Each year up to 5.4 million people are bitten by snakes globally. This can result in as many as 125,000 deaths and up to 400,000 permanent disabilities. But despite these dire statistics snake bite is a treatable disease.

ABOUT AVRU
The Australian Venom Research Unit (AVRU) works to prevent deaths caused by venomous snakes, and improve the medical treatment of snake bite nationally and internationally.

The Unit’s current focus is Papua New Guinea (PNG), where up to 1,000 people each year die from snake bites.

The work in PNG has been a good test case, where an affordable and sustainable antivenom treatment has been developed for one of the most lethal snakes in the world in a challenging setting. The antivenom is currently in clinical trials in Port Moresby, and significant potential exists to translate this research into Africa, Asia and even at home here in Australia.

AVRU is a recognised centre of excellence in the Asia-Pacific Region. Founded in 1994 by venom research pioneer, the late Associate Professor Struan Sutherland AO, AVRU strives to create knowledge and innovative pathways that will reduce the burden of venom-related injury and mortality and lead to new discoveries that benefit individuals and communities.

SNake BITE: A FORGOTTEN DISEASE
Snake bite is a neglected disease that predominantly affects the lives of poor rural people in developing tropical nations. Most victims of snake bite lack access to safe, effective and affordable antivenom, and even when these are available, they don’t have the health workers with the right training to manage it.

Globally there may be as many as 5.4 million snake bites each year, resulting in up to 125,000 deaths and leaving as many as 400,000 people suffering permanent disability, including limb disfigurement and amputation.

The World Health Organisation recently recognised the importance of snake bite adding it to the list of Neglected Tropical Diseases.
PAPUA NEW GUINEA'S SNAKE BITE BURDEN

Papua New Guinea (PNG) has one of the highest localised snake bite rates in the world. In some parts of PNG, snake bite mortality rates can be three times higher than those from other diseases such as malaria or tuberculosis.

In southern PNG Papuan taipan snakes cause more than 90% of all cases of envenoming admitted to Port Moresby General Hospital. This accounts for 60% of all ventilator bed-days in its ICU.

Up to 63% of victims are under 25 years of age, and nearly half of all fatalities involve children. Injuries suffered include spontaneous bleeding, irreversible paralysis, and sometimes muscle damage, heart rhythm problems and acute kidney injury.

Despite these dire statistics, snake bite is a treatable disease, and early administration of effective antivenom can be life-saving.

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THE WORK WE DO

Since 2005 the University of Melbourne, in partnership with the University of Papua New Guinea (UPNG) and Port Moresby General Hospital have sought to address the problem of snake bite in PNG. Our approach is a multidisciplinary model that embraces research, public education, health worker training and improved treatment of envenomed patients. The goals are to reduce the number of deaths due to snake bite, and to improve patient care so that mortality is reduced. In doing so we aim to:

- build local scientific and medical capacity;
- improve access to safe, affordable and life-saving antivenoms;
- remove gaps in our knowledge of snake bite in PNG;
- translate our findings into practice; and
- ensure program sustainability into the future.

ACHIEVEMENTS

Since AVRU was established, awareness of snake bite as an important public health issue in PNG has significantly increased along with improved outcomes in many of the project goals.

Improved Antivenom Access

- Our major achievement has been collaborative development of a new GMP-compliant, ‘Papuan taipan antivenom ICP’ for use in the treatment of Papuan taipan envenoming. At a cost of approximately US$150/vial, the new ICP taipan antivenom will substantially reduce current treatment costs, while improving its availability and patient outcomes.

Local Capacity Building

- 2004: Coordination of a national training course in snake bite management; after management and supervision of UPNG students and PNG doctors undertaking the Master of Medicine program
- 2005: Serpentarium is established to house venomous snakes and produce venoms for use in antivenom production and toxicology research
- 2012: Opening of the Charles Campbell Toxinology Centre laboratory at the UPNG medical school and the CCTC Snake bite Clinic in the emergency department at Port Moresby General Hospital
- 2013: Launched a Mobile Intensive Care Ambulance retrieval service as a means of providing advanced medical services to rural snake bite patients who would otherwise die before reaching hospital.

Education and translating research into practice

- Substantially improved the knowledge of snake bite injury in PNG by publishing many of our findings and developing new snake bite management protocols which have been adopted and supported by medical professionals in PNG
- Increased utilisation of appropriate first aid methods by members of the public and by health workers through the dissemination of first aid leaflets and the conduct of training programs
- Developed and disseminated educational and training resources for medical personnel and health workers
- Actively involved in the teaching of fifth year MBBS students at UPNG, and are negotiating a new Memorandum of Agreement with UPNG which will see us further integrate our activities with the medical school from 2015-2020.
OUR IMPACT

Snake bite treatment

Our Snake Bite Clinic in Port Moresby treats 325-400 snake bite victims each year, including 50-60 critically ill rural patients whose lives are saved by the medical teams we deploy to retrieve them in our Mobile Intensive Care Ambulance. Without this life-saving service many of these patients would die before ever arriving at hospital. Our medical staff provide expert advice by telephone to remote health centre staff managing snake bite cases in other areas of PNG, and our snake bite treatment protocols are in use throughout PNG. In Port Moresby, the introduction of our protocols for the treatment of snake bite during 2006-2008 resulted in case fatality rates of 14.9% dropping to just 2.2%.

Education and training

Our staff visit dozens of communities in PNG’s Central Province each year to provide snake bite awareness and prevention education, to teach appropriate first aid, and to collect venomous snakes for research and antivenom production. We make 25-30 annual visits to rural health centres to provide critical training opportunities for health workers and teach them modern airway and breathing rescue skills that benefit all of their critically ill emergency patients. Where we can, we donate medical equipment to health centres and train staff to use and care for the new items. For as little as A$700 we can provide a health centre with all of the basic equipment needed to save the life of a patient with airway and breathing problems, and for A$25 we can provide a snake bite first aid kit to a rural family or small community.

PAPUA NEW GUINEA: OUR VISION FOR THE FUTURE

Our goal in PNG is to save the lives of snake bite patients by providing leadership, advocacy and applied practical solutions. Snake bite is a treatable medical emergency and we hope to deliver the capacity to enable PNG to eventually produce antivenoms locally and combine their wider use with sustained community and health worker training programs.

Our current programs have the potential to be expanded. Our ambition is to establish training places in clinical toxicology for doