeller Foundation in 1933 that saved the institute from probable closure. In 1943, Kellaway resigned from the Walter and Eliza Hall Institute, and took the directorship of London's Wellcome Research Laboratories, where he remained until his death.

Kellaway became a Fellow of the Royal Society of London in 1940. This bronze medal was created to commemorate this honour a year later. Andor Meszaros (1900–1972) a distinguished sculptor captured the character and intelligence of Kellaway in this intimate rendition in bronze.

Professor Douglas Hilton

Cat. 7 Andor Meszaros, **Charles H Kellaway FRS**, 1941; bronze; 9.5 × 9.8 × 1.0 cm. Medical History Museum, MHM03203



Fannie Eleanor Williams

South Australian Fannie Eleanor Williams (1884–1963) trained as a nurse and sanitary inspector but spent her life working as a medical scientist, specialising in bacteriology and serology. After laboratory-based roles at the Adelaide Children's and Adelaide Hospitals, she served in World War I, receiving an Associate Royal Red Cross for her research into dysentery with Charles Martin.

In 1920 Williams joined the Walter and Eliza Hall Institute of Medical Research in pathology and medicine as second assistant. There she ran the diagnostic microbiology laboratory and continued research into dysentery and then hydatids. In 1927 she joined the director, Charles Kellaway, on his major research program on Australian snake venoms. They conducted basic research into immunological aspects of envenomation, fractionation of venoms, the pharmacological action of toxins, and the serological and blood relationships of some common Australian snakes. Their efforts over 1932–36 focused upon two related observations: the 'curari-like' paralysis by venoms that left nerve tissues largely intact, and the destructive myolytic effects on various muscle tissues. Other subjects included haemolysis by venoms, the toxicity and sterility of commercial preparations containing venom, bacterial flora of the mouths of venomous snakes, and antigenic differences between the venoms. Although rarely noted, much of this work formed an important background to the institute's later transition towards immunology.

In World War II, Williams was prominent in the establishment of the Red Cross Blood Bank. She was, according to Macfarlane Burnet and Ian Wood, 'the channel through which serological techniques developed in Melbourne'. In the 1940s, Williams specialised in carrying out Wassermann hydatid tests, applying known technology to a new disease and becoming an expert in hydatid complement fixation tests.

Williams co-authored fifty-five publications between 1917 and 1947. Then the institute's longest-serving employee, she retired in 1957 and received an MBE for her contributions.

Dr Kirsty Harris

Photographer unknown, **Fannie Eleanor Williams (1884–1963)**, c. 1924; photograph; 15.5 × 11.2 cm. Walter and Eliza Hall Institute Archives

Donald Thomson: Australia's Lawrence of Arabia

The Aborigines of Cape York Peninsula distinguished between the snakes of the region, recognising the taipan *Oxyuranus scutellatus* (thaypan in several local languages) as being more 'cheeky' (dangerous) than the mulga snake *Pseudechis australis*. Donald Thomson (1901–1970), the noted anthropologist and zoologist, observed that 'the natives hold the taipan in great dread, and it appears to have been responsible for many deaths among them'. Thomson explored Cape York in 1928, 1929 and 1932–3, during which time he collected large numbers of animals, including 200 snakes, and wrote copious notes including Aboriginal knowledge about them. Of the taipan, he wrote:

> On 11.7.32 it snapped three times in rapid succession before 'fastening in', and at these three bites the great part of its venom was expressed. These ... snap bites which appear to be its regular way of biting follow upon one another with such rapidity that there would be almost no hope of prey escaping any one of them ... It is not such a powerful snake nor so difficult to hold as *P. australis*, but much more dangerous.

These expeditions overlapped with his work at the Walter and Eliza Hall Institute assisting Charles Kellaway with research and antivenene development. During this time Thomson was able to examine taipans in detail and he realised that the first specimen collected in the 1860s near Rockhampton and named *P. scutellatus* and two more snakes collected on Cape York by William McLennan in the 1920s, later named *O. mclennani* by JR Kinghorn of the Australian Museum, were actually the same species. Thomson published his findings in 1933, naming the species *Oxyuranus scutellatus*, and giving it the name taipan, derived from the Aboriginal usage. He became one of Australia's foremost anthropologists, especially noted for his strong bonds with the Yolngu people.

Thomson wrote newspaper articles on natural history over many decades and had voluminous correspondence with his readers on snakes, spiders, wasps and other venomous beasts. But his fascination with snakes had a practical aspect. Thomson undertook local expeditions from the family home at Eltham to hunt for tiger snakes on the basalt plains near Werribee, west of Melbourne, in the 1960s, accompanied by his four young children. I am not aware that many snakes were caught on these family outings, but his children retain vivid memories of those trips nearly fifty years later.

Ian Temby

References: H Morphy, 'Thomson, Donald Finlay Fergusson (1901–1970)', *Australian Dictionary of Biography*, 2002, p. 16. Donald F Thomson, 'Australian snakes of the genera *Pseudechis* and *Oxyuranus*', *Proceedings of the Zoological Society of London*, vol. 103, 1933, pp. 855–60.

Photographer unknown, **Donald Thomson milks venom from a taipan, *Oxyuranus sp.*, Cape York Peninsula, Queensland**, 1928; nitrate; 13.0 × 10.5 cm. Courtesy of the Thomson family and Museum Victoria, TPH5383.

Budden's taipan

In 1949, Kevin Budden (1930–1950) and friends, Neville Goddard and Roy Mackay, wanted to catch the highly feared and elusive taipan. The lack of a specific antivenom, combined with a toxic venom and strike efficiency, created a sense of urgency in this quest. Budden was a safe snake handler and already had experience with dangerous southern Australian snakes including the difficult to handle common brown snake. They set out for Coen, as Mackay had found records of taipans from this locality in the Australian Museum where he was employed as a taxidermist. Upon arrival, they found themselves in a sea of tall grassland that made it almost impossible to see snakes. They missed one which slid through Goddard's legs and another which sought refuge in the roots of a tree beside the Coen River and would not re-emerge.

In 1950, twenty-year-old Budden went to Cairns on another taipan quest. He caught twenty-seven snakes before finding a taipan at the rubbish dump near Edge Hill. He caught it without any equipment or snake bag and walked to the nearest road and summoned a truck, in 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. Horrified onlookers wanted to kill the snake, but Budden insisted it was too valuable for research. The snake 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. Early signs of paralysis appeared, Budden's condition gradually worsened and, despite receiving tiger snake antivenom, he died on 28 July 1950. 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.' Budden's dying wish was for the snake to be sent south for research. It was sent to the Commonwealth Serum Laboratories where they arranged for well-known naturalist David Fleay to undertake the task.

Peter Mirtschin

Cat. 149 **Coastal taipan** ***Oxyuranus scutellatus***, **Queensland, near Cairns**, July 1950; specimen in ethanol; 32.5 × 19.5 cm. Museum Victoria, D008175

What Australian toxinology owes to Adolph Hitler

The rise of Nazi Germany led to a tide of Jewish refugees, many of whom subsequently contributed to scientific advances in the Allied countries. Nobelist Ernest Chain fled Berlin in 1933 and undertook pioneering studies of Australian snake venoms at Oxford before moving onto penicillin. Similarly, Wilhelm Feldberg, dismissed from the Physiological Institute in Berlin in 1933, spent 1936–38 in Australia, examining the tissue responses to venoms, work that ultimately resulted in the identification of the leukotrienes. Saul Wiener (1923–2010) made major contributions to world toxinology and human genetics despite growing up in the tumult of the Wehrmacht.

Born in Düsseldorf, Wiener migrated to Melbourne after Kristallnacht in 1938 and completed medicine at the University of Melbourne in 1947, despite not speaking English upon his arrival. Soon thereafter he enrolled as a PhD student and studied rheumatic fever in the Department of Microbiology. His 1953 degree made him equal second as an Australian medical graduate achieving an Australian PhD. Whilst employed as a research officer in the Commonwealth Serum Laboratories (1952–58), he developed the redback spider antivenom and the world's first marine antivenom, against stonefish. He also researched the funnel-web spider, pioneered the study of *Chironex fleckeri* box jellyfish venom and first demonstrated the toxicity of fresh cone snail venom.

Wiener's 1960 MD thesis was probably the first higher degree in toxinology in Australia and included perhaps the first Australian toxinology publication in the journal *Nature*. After leaving CSL in 1958, Wiener's interest in immunology led to a year as a Fulbright Scholar at Columbia University where he developed new skills in chromosome analysis. Returning to Melbourne he commenced as a staff specialist (allergist) at the Royal Melbourne Hospital. His research moved into cytogenetics, including some of the earliest work on familial X-linked mental retardation ('Fragile X'). Notably Grant Sutherland, the internationally renowned human geneticist, had his first job (as a research assistant) under Wiener. The late Chancellor Sir Roy Douglas Wright (known to his colleagues as Pansy) characterised these German diaspora as 'what Australian physiology owes to Adolph Hitler'.

Dr Kenneth D Winkel

References: S Wiener and FH Drummond, 'Assay of spider venom and antivenin in *Drosophila*', *Nature*, vol. 178, 1956, pp. 267–8. RD Wright, 'What Australian physiology owes to Adolph Hitler', *Proceedings of the Australian Physiological and Pharmacological Society*, vol. 14, no. 1, 1983, pp. 22–7.

Cat. 40 Photographer unknown, **Saul Wiener at the Commonwealth Serum Laboratories**, c. 1952; photograph; 24.5 × 30.5cm. Saul Wiener Collection, Medical History Museum, MHM02013.69

Cat. 42 Commonwealth Serum Laboratories, **Saul Wiener's photographs of specimens used for research for the development of funnel-web and redback spider antivenoms**, c. 1955; photographs; 9.4 × 12.3 cm. Saul Wiener Collection, Medical History Museum, MHM02013.83–86

The Value of a Snail

In 1796 such was the value given to a rare cone snail shell that it sold at an Amsterdam auction for 273 guilders versus 43 guilders for Vermeer's painting *Woman in blue reading a book*. Today, whilst these shells are still collected for their aesthetic qualities, it is their venom that attracts more attention. Saul Wiener (1923–2010), whilst visiting Heron Island on the Great Barrier Reef, collected the shells illustrated here, in the late 1950s. In January 1982 he wrote to Struan Sutherland about that event: 'I took with me a specially constructed cage with mice and they spent the night with me under my bed in Gladstone. As previous workers had been unable to demonstrate toxicity of cone snail extract working with material sent by mail, I thought it best to work with fresh material which proved successful.' This first demonstration of the toxicity of fresh venom, published in 1960, began the long path to the commercialisation of entirely new classes of drugs, most famously Zinconotide. This novel cone snail venom-derived drug is used in the treatment of severe and chronic pain and acts through blocking a specific type of neuronal calcium channel.

The Italian neuroscientist Rita Levi-Montalcini (1909–2012) also provided an eternal lesson in the value of venoms. The study of the nature of nerve growth factor (NGF), critical to the subsequent development of the whole field of growth factors, was facilitated by her remarkable but serendipitous 1953 discovery that snake venom was very rich in this substance (indeed much richer than her original sarcoma cell source). The much greater abundance of this factor in the venom allowed her collaborator, biochemist Stanley Cohen, to characterise the protein and search for a mammalian homologue. They shared the 1986 Nobel Prize for this discovery.

Most famous, as the first modern example of an actual venom-based drug, is that of Captopril, the prototype angiotensin converting enzyme inhibitor. This derivative of a peptide sourced from the venom of the Brazilian pit viper (*Bothrops jararaca*) inhibits an enzyme that is essential for the production of angiotensin, a vaso-constrictor compound associated with hypertension.

Dr Kenneth D Winkel

Reference: BM Olivera, et al., 'Diversity of Conus neuropeptides', *Science*, vol. 20, July 1990, pp. 257–63.

Cat. 13 **Cone shells collected by Saul Wiener**, c. 1958; shell; 6.5 × 12.0 × 8.0 cm; 6.0 × 9.5 × 6.0 cm; 5.0 × 9.0 × 5.5 cm.
Saul Wiener Collection, Medical History Museum, MHM02013.80–82

Telephone no. 9, Port Moresby Papua

> Dear Dr Kellaway,
>
> Nearly a year ago now I sent you a letter & the head of a black snake, which must be a different species to the Australian one, as it is the chief cause of death from snake bite in this district ... Did you get it?

So began a letter from Dr WE Giblin of 'Telephone no. 9, Port Moresby Papua' on 23 June 1935 to the director of the Walter and Eliza Hall Institute. The correspondent inquired about the possibility of a visit 'to learn something about the preparation of an antivenene right from the first stages of how to catch a snake'. He included detailed notes on a 'most unusual and dramatic' case of fatal snakebite which he had recently attended.

Charles Kellaway responded by return post on 1 July and considered that the 'black snake' was *Oxyuranus scutellatus*, the taipan. He advised that 'it is probably one of the most deadly snakes in the world' and confirmed that 'we would be delighted to see you when you come over in October and also I will put you in touch with Morgan, who is doing all the antivenene work at the Commonwealth Serum Laboratories'.

It is apparent that this 'inquiry' started a long-term engagement between WEHI, Commonwealth Serum Laboratories (CSL), the University of Melbourne and those involved in snakebite in Papua New Guinea (PNG). A further example is the many letters exchanged between John Graydon and Ken Slater and 'Moresby' doctors such as Charles Campbell on snakes in the late 1950s. Slater provided venom for developing the Papuan black snake antivenom (illustrated here), a product released by CSL in 1959.

In 2005, events came full circle when Australian Venom Research Unit (AVRU) student David Williams was awarded the inaugural Nossal Institute of Global Health PhD Scholarship for Australia for studies on PNG snakebite. David's work resulted in the development of the first new monovalent snake antivenom for Australia and PNG in fifty years. The antivenom against the Papuan taipan (illustrated here in the 'dangerous snakes of PNG' stamp series) finally addresses 'the chief cause of death from snake bite' as identified by Giblin in 1935.

Dr Kenneth D Winkel

Reference: Walter and Eliza Hall Institute Archives, Black snake correspondence, WEHA00050, 1932–41.

Cat. 87 Papua New Guinea Philatelic Bureau, **First day cover Papua New Guinea dangerous snakes**, 13 September 2006; postage stamps; 21.0 × 10.0 cm. AVRU Collection, University of Melbourne

Cat. 102 CSL, **Papuan black snake antivenene**, 1960; antivenom, glass, cardboard; 12.5 × 3.5 × 3.5 cm

An Ominously quiet box

> 'Look here, I don't mind dying of snakebite, but I don't want a broken neck.'
> David Fleay, on being driven to hospital after a tiger snakebite in 1940

Although naturalist David Fleay (1907–1993) was most famous as the man who first bred (in 1943) the venomous platypus, he contributed to the story of venom in many other critical ways. For example, in 1927, whilst attending Melbourne University and Teachers College, he began supplying tiger and copperhead snake venom to the emerging venom research program at the Walter and Eliza Hall Institute (WEHI). Indeed he kept snakes at Ridley College in Parkville during this time (he had to seek permission from his parents). Subsequently he milked all venomous Australian snake species and provided the venom to WEHI and thereafter to CSL throughout a remarkably long career. No other zoologist contributed in a continuous line of collaboration from Kellaway to Sutherland. The letter featured here speaks to his memory of both men.

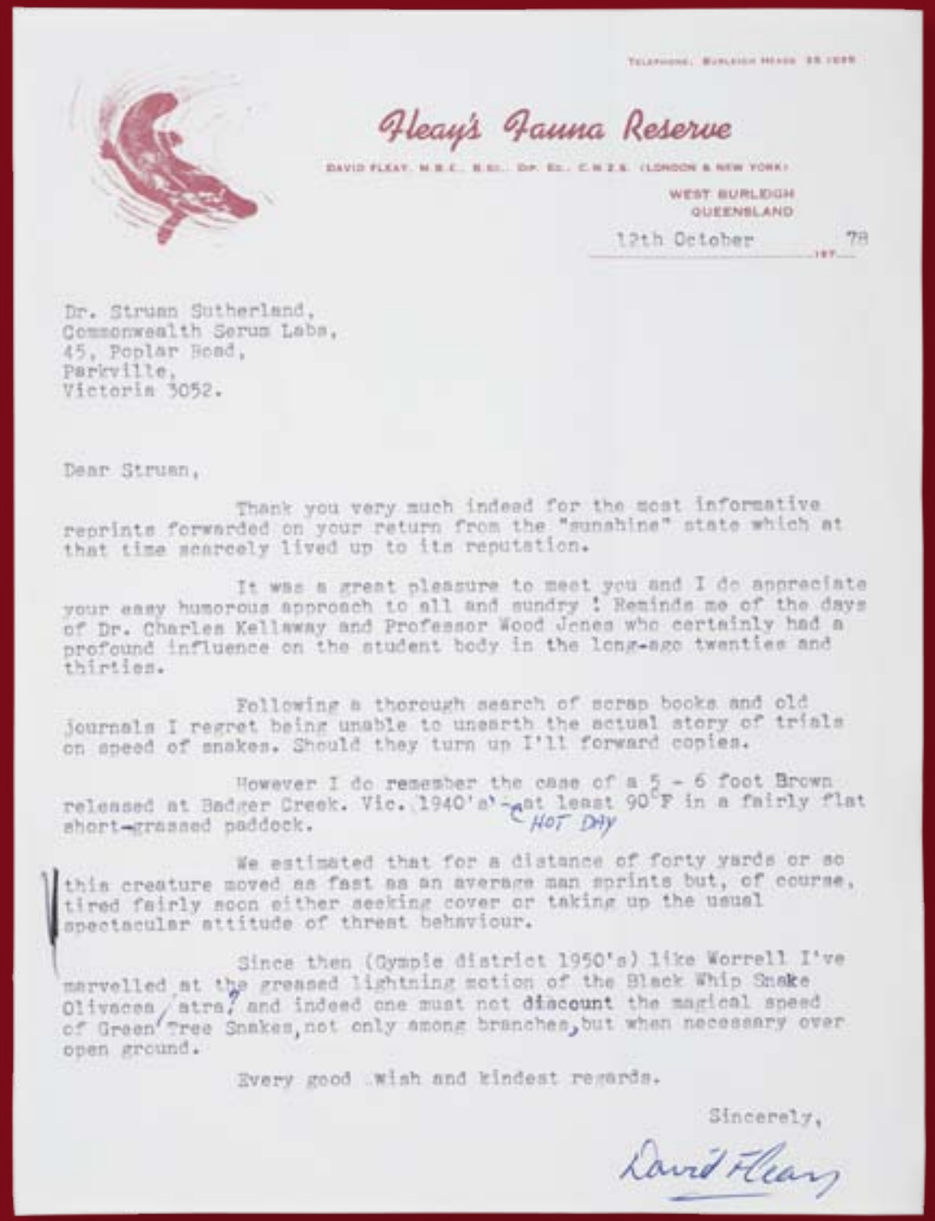
Despite a career full of 'firsts', not all of his activities ended successfully. For example, in 1930 he unsuccessfully attempted to extract platypus venom at Melbourne Zoo with Charles Kellaway—the latter eventually had to use venom kept by CJ Martin for his experimental studies; it was more than thirty years old! In 1940 Fleay was bitten by a tiger snake at Healesville and had to go without antivenom as all supply was diverted to the Army. Instead, he was treated with incision, ligature and permanganate of potash injections. He was also, after Donald Thomson, the second person to milk the living taipan snake. However, unlike Thomson, the snake he milked, in 1950, was Kevin Budden's 'killer'. The animal was housed in an 'ominously quiet' box at Melbourne Museum and 'showed itself to be in an exceedingly savage temper.' Yet all went well and that milking was instrumental in the development of CSL's taipan antivenom (released in 1955).

By 1954 Fleay was keeping taipans in captivity and by 1958 he was the first to have them captive breeding. Around the same time he researched and supplied venom to CSL from the rough-scaled snake, *Tropidechis carinatus*. It was thought to be fairly harmless until Fleay demonstrated otherwise, in 1953, with a dog who died within twenty minutes of a bite. Fleay was an inveterate science communicator, a teller of true stories of venom.

Dr Kenneth D Winkel

References: J Hetherington, 'Uncommon men', *The Age*, 23 January 1963. R Fleay-Thomson, *Animals first: The story of pioneer Australian conservationist and zoologist David Fleay*, Nerang: Petaurus, 2007. D Fleay, 'The tales of the taipan', *Courier Mail*, 26 May 1984.

Cat. 96 Fleay's Fauna Reserve, **Letter to Struan Sutherland, Commonwealth Serum Laboratories, Parkville from David Fleay on the speed of a black whip snake**, 12 October 1978; ink on paper; 26.0 × 20.5 cm. AVRU Collection, University of Melbourne



Fleay's Fauna Reserve

DAVID FLEAY, M.B.E., B.Sc., Dip. Ed., C.N.Z.S. (LONDON & NEW YORK)

WEST BURLEIGH
QUEENSLAND

12th October 78

Dr. Struan Sutherland,
Commonwealth Serum Labs,
45, Poplar Road,
Parkville,
Victoria 3052.

Dear Struan,

Thank you very much indeed for the most informative reprints forwarded on your return from the "sunshine" state which at that time scarcely lived up to its reputation.

It was a great pleasure to meet you and I do appreciate your easy humorous approach to all and sundry ! Reminds me of the days of Dr. Charles Kellaway and Professor Wood Jones who certainly had a profound influence on the student body in the long-ago twenties and thirties.

Following a thorough search of scrap books and old journals I regret being unable to unearth the actual story of trials on speed of snakes. Should they turn up I'll forward copies.

However I do remember the case of a 5 - 6 foot Brown released at Badger Creek. Vic. 1940's - HOT DAY at least 90°F in a fairly flat short-grassed paddock.

We estimated that for a distance of forty yards or so this creature moved as fast as an average man sprints but, of course, tired fairly soon either seeking cover or taking up the usual spectacular attitude of threat behaviour.

Since then (Gympie district 1950's) like Worrell I've marvelled at the greased lightning action of the Black Whip Snake Olivacea / atra, and indeed one must not discount the magical speed of Green Tree Snakes, not only among branches, but when necessary over open ground.

Every good wish and kindest regards.

Sincerely,

David Fleay

Don't get bitten, that's all I can say

The following extract comes from Douglas Adams' interview of Struan Sutherland (1936–2002) as recorded in his 1990 book, *Last chance to see*:

There is in Melbourne a man who probably knows more about poisonous snakes than anyone else on earth. His name is Dr Struan Sutherland and he has devoted his entire life to a study of venom.

> 'And I'm bored with talking about it,' he said when we went along to see him the next morning.
>
> 'Can't stand all these poisonous creatures, all these snakes and insects and fish and things. Wretched things, biting everybody. And then people expect me to tell them what to do about it. I'll tell them what to do. Don't get bitten in the first place. That's the answer. I've had enough of telling people all the time. Hydroponics, now, that's interesting. Talk to you all you like about hydroponics. Fascinating stuff, growing plants artificially in water, very interesting technique. We'll need to know all about it if we're going to go to Mars and places. Where did you say you were going?'
>
> 'Komodo'
>
> 'Well, don't get bitten, that's all I can say. ... The most poisonous spider is the Sydney funnel-web. We get about five hundred people a year bitten by spiders. A lot of them used to die, so we had to develop an antidote to stop people bothering me with it all the time.'
>
> 'So what do we do if we get bitten by something deadly, then?', I asked. He blinked at me as if I were stupid.
>
> 'Well what do you think you do?, he said. 'You die of course. That's what deadly means.'

In 1979 the National Health and Medical Research Council endorsed the use of the pressure immobilisation bandaging technique, as developed by Struan Sutherland at CSL, as the recommended first aid method for Australian snakebite. This technique, demonstrated here by Sutherland, combines occlusive bandaging of medium pressure to block lymphatic transport of toxins, with limb splinting and patient immobilisation. With the publication of his landmark paper in *The Lancet* on this method, Sutherland left what is arguably his most important legacy to the field of toxinology.

Dr Kenneth D Winkel

Cat. 64 **Struan Sutherland demonstrating the pressure immobilisation technique on volunteer CSL staff member Erin Lovering, 1979**, in Struan Sutherland, *A venomous life: The autobiography of Professor Struan Sutherland*, Melbourne: Hyland House, 1998, p. 275. Copyright Struan Sutherland. Used with permission. AVRU Collection, University of Melbourne

This is a special day

At 8.00pm on 15 February 1927, at Thornleigh, Sydney, a two-year-old boy was bitten by a male funnel-web spider. By 9.30pm he was dead. Charles Kellaway investigated this venom but he was 'most disappointed with the performance of spiders in direct bite experiments upon the laboratory animals'. Subsequently, in the 1950s, Saul Wiener used more than 5000 spiders in his studies of the same venom (the spiders illustrated here are from his collection). It took fifty years, twelve more deaths, thousands more spiders and countless experiments and experimenters before the resolution of this deadly problem. Eventually it was realized that the venom was deadly only to humans and monkeys, and to newborn mice. Professor John Pearn was a witness on the day things changed:

> I've been privileged to have some wonderful moments in my life. One of those occasions was in late 1980 or early 1981 ... I was in Melbourne ... I remember ringing Struan up and saying I'd like to talk about this. Struan said, '... We're doing the LD50s on the use of the model of newborn mice injected with the funnel-web spider venom protected with the [then emergent] funnel-web antivenom.' I remember going out to CSL the next day and going with Struan to his room where he had two plastic containers. They were green in colour, and full of coarse wood shavings. In one, there were five little nude pink newborn mice, all dead. In the other, the shavings were moving as the newborn mice wriggled around in that box. I remember the words Struan said, 'This is a special day.' And it was one of the definitive experiments.

Struan enlisted the help of two intensive care physicians (Alan Duncan and James Tibballs) at the Royal Children's Hospital in Melbourne who showed that the antivenom saved envenomated monkeys. In December 1980 the first funnel-web antivenom was issued to NSW hospitals for prospective trials (vials from batch 1 and 2 are illustrated here). The first human life was saved in January 1981, and no deaths have occurred since.

Associate Professor James Tibballs

References: JN Pearn, *Venomous country: Struan Sutherland, medical science and Australian animal toxins witness seminar*, The Melbourne Museum, April 26, 2003. SK Sutherland, J Tibballs and AW Duncan, 'The effects of Sydney funnel-web spider (*Atrax robustus*) antivenomation in monkeys and treatment with antivenom', *Toxicon*, vol. 3, 1983, pp. 453–6. MM Fisher, J Raftos and RT McGuiness, et al., 'Funnel-web spider (*Atrax robustus*) antivenom: Early clinical experience', *Medical Journal of Australia*, vol. 2, 1981, pp. 525–6.

Cat. 17 **Funnel-web spider (male and female) specimens collected by Saul Wiener**, c. 1950s; specimens in ethanol; male: 15.5 × 7.5 cm. Saul Wiener Collection, Medical History Museum, MHM02013.62

Cat. 90 and 91 Commonwealth Serum Laboratories, **Funnel-web antivenom batches 01 and 02**, c. 1980; antivenom, glass; 5.8 × 2.0 × 2.0 cm; 4.6 × 2.0 × 2.0 cm. AVRU Collection, University of Melbourne

Why was she not released?

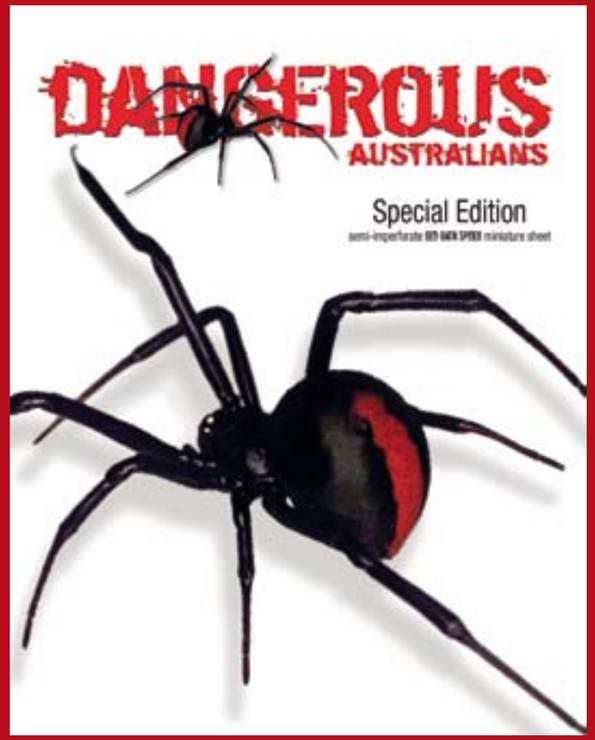
In 2006 Australia Post issued a redback spider stamp as part of the Dangerous Australians series, but due to concerns about the possibility of a negative public response it was only a limited issue. The other creatures featured in the series included the white shark, eastern brown snake, box jellyfish, saltwater crocodile and blue-ringed octopus. In the more widely issued Dangerous Australians series, the redback spider was replaced by the yellow-bellied sea snake. Below is an extract from the Dangerous Australians special edition explaining the reasons for caution:

> Introducing a special edition semi-imperforate Dangerous Australian miniature sheet including the famous Australian redback spider (*Lactrodectus hasselti*).
>
> While the other five Dangerous Australians feature in a stamp issue of the same name, a redback spider was not part of the issue. This redback spider miniature sheet is exclusive to this pack. It will not be included in the 2006 collection of Australian stamps.
>
> Why was the spider not released as a general postage stamp? Although originally commissioned as the sixth stamp in the Dangerous Australians, we thought that the realistic size of this venomous spider on the stamp might alarm poster users who might mistake it for a real redback!
>
> And if you ever come across a redback spider? Remember that only the ten millimetre long female with the distinctive orange-red strip is dangerous. The much smaller (less than five millimetres long) males are too small to bite people. Keep out of her way and if bitten seek immediate medical assistance. There is effective antivenom for redback spider bites.

On the back of the pack was information about the Dangerous Australians combining important discoveries as well as advice on the need to be wary. It is interesting to note that the fear of venomous spiders precluded their inclusion in any form in the series released to the public for general use despite the fact that the availability of antivenom had decreased dramatically their danger to the public.

Dr Jacqueline Healy

Cat. 62 Australia Post, **'Why was she not released? Redback spider booklet with Dangerous Australians stamps special edition**, 2006; print on paper; 0.3 × 25.0 × 19.0 cm. National Philatelic Collection, Australia Post. This material has been reproduced with permission of the Australian Postal Corporation. © Copyright Australia Post.



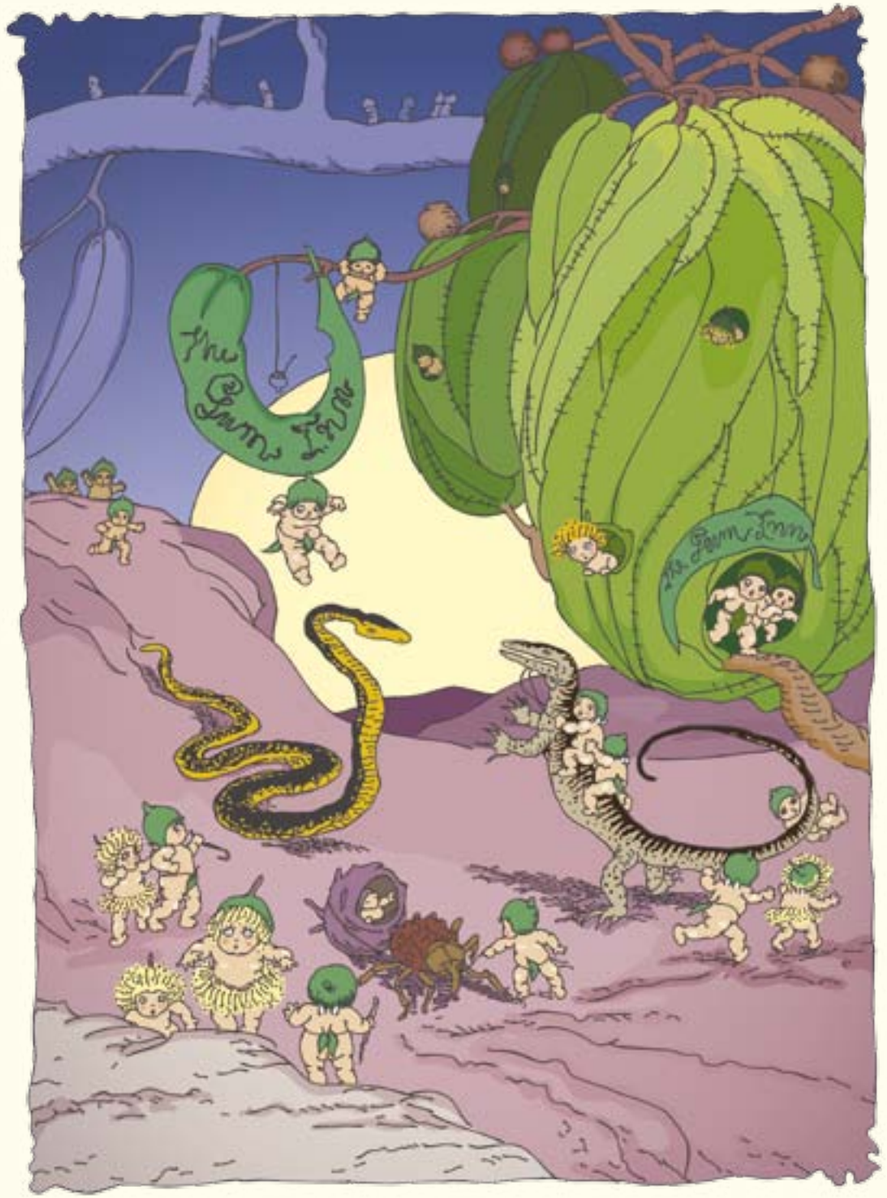
Mrs Snake was furious

May Gibbs (1877–1960) followed in the footsteps of Beatrix Potter in combining art and science to create an environmentally progressive children's literature. Gibbs migrated with her family from England to Western Australia at aged four. She spent several years absorbing the sounds, scenes and scents of 'the bush' before settling in Perth. It was the 1918 publication of her iconic *Snugglepot and Cuddlepie* that brought her lasting fame. The consolidated *Complete adventures*, first published in 1940, has never been out of print. The artwork featured here is from that first book that followed the gumnut babies on their quest to find safety from the perils of the wild. It combines naturalistic figures, such as the righteous snake-eating Mrs Kookaburra, with heroic events such as the battles against the evil Banksia men and the predatory Mrs ['furious'] Snake.

Nevertheless Gibbs' uniquely Australian mythology was far from the first work of morally laden popular literature that dealt with the hazards of venomous creatures. Indeed snakes were common characters in Australian children's, and even adult, fiction from the 1870s (rarely as the good guys!). One such story that, in contrast to the gumnut babies, was almost entirely focused on the travails of a snake family, with a distinctly kind-hearted Mrs Snake, was 'The conceited snake' by English born colonial artist Cyrus Mason (1829–1915). This tale of juvenile hubris featured in *The Australian Christmas story book* for 1871. Consistent with the vibrant state of 'citizen science' in that era, its climactic scene was one of 'town hall' vivisection and antidote testing manifest as mortal combat between snake and cat (guess who wins).

Presenting a third narrative pathway, the very re-inventor of Australian realism, Henry Lawson (1867–1922), placed the snake directly as a fellow traveller in the harshness of the outback within his desolate short story 'The drover's wife' (1892). No lesser than Arthur Conan Doyle (1859–1930), in the same year, embraced the power of venom with his early Sherlock Holmes story, 'The adventure of the speckled band' (1892), which he felt was his best 'Holmes' story. Subsequently Agatha Christie, JRR Tolkien, Ian Fleming, Michael Crichton, JK Rowling and many others have embraced the fear and fascination inherent within the story of venom.

Dr Kenneth D Winkel



May Gibbs sketch, 1920, **Snugglepot and Cuddlepie defeat the evil Mrs Snake**; digitally recreated. © The Northcott Society and the Cerebral Palsy Alliance 2013

Irukandji Syndrome

> ... and we're back to the stage where Flecker started. We know something and we know almost nothing ... We've solved two or three problems and it appears [we have] at least another four to go.
>
> Dr Jack Barnes in B Kinsey, *More Barnes on box jellyfish*, 1988, p. 48

Science is an endless frontier. Ever since Struan Sutherland was invited to join the department of pharmacology in 1994, my Cardiovascular Therapeutics Unit has been collaborating with the Australian Venom Research Unit to unlock the secrets of a particularly challenging venom, that of the Irukandji jellyfish (*Carukia barnesi*). This marine sting, and associated jellyfish, is colloquially known by the anglicised version of the name of the original custodians of the lands between Cairns and Port Douglas (the Yirrganydji people) where this envenomation is most common. Although it is related to the much larger multi-tentacled *Chironex fleckeri* box jellyfish, unfortunately the CSL *Chironex* antivenom is ineffective against the Irukandji venom. Now, almost twenty years after Struan engaged us on this quest, as Dr Jack Barnes—who discovered this jellyfish back in 1961, commented (quoted above)—we have solved some problems associated with this jellyfish, but have many more to go.

Although it has taken many years, mostly due to a shortage of jellyfish for study, we have persisted and now understand the basic pharmacology of this potentially lethal sting. We found that this jellyfish triggers the release of a storm of nerve activity that releases sensory and autonomic sympathetic and parasympathetic transmitters and circulating adrenaline. This translates to a very painful envenomation that is associated with sweating, anxiety, nausea, vomiting, a rapid pulse and raised blood pressure. Of concern is the fact that this can lead to intracranial hypertension and haemorrhage (two sting victims have died this way). But we still don't have a specific antivenom or other pharmacological antidote.

We could not complete this project from Melbourne because of the tyranny of distance. We require colleagues in Queensland, and elsewhere, to help us collect, classify and study these creatures. While there is healthy competition amongst scientists to solve problems, this particular challenge is *our* problem; we are Australians and we've got to solve it. No-one else will.

Professor James A Angus

References: JH Barnes, 'Cause and effect in Irukandji stingings', *Medical Journal of Australia*, vol. 1, 1964, pp. 897–904.
KD Winkel, et al., 'Cardiovascular actions of the venom from the Irukandji (*Carukia barnesi*) jellyfish: Effects in human, rat and guinea-pig tissues in vitro and in pigs in vitro, *Clinical and Experimental Pharmacology and Physiology*, vol. 32, no. 9, 2005, pp. 777–88.

Above: Lisa-Ann Gershwin, **The overall low-power (2.4X) microscopic appearance of a typical *Carukia barnesi* jellyfish shows the characteristic pyramidal-shaped medusa or bell (1.0 cm diameter at base)**; photographed using a Zeiss Optical System SV-11, Jena, Germany. Below: Lisa-Ann Gershwin, **Close up (40X magnification) of *Malo maxima* 'Broome Irukandji' jellyfish cnidocil (venom injection apparatus)**.

List of Authors

Dr John Anderson, BPharm, MPharm, PhD Pharm, was appointed to the position of Senior Vice President and General Manager, bioCSL on 1 September 2012 following a ten-year career in various senior roles at CSL. In his current role John is responsible for bioCSL's Vaccine, Pharmaceutical, Diagnostics and Third Party Logistics businesses. Prior to CSL John spent fourteen years in senior leadership roles at GlaxoSmithKline Australia.

Professor James A Angus, AO, BSc, PhD, FAA, Dean of the Faculty of Medicine, Dentistry and Health Sciences at the University of Melbourne, 2003–13. He was President of the Academic Board, 2000–01, first Vice President of the International Union of Pharmacology, and President of Medical Deans Australia and New Zealand, 2009–11.

Professor Kerry Arabena, BSW, PhD, is Chair for Indigenous Health and Professor and Director, Onemda VicHealth Koori Health Unit. A descendant of the Meriam people of the Torres Strait and a former social worker with a doctorate in human ecology, Professor Arabena has an extensive background in public health, administration, community development and research working in senior roles in Indigenous policy and sexual health. She was a founding co-chair of the new national Indigenous peak body, the National Congress of Australia's First Peoples, a collective voice to lobby governments on Indigenous issues and is a current Director of Indigenous Community Volunteers, a national community development organisation focusing on the rights of Aboriginal and Torres Strait Islander people in rural and remote communities.

Professor James D Best, MBBS, MD, FRACP, FRCPath, FRC *Edin*, HonMD *St Andrews*, is Head of the Melbourne Medical School. After graduating from the University of Melbourne he trained in endocrinology and diabetes research, and worked as an endocrinologist at St Vincent's Hospital. He joined the university staff as Deputy Head of the Department of Medicine (St Vincent's Hospital) and in 1999 was appointed Professor of Medicine and Head of Department. He is on the National Health and Medical Research Council and chairs its Research Committee.

John Cann was awarded an OAM in 1992 for service to the community, conservation and the environment. The last snake man, John Cann indicated in 2010 that he was soon to retire. His last show was held on 18 April 2010.

Dr Nancy Cushing, BA(Hons), MMSt, PhD, lectures in Australian history in the University of Newcastle's School of Humanities and Social Science. She is a cultural and environmental historian interested in how Australians have understood and interacted with their environments, in particular with the non-human animals. She has published numerous articles and one book in this *field*, *Snake-bitten: Eric Worrell and the Australian Reptile Park*, with Dr Kevin Markwell. Her current research project explores the extent and perception of air pollution in Newcastle, NSW.

Dr Kirsty Harris, BA, MA, PhD, is Honorary Fellow, School of Historical and Philosophical Studies, University of Melbourne. Her current research includes Empire women at Gallipoli, and the life and work of Fannie Eleanor Williams, a founding member of the Walter and Eliza Hall Institute of Medical Research. She was the winner of the CEW Bean Prize for Military History in 2008.

Dr Barbara Hawgood, BSc MSc PhD (née Excell), is a New Zealander (father from Melbourne) and a retired physiologist formerly of King's College London. In her retirement she has written numerous biographical articles on Commonwealth and international medical scientists, initially involving those working in the field of snake envenomation. She publishes in the *Journal of Medical Biography*.

Dr Jacqueline Healy, BA(Hons), MBA, PhD, is the Curator of the Medical History Museum, University of Melbourne. She was the inaugural Director of Bundoora Homestead Art Centre, the public art gallery of the City of Darebin, from 2002 to 2011. Previous positions include Director of the Museum and Art Gallery of the Northern Territory and Director, Public Programs, National Gallery of Victoria.

Professor Douglas Hilton, BSc, BSc(Hons), PhD, is the director of the Walter and Eliza Hall Institute and head of the University of Melbourne Department of Medical Biology. His research career as a molecular biologist has focused on blood cell formation and signaling between cells. For a hobby, he is an avid moth collector.

Peter Hobbins, BA, BSc, MMedHum, is a Research Associate in history and archaeology at the University of Sydney where he is currently completing a PhD in history. As an undergraduate at Melbourne University, Peter studied both English literature and pharmacology, undertaking an honours project on Australian snake venoms. His historical publications have primarily examined twentieth-century medical research, especially the career of venom scientist Charles Kellaway. Peter's doctoral thesis explores venomous animals in Australia and New Zealand from 1788 to 1914, focusing particularly on the adoption of animal experimentation to study venoms and antidotes.

Dr Kevin Markwell, BA(Hons), BEdSt, MA, PhD, is at the School of Tourism and Hospitality Management, Southern Cross University. He is a cultural geographer with a research interest in the relationships between leisure, tourism and nature, in particular how people experience and come to understand and make meaning of nature, particularly animals, within leisure and tourism contexts. He is the author of several books including *Snake-bitten: Eric Worrell and the Australian Reptile Park*, co-authored with Dr Nancy Cushing.

Peter Mirtschin, BTech, MechEng, is Adjunct Research Fellow at the School of Pharmacy and Medical Sciences, University of South Australia. He has had an interest in venomous snakes and their venoms for forty-five years during which many scientific papers and a number of books on snakes were written. His involvement produced some novel activities and uses of venoms. He operated Australia's largest snake venom production facility where venoms, venom fractions and antibodies were sold throughout the world.

Dr Michael Slouber, BA, MA, PhD, teaches South Asian Studies at Western Washington University in the USA. His thesis on the early history of snakebite medicine in India was awarded a doctorate at the University of California, Berkeley in 2012. He says, 'The more I learn about venomous snakes, the more terrified I am of them!'

Ian Temby, MAppSc, Churchill Fellow 1999, is a wildlife management consultant. He began work in 1970 with CSIRO, on dingo ecology, then worked for four and a half years in South Africa on a CSIRO dung beetle research project and researching non-ungulate mammals. He spent thirty-three years with the Department of Sustainability and Environment (DSE). In 2005, he published *Wild neighbours: The humane approach to living with wildlife*. He is chair of two animal ethics committees and the DSE Independent Panel of Experts (advising on wildlife management). He is also a member of the expert panel advising Sydney Botanic Gardens on their relocation of flying-foxes. He has led expeditions in South America and Arnhem Land and has known the Thomson family since school days.

Associate Professor James Tibballs, BMedSci, MBBS, MEd, MBA, MD, MHlth&MedLaw, PGDipArts(Fr), DALF, FANZCA, FCICM, FACLM, is Principal Fellow of the Australian Venom Research Unit and Department of Paediatrics at the University of Melbourne, and Deputy Director of Intensive Care at the Royal Children's Hospital, Melbourne. He co-authored, with Struan Sutherland, the textbook *Australian animal toxins*.

Dr Kathleen Walker-Meikle, BA, MSc, PhD, completed her PhD in medieval history at University College London. She is currently a Wellcome Trust research fellow at the University College and is writing a book on medieval animal bites and venoms. Her publications include *Medieval Pets* (Boydell and Brewer, 2012), *Medieval Cats and Medieval Dogs* (British Library, 2011 and 2013).

Heleana Wauchope-Gulwa comes from Arnhemland, from the western side region (Barrah), her mother's country. Her clan group is Gudwala/Nakarra and her main languages are western Gunwinggu and English. Her traditional Indigenous identity is inherited from her mother, Molly Yarrngu. Her father is a balanda (Caucasian). She says: 'I live in two worlds—two mirrors—both ways, my mother's and my father's. My bush education came from old people's knowledge handed down through generations of wisdom, knowledge and leadership. I am a former ranger and am now studying to become a teacher at Maningrida College to share the knowledge I have gained.'

Dr Kenneth D Winkel, MBBS, BMedSci, PhD, FACTM, has been Director of the Australian Venom Research Unit, Department of Pharmacology, University of Melbourne, since 1999. In that capacity he continues the work of Struan Sutherland and his predecessors on venomous bite and sting injury and its prevention. He is past president of the Australasian College of Tropical Medicine and wrote his first scientific paper, as a medical student, on the diet of the Australian marsupial mole.

List of Works

MEDICAL HISTORY MUSEUM, UNIVERSITY OF MELBOURNE

1 **Apollo and Salutaris medal**, 1969
bronze
0.5 × 5.2 cm
MHM03049

2 Crosbie Morrison
Beware of the redback spider
The Argus, 16 July 1955
42.0 × 32.0 cm
Saul Wiener Collection
MHM02013.78

3 Savigny and Company
Candlestick used by Professor Halford, c. 1867
brass, metal and wood
14.0 × 8.0 cm
Gift of Miss Edith Broughton and Mrs Muriel Bell
MHML0047

4 Albert Martin & Co., London
Cauterising iron, n.d.
iron, wood and brass
44.0 × 4.0 × 3.0 cm
MHM00229

5 W & H Hutchinson
Cautery irons, 1895
metal, wood and fabric
21.0 × 9.5 × 4.0 cm
Gift of AMA (Vic) 2011
MHM04022

6 Maker unknown
Cautery set, c. 1900
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15.0 × 20.0 × 13.5 cm
MHM00284

7 Andor Meszaros (1900–1972)
Charles H Kellaway FRS, 1941
bronze
9.5 × 9.8 × 1.0 cm
MHM03203

8 Photographer unknown
Charles J Martin, c. 1903
photograph
24.1 × 16.6 cm
MHM01319

9 Felton Grimwade & Co., Melbourne
Chloride of lime antidote for snake bite, c. 1895
glass, metal, leather and wood
3.1 × 12.7 × 9.2 cm
MHM03933

10 Photographer unknown
CJ Martin workshop, c. 1903
photograph
11.0 × 9.0 cm
MHM000410

11 **Cobra and mongoose specimen**, c. 1970
skin and fur
52.0 × 43.5 × 33.0 cm
Saul Wiener Collection
MHM02013.79

12 Powell & Lealand, London
Compound monocular and binocular microscope, c. 1864
glass, brass, gold and silver
46.2 × 24.4 × 16.7 cm
Gift of Mrs Dorothy C Banks, granddaughter of Professor George Britton Halford
MHM00038

13 **Cone shells collected by Saul Wiener**, c. 1958
shell
6.5 × 12.0 × 8.0 cm, 6.0 × 9.5 × 6.0 cm, 5.0 × 9.0 × 5.5 cm
Saul Wiener Collection
MHM02013.80-82

14 Maker unknown
Corrigan cautery set, 1905
brass, steel and wood
7.2 × 1.3 × 1.8 cm
Gift of Dr Walter D Counsell
MHM00180

15 **Endura car first aid kit including Trafalgar snake bite outfit**, c. 1950s
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4.7 × 13.4 × 21.0 cm
Gift of Dr John Paull, 2013
MHM02013.58

16 **Expenses incurred by the snakes at Richmond Depot**, 1876
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AMA Archives, Brownless Biomedical Library

17 **Funnel-web spider (male and female) specimens collected by Saul Wiener**, c. 1950s
specimens in ethanol
15.5 × 7.5 cm
Saul Wiener Collection
MHM02013.62

18 **Funnel-web spider (male) specimen**, c. 1950s
specimen in perspex
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Saul Wiener Collection
MHM02013.63

19 **Gehrlich and Hata medal**, n.d.
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MHM03138

20 Commonwealth of Australia, Department of Health, Commonwealth Serum Laboratories
Handbook of instructions. Biological products for human and laboratory use 1948–49
17.0 × 11.0 cm
Gift of John Bates
MHM02013.59

21 Commonwealth of Australia, Department of Health, Commonwealth Serum Laboratories
Handbook of instructions. Biological products for human and laboratory use 1948–49
18.0 × 12.0 cm
Gift of John Bates
MHM02013.60

22 **He milks to save lives**
Herald, 23 September 1958
Redback spider scrapbook
3.2 × 34.0 × 22.1 cm
Saul Wiener Collection
MHM02013.61

23 **Holloway's pills and ointment medal**, 1857
England
bronze
3.5 × 0.4 cm
MHM03165

24 Commonwealth Serum Laboratories
Know the spider and the cure!, c. 1950s
pamphlet
18.0 × 12.0 cm
Saul Wiener Collection
MHM02013.64

25 Betty Hadlington
Know your Australian spiders and ticks
Peakhurst, NSW: Huntsman Press, 1962
0.5 × 23.0 × 17.0 cm
Saul Wiener Collection
MHM02013.65

26 **Lauder Brunton snake-bite remedy**, c. 1900
wood, metal and potassium permanganate (Condy's Crystals)
6.3 × 1.3 cm
Gift of Dr Walter Counsell
MHM00181

27 **Letter from the sergeant at Swan Hill on the results of a party of aboriginals hunting snakes (31 captured)**, 25 January 1886
ink on paper
33.0 × 20.5 cm
AMA Archives, Brownless Biomedical Library

28 **Letter to the president, Medical Society of Victoria from the councillors of the City of Melbourne thanking the Society for their efforts in seeking an antidote to snake poisoning**, 8 May 1876
ink on paper
33.0 × 20.0 cm
AMA Archives, Brownless Biomedical Library

29 Victor Ernst Cobb (1976–1945)
Medical College Melbourne University, 1912
ink on paper
9.0 × 13.0 cm
Gift of Dr Colin Holden, 2012
MHM02010.28

30 **Milking of spiders aids serum research**
Sydney Morning Herald, 25 September 1958
Redback spider scrapbook
3.2 × 34.0 × 22.1 cm
Saul Wiener Collection
MHM02013.61

31 **Petit's spiral tourniquet**, 1906
brass, metal, fabric and stone
11.0 × 6.5 × 3.5 cm
Gift of WR Angus
MHM01652

32 **Post office telegraph sent from Beechworth to GB Halford seeking advice on treatment of snakebite**, 21 June 1876
ink on paper
22.0 × 23.0 cm
AMA Archives, Brownless Biomedical Library

33 Commonwealth of Australia, Department of Health, Commonwealth Serum Laboratories
Price list. Biological products for human and laboratory use, 1952–53
18.0 × 12.0 cm
Gift of John Bates
MHM02013.66

34 Photographer unknown
Professor George Britton Halford (1824–1910), c. 1880
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17.8 × 12.7 cm
MHM00874

35 **Professor Halford business card**, c. 1880s
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3.8 × 7.6 cm
MHM02686

36 **Received from D McCrea, the sum of 3 pounds and ten shillings for 25 dogs delivered at Richmond Depot**, 15 March 1876
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18.0 × 11.5 cm
AMA Archives, Brownless Biomedical Library

37 Saul Wiener (1923–2010)
Redback spider, c. 1955
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Saul Wiener Collection
MHM02013.67

38 **Redback spider specimen *f. Theridiidae. sp. Latrodectus hasseltii***, n.d.
specimen in perspex
2.5 × 8.0 × 5.5 cm
Saul Wiener Collection
MHM02013.68

39 Beacham's Pharmacy, Flinders Street, Melbourne
Sale of poisons register 1922–1929
print, ink on paper
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MHM02436

40 Photographer unknown
Saul Wiener at the Commonwealth Serum Laboratories, c. 1952
photograph; 24.5 × 30.5 cm
Saul Wiener Collection
MHM02013.69

41 Nikon, Japan
Saul Wiener's microscope, c. 1950
36.5 × 13.5 × 26.0 cm
Saul Wiener Collection
MHM02013.70

42 Commonwealth Serum Laboratories
Saul Wiener's photographs of specimens used for research for the development of funnel-web and redback spider antivenoms, c. 1955
photographs
9.4 × 12.3 cm (5 images)
Saul Wiener Collection
MHM02013.83-87

43 Victor Ernst Cobb (1876–1945)
School of Physiology, 1921
etching on paper
9.0 × 13.0 cm
MHM00401

44 **Snakebite kit arranged by Dr Randle, instructions from Dr A Mueller for his antidote of strychnia**, 1892
wood, metal, cardboard and glass
2.7 × 11.2 × 8.2 cm
Gift of Dr Robert G Sim
MHM02691

45 **Snakebite lancet outfit**, c. 1900
wood, metal and potassium permanganate (Condy's Crystals)
6.8 × 1.3 cm
Gift of Dr Brian Essex
MHM02484

46 **Snake skin collected by Saul Wiener**
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120.5 × 11.0 cm
Saul Wiener Collection
MHM02013.72

47 James L Hatrick & Co. Ltd, London
Sterilex snake-bite lancet suggested by Sir Lauder Brunton, c. 1900
wood, metal and potassium permanganate (Condy's Crystals)
7.4 × 1.6 cm
MHM02013.74

48 **Stonefish on carved wooden stand collected by Saul Wiener**, n.d.
specimen, wood
22.5 × 22.0 × 9.8 cm
Saul Wiener Collection
MHM02013.73

49 Saul Wiener (1923–2010)
The Australian redback spider (*Latrodectus hasselti*). 1. Preparation of antiserum by the use of venom absorbed in aluminium phosphate
Reprinted from the *Medical Journal of Australia*, vol. 1, 1956, pp. 739–42
22.0 × 28.0 cm
Saul Wiener Collection
MHM02013.75

50 Denis Brothers & Co.
The James Beaney Medal for Surgery awarded to Dr Charles J Trood, 1877
gold, fabric
16.0 × 5.0 × 0.5 cm
MHM02417

51 **Theriaca jar**, c. 1880
ceramic
25.8 × 14.2 × 15.0 cm
MHM01235

52 Sears Studios, Melbourne
Third year medical students with Professors CJ Martin and Harry Brookes Allen, 1903
photograph
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MHM00303

53 **Tourniquet**, c. 1900
cloth, wood, paper and metal
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MHM01405

54 Novelty Products Co., New York
Tourniquet web
tape, cloth, felt, metal and cardboard
8.0 × 5.0 × 3.0 cm
Gift of Mr Denis Cahill
MHM02043

55 **Venom spines of stonefish collected by Saul Wiener**, n.d.
spines mounted on paper
18.5 × 13.5 cm
Saul Wiener Collection
MHM02013.77

56 J Ros Garnet, ed.
Venomous Australian animals dangerous to man
Published by Commonwealth Serum Laboratories, 1968
1.0 × 15.0 × 25.0 cm
Saul Wiener Collection
MHM02013.76

57 **Vouchers in the experiment in snake poisoning**, 1876
ink on paper
11.5 × 8.0 cm
AMA Archives, Brownless Biomedical Library

58 **150 years of the Academie Nationale de Medecine**, 1970
bronze
0.8 × 6.8 cm
MHM03052

NATIONAL PHILATELIC COLLECTION, AUSTRALIA POST

59 Australia Post
Envelope with 'Dangerous Australians' stamps, 2006
print on paper
19.0 × 11.0 cm

60 Australia Post
Postcard with jellyfish stamp, Dangerous Australians collection, 2006
print on paper
14.5 × 10.5 cm

61 Australia Post
Postcard with octopus stamp, Dangerous Australians collection, 2006
print on paper
14.5 × 10.5 cm

62 Australia Post
Why was she not released? Redback spider booklet with Dangerous Australians stamps special edition, 2006
print on paper
0.3 × 25.0 × 19.0 cm

AUSTRALIAN VENOM RESEARCH UNIT COLLECTION, UNIVERSITY OF MELBOURNE

63 Struan Sutherland (1936–2002)
A sting in the tale
The Age, 2002
24.0 × 18.5 cm

64 Struan Sutherland (1936–2002)
A venomous life: The autobiography of Professor Struan Sutherland
Melbourne: Hyland House, 1998
3.0 × 23.5 × 15.0 cm

65 National Council for Scientific and Technological Development (CNPq) Brazil
Animais pecontentos (Venomous animals), 2004
booklet
18.0 × 14.0cm

66 Rosemary Fleay-Thomson
Animals first: The story of pioneer Australian conservationist and zoologist, David Fleay
Nerang: Petaurus Publishing, 2007
4.0 × 23.5 × 16.0 cm

67 CSL bioplasma immunohaematology
Australia: World's most deadly venomous snakes, world's most effective snakebite treatment
pamphlet
30.0 × 21.0 cm

68 Struan K Sutherland (1936–2002)
Australian animal toxins: The creatures, their toxins, and care of the poisoned patient
Melbourne: Oxford University Press, 1983
4.0 × 23.5 × 16.0 cm

69 CSL Ltd
Black snake antivenom, expiry February 2001
antivenom, glass, cardboard
16.0 × 3.5 × 3.5 cm

70 Commonwealth Serum Laboratories
Black tiger snake venom, 26 February 1935
venom, glass
17.0 × 2.5 × 2.8 cm

71 **Blue-ringed octopus (*Hapalochlaena sp.*)**, n.d.
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72 Commonwealth Serum Laboratories
Box jellyfish antivenom, expiry November 2000
antivenom, glass, cardboard
9.0 × 3.5 × 2.5 cm

73 **Box jellyfish**, n.d.
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12.0 × 8.5 cm

Cat. 45 **Snakebite lancet outfit**, c. 1900; wood, metal and potassium permanganate (Condy's Crystals); 6.8 × 1.3 cm. Gift of Dr Brian Essex; Medical History Museum, MHM02484

Cat. 47 James L Hatrick & Co. Ltd, London, **Sterilex snake-bite lancet suggested by Sir Lauder Brunton**, c. 1900; wood, metal and potassium permanganate (Condy's Crystals); 7.4 × 1.6 cm. Medical History Museum, MHM02013.74

Cat. 26 **Lauder Brunton snake-bite remedy**, c. 1900; wood, metal and potassium permanganate (Condy's Crystals); 6.3 × 1.3 cm. Gift of Dr Walter Counsell; Medical History Museum, MHM00181

74 Commonwealth Serum Laboratories
Brown snake antivenene,
22 March 1960
antivenom, glass, cardboard
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75 Commonwealth Serum Laboratories
Brown snake antivenene,
29 August 1963
antivenom, glass, cardboard
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76 CSL Ltd
Brown snake antivenom,
expiry November 2001
antivenom, glass, cardboard
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77 Commonwealth Serum Laboratories
Brown snake venom collected by Charles Tanner, n.d.
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78 Commonwealth Serum Laboratories
Chapel Island tiger snake venom collected by Eric Worrell, 7 May 1960
venom, glass
2.5 × 15.5 cm

79 Photographer unknown
Charles Halliley Kellaway (1889–1952), Director of the Walter and Eliza Hall Institute of Medical Research, 1923–44, n.d.
photograph
24.0 × 31.5 cm
Courtesy of the Royal Society

80 Vern Draffin
Charles Tanner (1911–1996), n.d.
photograph
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81 Commonwealth Serum Laboratories
Cobra venom, Kasauli, India, 1973
venom, glass
3.0 × 16.0 × 2.5 cm

82 Commonwealth Serum Laboratories
Death adder antivenene,
22 March 1960
antivenom, glass, cardboard
3.0 × 12.0 × 3.5 cm

83 Photographer unknown
Dr Bill Lane (d. 1974), Director of the Commonwealth Serum Laboratories 1966–1974, n.d.
photograph
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84 **Envelope addressed to Struan Sutherland from Charles Tanner for posting of venom samples**, 1984
print, ink on paper
0.5 × 12.0 × 17.5 cm

85 Commonwealth Serum Laboratories
Ethiopian viper venom collected by Italian colleague, 14 January 1956
venom, glass
17.0 × 3.0 × 3.0 cm

86 CSL Bioplasma Immunohaematology
Festeid taim snek i kaikai man
pamphlet
30.0 × 21.0 cm

87 Papua New Guinea Philatelic Bureau
First day cover Papua New Guinea dangerous snakes,
13 September 2006
stamps
21.0 × 10.0 cm

88 The Florida Poison Information Network and the Florida Department of Health
Florida's poisonous spiders and snakes: A guide to prevention and first aid, c. 2000
pamphlet
20.0 × 8.0 cm

89 CSL Ltd
Funnel-web antivenom, expiry July 2002
antivenom, glass, cardboard
9.7 × 3.5 × 3.4 cm

90 Commonwealth Serum Laboratories
Funnel-web antivenom 01 (first batch), c. 1980
antivenom, glass, cardboard
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91 Commonwealth Serum Laboratories
Funnel-web antivenom 02, c. 1980
antivenom, glass, cardboard
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92 Commonwealth Serum Laboratories
Funnel-web spider antivenom,
expiry February 1985
antivenom, glass, cardboard
6.6 × 13.0 × 7.2 cm

93 Tom Reilly
Hey missster, one false move and you're hisstory
The Sunday Age, 28 December, 2008
38.0 × 28.0 cm

94 **Jidesheng sheyao pian, Chinese snakebite remedy**, c. 2010
mixed media
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95 Commonwealth Serum Laboratories
King Island tiger snake venom collected by Eric Worrell,
11 May 1960
venom, glass
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96 Fleay's Fauna Reserve
Letter to Struan Sutherland Commonwealth Serum Laboratories, Parkville from David Fleay on the speed of a black whip snake,
12 October 1978
ink on paper
26.0 × 20.5 cm

97 Commonwealth Serum Laboratories
Malaysian viper venom,
2 February 1969
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98 Commonwealth Serum Laboratories
Milking vial, brown snake venom collected by Charles Tanner, channel country and Cape York,
11 August 1978
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99 **Mould of black snake fangs collected by Neil Hamilton Fairley**,
18 February 1928
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100 **Mould of tiger snake fangs collected by Neil Hamilton Fairley**,
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101 Papua New Guinea Philatelic Bureau
Papua New Guinea Dangerous Snakes stamp pack, 13 September 2006
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102 Commonwealth Serum Laboratories
Papuan black snake antivenene,
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103 Commonwealth Serum Laboratories
Philippines cobra venom,
14 Februray 1963
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104 South African Institute for Medical Research, Johannesburg
Puff adder venom,
1955
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105 CSL Ltd
Redback spider antivenom, expiry December 2000
antivenom, glass, cardboard
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106 Commonwealth Serum Laboratories
Rough scale snake venom collected by David Fleay, 3 February 1961
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107 Queensland Government
Safe swimming in tropical waters,
n.d.
multilingual pamphlet
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108 South African Institute for Medical Research, Johannesburg
Snakebite kit, 1975
antivenom, syringe
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109 Photographer unknown
Saul Wiener (1923–2010), n.d.
photograph
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Courtesy of Royal Melbourne Hospital Archives

110 CSL Ltd
Sea snake antivenom,
expiry March 2001
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111 **Snake condoms**, c. 2000
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112 Commonwealth Serum Laboratories
Snake venom detection apparatus,
expiry September 1991
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4.6 × 2.5 × 14.5 cm

113 CSL Ltd
Snake venom detection kit, expiry 10 May 2007
mixed media
5.5 × 12.5 × 13.0 cm

114 Sri Lanka Medical Association
Snakebite prevention and first aid,
1994
booklet
21.0 × 14.0 cm

115 Brooke Baskin, et al.
Snakes in the suburbs
The Courier Mail, 4 November 2011
40.0 × 28.5 cm

116 CSL Ltd
Stonefish antivenom, expiry July 2002
antivenom, glass, cardboard
9.5 × 3.0 × 5.5 cm

117 Commonwealth Serum Laboratories
Taipan venom, 24 November 1961
venom, glass
3.0 × 16.0 × 2.5 cm

118 L Schrire, et al.
The diagnosis and treatment of envenomation in South Africa, 1996
South African Institute for Medical Research, Johannesburg
20.5 × 11.0 cm

119 Roger Lowe and RP Cooper
The venom patrol
Kew East, Vic.: Windy Hollow Books, 2008
1.5 × 22.0 × 3.0 cm

120 University of Melbourne
The venom patrol: First aid techniques, 2008
poster
42.0 × 30.0 cm

121 CSL Ltd
Tick antivenom, powder for injection, expiry April 2001
antivenom, glass, cardboard
9.0 × 3.5 × 3.3 cm

122 Commonwealth Serum Laboratories
Tiger snake antivenene, 6 October 1964
antivenom, glass, cardboard
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123 CSL Ltd
Tiger snake antivenom, expiry May 2001
antivenom, glass, cardboard
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124 Commonwealth Serum Laboratories
Tiger snake venom, Baw Baw,
3 September 1955
venom, glass
3.0 × 16.0 × 2.5 cm

125 SYN-AKE®, Barbaria, Spain
Veneno de Serpiente, snake venom anti wrinkle cream, 2008
venom, cream
8.5 × 8.5 × 8.5 cm

126 Hong Kong Post
Year of the Snake stamp, 2002
print on paper
20.0 × 14.0 cm

SPECIAL COLLECTIONS, BAILLIEU LIBRARY, UNIVERSITY OF MELBOURNE

127 Keith C McKeown (1892–1952)
Australian spiders, 2nd ed.
Sydney: Angus and Robertson, 1963
22.0 × 12.0 × 6.5 cm

128 George Metcalfe
Australian zoology
Sydney: EW Cole, 1895
1.5 × 12.5 × 19.0 cm

129 Edgar R Waite (1866–1928)
A popular account of Australian snakes: With a complete list of the species and an introduction to their habits and organisation
Sydney: Thomas Shine, 1898
12.5 × 19.0 × 3.0 cm

130 Gaius Plinius Secundus (Pliny, the Elder) (23 AD 79)
C. Plini Secundi naturalis historiæ: cum commentariis & adnotationibus Hermolai barbari, Pintani, Rhenani, Gelenii, Dalechampii, Scaligeri, Salmasii, Is. Vossii, & Variorium ...
Lugd. Batav. Roterodami: Apud Hackios, 1668–1669
7.2 × 19.7 × 13.2 cm

131 Silas Weir Mitchell (1829–1914)
Experimental contributions to the toxicology of rattle-snake venom
New York: Moorhead, Simpson and Bond, 1868
1.6 × 23.4 × 15.6 cm

132 Francesco Redi (1626–1698)
Francisci Redi patritii Aretini Experimenta circa generationem insectorum: ad nobilissimum virum Carolum Dati
Amstelodami: Sumptibus Andreae Frisii, 1671
3.7 × 13.7 × 8.1 cm

133 Galen (AD 130–200)
Galeni librorvm quarta classis: signa qvibvs tvm dignoscere morbos & locos affectos, tum praescire future possimus, docet ...
Venetiis: Apvd Ivntas, 1597
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134 Peitro Andrea Gregorio Mattioli (1501–1577)
I discoursi di M Pietro Andrea Matthioli ...
Venice: Vincenzo Valgrisi, 1568
35.0 × 25.0cm × 15.0 cm
Acquired with the generous assistance of the Friends of the Baillieu Library to celebrate the University of Melbourne Medical School's 150th anniversary

135 Arthur Conan Doyle (1859–1930)
The adventure of the speckled band
Memoirs of Sherlock Holmes
London: G Newnes, 1899, pp. 90–1
22.0 × 16.0 × 10.0 cm

136 Augustus Mueller (fl. 1893)
On snake-poison: Its action and its antidote
Sydney: L Bruck, 1893
25.0 × 16.0 × 2.5 cm

137 Bengal Secretariat Press, Calcutta
Report of the Commission appointed to investigate on the intravenous injection of ammonia, etc., in Indian and Australian snake-poisoning, 1874
25.0 × 17.0 × 3.5 cm

138 William Harvey (1578–1657)
The anatomical exercises of Dr William Harvey ...
London: R Lowndes and M Gilliflower, 1673
18.0 × 11.0 × 6.0 cm

139 **The Australasian medical gazette: Being the official organ of the combined Australian Branches of the British Medical Association, vol. 10**, October 1890 to September 1891
Sydney: L Bruck, 1882–1914
24.0 × 19.0 × 5.0 cm

140 **The Australasian medical gazette: Being the official organ of the combined Australian Branches of the British Medical Association, vol. 11**, October 1891 to December 1892
Sydney: L Bruck, 1882–1914
25.0 × 19.0 × 5.5 cm

141 **The Holy Bible containing the old and new testaments** ...
Glasgow: William Collins, 1862
16.0 × 11.0 × 4.0 cm

142 Keith C McKeown (1892–1952)
The land of Byamee: Australian wild life in legend and fact
Sydney: Angus and Robertson, 1938
5.0 × 19.0 × 14.0 cm

143 George Britton Halford (1824–1910)
The new treatment of snake-bite: With plain directions for injecting
Melbourne: Stillwell and Knight, 1869
2.0 × 21.3 x14.0 cm

144 Angus MacKay (1824–1886)
The semi-tropical agriculturalist, and colonists' guide: Plain words upon station, farm and garden work, house-keeping and the useful pursuits of colonists, with directions for treating wounds, fevers, snake bite ...
Brisbane: Watson, 1875
15.0 × 23.0 × 4.0 cm

145 Gerard Krefft (1830–1881)
The snakes of Australia: An illustrated and descriptive catalogue of all the known species
Sydney: T. Richards, 1869
27.0 × 23.0 × 6.0 cm

146 George Britton Halford (1824–1910)
Thoughts, observations, and experiments on the action of snake venom on the blood
Melbourne: Stillwell, 1894
1.6 × 22.2 × 14.7 cm

MUSEUM VICTORIA

147 Mulford Laboratories, USA
Antivenin, *Nearctic crotalidae*, one syringe, North American anti-snakebite serum, 20 May 1935
antivenom, glass, cardboard
3.7 × 11.8 × 4.9 cm
CSL Collection
HT003372

148 South African Institute for Medical Research, Johannesburg
Antivenene serum, neutralises the venoms of cobras, adders, June 1937
antivenom, glass, cardboard
3.4 × 8.5 × 3.8 cm
CSL Collection
HT003374

149 **Coastal taipan *Oxyuranus scutellatus***, July 1950
The snake was captured by Kevin Budden (who subsequently died from the snakebite) near Cairns, Queensland, and was milked by David Fleay
specimen in ethanol
32.5 × 19.5 cm
D008175

150 Education Department of Victoria
Dangerous snakes of Victoria indicated by Professor McCoy, 1877
print on paper
109.0 × 70.0 cm
PZ287

151 **Eastern brown snake *Pseudonaja textilis***, n.d.
Sebastian near Bendigo, Victoria
specimen in ethanol
22.0 × 10.5 cm
D004287

152 South African Institute for Medical Research, Johannesburg
Monvalent concentrated anti-gaboon viper serum, May 1937
antivenom, glass, cardboard
3.5 × 8.5 × 3.7 cm
CSL Collection
HT003373

153 Veterinary Research Institute, Victoria
Platypus *Ornithorhynchus anatinus*, n.d.
specimen in ethanol
25.0 × 10.0 cm
C025477

154 Frederick McCoy (1823–1899)
Prodromus of the zoology of Victoria, vol. 1
Melbourne: Govt Printer, 1878
20.0 × 6.0 × 26.0 cm
LIB059658

155 **Snake catching stick**, c. 1920
wood
16.5 × 181.5 × 3.0 cm
HT002827

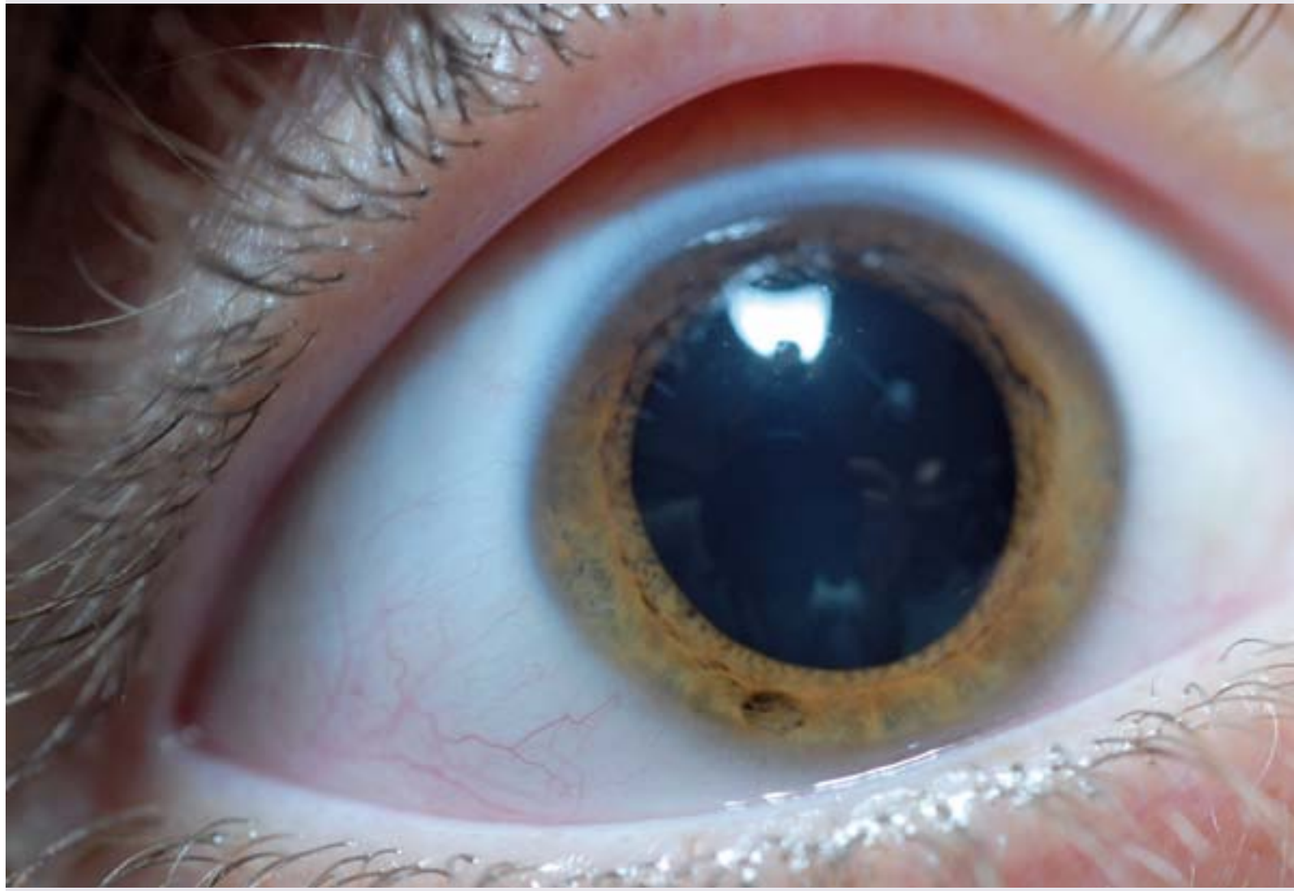
156 Commonwealth of Australia, Department of Health
Tiger snake antivenene, 12 December 1952
Prepared in the Commonwealth Serum Laboratories
antivenom, glass, cardboard
2.7 × 10.3 × 2.8 cm
CSL Collection
HT023168

157 Commonwealth of Australia Department of Health
Tiger snake antivenene, 1953
Prepared in the Commonwealth Serum Laboratories
antivenom, glass, cardboard
3.0 × 12.0 × 3.5 cm
CSL Collection
HT003515

158 Commonwealth of Australia Department of Health
Tiger snake antivenene, 31 December 1955
Prepared in the Commonwealth Serum Laboratories
antivenom, glass, cardboard
2.8 × 10.1 × 2.8 cm
CSL Collection
HT023166

159 Commonwealth of Australia, Department of Health
Tiger snake antivenene, March 1956
Prepared in the Commonwealth Serum Laboratories
antivenom, glass, cardboard
2.8 × 10.2 × 2.9 cm
CSL Collection
HT013241

160 Commonwealth of Australia Department of Health
Tiger snake antivenene, 19 July 1961



Brent McSharry, **A patient's fixed dilated pupil paralysed by the action of Australian coastal taipan venom**, 28 November 2007; digital photograph, Nikon D200 Nikon 60mm f2.8 macro lens + Nikon SB800 flash (set at matrix + 0.3 stop), ISO 200

Prepared in the Commonwealth Serum Laboratories
antivenom, glass, cardboard
2.7 × 10.4 × 2.9 cm
CSL Collection
HT003364

161 Arthur Bartholomew (1834–1904)
Tiger snake *Notechis scutatus*, c. 1870
watercolour, pencil and ink on paper
26.0 × 15.0 cm
PZ3.1

162 **Viper *viperidae***, c. 1870
skeleton
3.5 × 4.5 × 17.5 cm
D073620

STATE LIBRARY OF VICTORIA

163 Samuel Calvert (1828–1903)
A group of Australian snakes
The Illustrated Melbourne Post, 1868
engraving
9.2 × 11.5 cm
IMP22/05/68/65s

164 **Sketches of snake-bite experiments in the Melbourne Gaol**
The Australasian Sketcher, 17 February 1877
wood engraving
41.0 × 30.5 cm
A/S17/02/77/184

165 **Snake adventures in the bush**
The Illustrated Australian News, 16 May 1883, p. 76
wood engraving
25.4 × 18.4 cm
IAN16/05/83/76

166 Photographer unknown
Woman by grave, c. 1880
glass negative (half plate)
12.2 × 16.6 cm
inscription on headstone: Erected by The Companions & Friends of Mark Marston who departed this life on March 4th 1880 Aged 19 years. Death caused from snake bite.
H85.106/3

THE ARTIST AND THE AUSTRALIAN ART PRINT NETWORK COLLECTION

167 Dennis Nona (Badu, Torres Strait Islands, b. 1973)
Uzu Pui (Stonefish medicine), 2005
etching, edition of 99
66.0 × 35.5 cm

WALTER AND ELIZA HALL INSTITUTE ARCHIVES

168 CH Kellaway
Dangerous venomous snakes
The Australasian, 31 December 1932

169 **Letter from the FG Morgan, Director Commonwealth Serum Laboratories, to CH Kellaway, Director Walter and Eliza Hall Institute, on the death of a boy from snakebite because of no available antivenom**, 14 November 1932
ink on paper
33.5 × 21.0 cm

170 **Letter from a doctor in Kerang to CH Kellaway, Director Walter and Eliza Hall Institute requesting information about the appropriate antivenom to stock**, 20 January 1931
ink on paper
20.8 × 17.5 cm

171 **Letter from the secretary of the Office of the Commissioner of Railways, Queensland to CH Kellaway, Director Walter and Eliza Hall Institute on transportation of live snakes**, 18 April 1932
ink on paper
25.0 × 19.0 cm

172 **Letter from the NSW Office of the Director General of Public Health, to Dr Hamilton Fairley, Walter and Eliza Hall Institute on treatment of snakebite, referred to Director, Charles Kellaway for reply**, 21 May 1929
ink on paper
21.0 × 13.0 cm

173 CH Kellaway and Donald F Thomson
Observations on venom of a melanotic insular variety of the tiger snake *(Notechis scutatus)*
Reprinted from the *Australian Journal of Experimental Biology and Medical Science*, vol. 10, 1932, pp. 35–46

174 **Paper on treatment of snakebite by CH Kellaway, Director Walter and Eliza Hall Institute and FG Morgan, Director of the Laboratories Division, Commonwealth Department of Health**, c. 1930
print on paper
20.5 × 33.0 cm

175 FW Fitzsimmons (1870–1951)
Snake venoms: Their therapeutic uses and possibilities, 24 July 1929
reprint
22.5 × 14.5 cm

176 **Walter and Eliza Hall Research Institute of Pathology and Medicine, Ninth Annual Report, 1927–28 and Tenth Annual Report, 1928–29**
1.5 × 21.0 × 14.0 cm

HARRY BROOKES ALLEN MUSEUM OF ANATOMY AND PATHOLOGY, UNIVERSITY OF MELBOURNE

177 Walter and Eliza Hall Institute
Curl snake *Denisonia suta*, n.d.
specimen in ethanol
16.5 × 5.0 cm
531-006900

178 Walter and Eliza Hall Institute
Green tree snake *Dendrophus punctulatus*, n.d.
specimen in ethanol
18.0 × 10.0 cm
531-007361

179 Walter and Eliza Hall Institute
Ornamental snake *Denisonia maculata*, n.d.
specimen in ethanol
16.5 × 5.0 cm
531-006903

180 Walter and Eliza Hall Institute
Preserved snake (species unknown), n.d.
specimen in ethanol
531-006905

PRIVATE COLLECTIONS

181 **Bag used to collect snakes**, c. 2000
canvas and wood
79.0 × 19.0 × 20.0 cm
Collection of Brian Barnett OAM

182 Artist unknown
Box jellyfish season: Don't swim, don't touch, c. 1990
patch from t-shirt; mixed materials
25.0 × 18.0 cm
Collection of Spunner and Gray

183 Photographer unknown
Common brown snake in striking stance, c. 1965
photograph
10.0 × 15.5 cm
Collection of Brian Barnett OAM

DJ Williams, **Papuan taipan (*Oxyuranus scutellatus*) from Moreguinea, Central Province, Papua New Guinea**, © 2006; photograph. Reproduced with permission from DJ Williams

184 Eric Worrell (1924–1987)
Dangerous snakes of Australia
Sydney: Angus and Robertson, 1952
1.5 × 19.0 × 13.0 cm
Collection of Brian Barnett OAM

185 Suzanne Spunner (b. 1951)
Dragged screaming to paradise
Darwin: Paradise Productions, 1990
21.0 × 14.0 × 1.0 cm
Spunner and Gray collection

186 Todd Williams
Dragged screaming to paradise tea towel, c. 1990s
print on linen
47.0 × 70.0 cm
Spunner and Gray collection

187 **Eastern tiger snake**, c. 1965
print on card
10.0 × 15.5 cm
Collection of Brian Barnett OAM

188 Eric Worrell's Australian Reptile Park, Gosford
Eric Worrell milking a taipan
pamphlet
18.0 × 19.0 cm
Collection of Brian Barnett OAM

189 **Gin bottle**, c. 1860
glass
22.0 × 10.0 × 10.0 cm
Caswell collection

190 **Handmade tourniquet**, 2013
stick and rag
48.0 × 4.0 × 5.0 cm
Private collection

191 **Hook used to direct snakes**, c. 2000
This homemade device was crafted from Mr Brian Barnett's grandfather's walking stick
wood and metal
15.0 × 92.0 × 5.0 cm
Collection of Brian Barnett OAM

192 Sharon West (Australia)
James Cook and his party encounter a very large red bellied black snake, 2013
mixed media
21.0 × 32.0 × 14.0 cm
Artist's collection

193 Rickisha Redford-Bohme (Maningrida, b. 1999)
Kriol, Rembarrnga
Jellyfish, 2012
pencil on paper
21.0 × 19.0 cm
Artist's collection

194 Dept of Health and Community Services, Northern Territory Government
Jellyfish season, 1988
poster
59.0 × 42.0 cm
Spunner and Gray collection

195 Susan Marrawarr (Mumeka, b. 1967)
Kuninjku, Duwa
Ngalyod (Rainbow serpent), 1998
lithograph, ed. 3/30
33.0 × 51.0 cm
Spunner and Gray collection

196 Jane Yalunga (Wyndham, b. 1974)
Gija, Nangari
Old woman, 2009
lithograph, ed. 9/30
18.0 × 23.0 cm
Basil Hall Editions Darwin
Spunner and Gray collection

197 **Photographs and newspaper clippings of Brian Barnett OAM**, c. 1965
silver gelatin print and newspaper print
various sizes
Collection of Brian Barnett OAM

198 **Platypus: Poisons a fisherman**
newspaper article, n.d.
7.0 × 12.0 cm
Collection of Brian Barnett OAM

199 Sharon West (Australia)
Professor Halford specimen jar, 2013
mixed media
27.0 × 19.0 × 19.0 cm
Artist's collection

200 **Ron Richards, Mathoura, NSW Gulph River 6ft black snake**, 20 October 1962
shoelace used to measure snakes
cotton
18.0 × 10.5 cm
Collection of Brian Barnett OAM

201 **Running shoe with suspected death adder fang marks**, c. 2000
leather, rubber
23.0 × 10.0 × 12.5 cm
Loaned by Peter Mirtschin, Venom Supplies Pty Ltd

202 **Set of scales used by Charles Tanner**, c. 1960
wood, glass and metal
39.8 × 41.5 × 23.5 cm
Collection of Brian Barnett OAM

203 Daisy Nakamarra (Australia, b. 1936)
Luritja, Papunya
Snake, n.d.
ceramic
46.0 × 5.0 × 3.0 cm
Spunner and Gray collection

204 Artist unknown
Mutitjulu Community
Snake, c. 1980
wood
54.0 × 8.0 × 2.5 cm
Private collection

205 Cecil Francis Puruntatameri (1972–1996)
Nguiu, Bathurst Island
Dreaming: Kirrirlima (Jungle Fowl)
Skin Group: Burula & Japajapunga
Snake platter, 1994
ceramic; marked CFP 94
44.0 × 28.0 × 4.5 cm
Spunner and Gray collection

206 **Snake prised from showman's arm**
newspaper article, n.d.
9.0 × 15.5 cm
Collection of Brian Barnett OAM

207 The Natural Confectionery Co., Australia
Snakes, 2013
sugar
21.0 × 13.0 cm
Private collection

208 Djoyita
Gunwinggu
Oenpelli, NT
Snakes (death adders), c. 1980s
ochre on bark
69.0 × 5.6 cm
Private collection

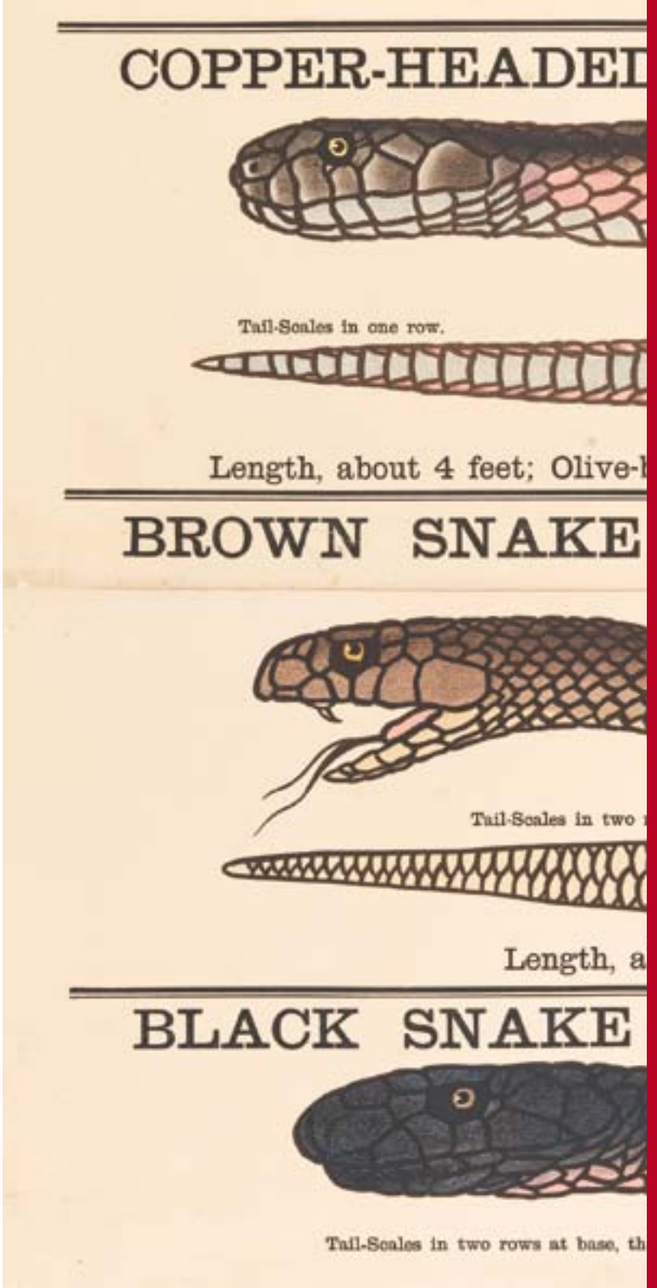
209 Berlei
Stockings, c. 2012
nylon
72.0 × 18.0 cm
Private collection

210 May Gibbs (1877–1969)
The complete adventures of Snugglepot and Cuddlepie
Melbourne: Angus and Robertson, 1977 [1946]
24.5 × 19.0 cm
Private collection

211 Sharon West (Australia)
This looks like a good place for a village, 2012
mixed media
32.0 × 63.0 × 44.0 cm
Artist's collection

212 **Whiskey bottle**, c. 1860
glass
25.0 × 14.0 × 14.0 cm
Caswell Collection

213 Homebrand
White vinegar, c. 2010
plastic, ink on paper and vinegar
25.0 × 12.0 × 9.0 cm
Private collection



The Medical History Museum in the Faculty of Medicine, Dentistry and Health Sciences at the University of Melbourne is the oldest and finest collection of its type associated with a medical school in Australia. Established in 1967 by Kenneth Russell, a professor of anatomy, with support from the Wellcome Trust, London, the museum covers the history of the Melbourne Medical School and the broader history of medicine in Australia and overseas.

The purpose of the museum is to encourage, through direct engagement with its collections, appreciation and understanding of the history of medicine and its role in society. The museum stimulates active learning through research, teaching and dialogue among communities of students, faculty, scholars, alumni and the wider public.

Further information on the museum can be found at museum.medicine.unimelb.edu.au.

Front cover: Photographer unknown, **Donald Thomson milks venom from a taipan, *Oxyuranus sp.*, Cape York Peninsula, Queensland**, 1928 (detail) (see pages 94–5)

Back cover: CSL, **Tiger snake antivenene instructions**, 1953 (detail) (cat. 157)

Inside front cover: Arthur Bartholomew, **Tiger snake *Notechis scutatus***, c. 1870 (detail) (cat. 161) (see page 79)

Inside front back: Education Department of Victoria, **Dangerous snakes of Victoria, indicated by Professor McCoy**, 1877 (detail) (cat. 150) (see pages 76–7)

Cover flap: Denis Brothers & Co., **The James Beaney Medal for Surgery awarded to Dr Charles J Trood**, 1877 (cat. 50) (see page 73)

COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF HEALTH

Commonwealth Serum Laboratories, Melbourne, Australia.

TREATMENT OF SNAKE-BITE IN AUSTRALIA

The principles underlying treatment for snake-bite are:—

1. **Prevent** or retard the absorption of venom into the general circulation (by ligature, etc.).
2. **Remove** venom from the bitten part as much as possible, (by washing, suction, incision, excision, etc.).
3. **Neutralise** absorbed venom (by antivenene).

URGENT

1. APPLY LIGATURE

   around a single-boned portion of a limb between the bite and the heart and keep the patient absolutely at rest.

2. REMOVE VENOM FROM THE BITTEN PART

   by washing, suction, incision and local venesection.

3. INJECT TIGER-SNAKE ANTIVENENE

4. PLACE PATIENT AT REST

   under no circumstances keep patient walking about. Observe closely for persistence of symptoms. Give more antivenene if needed.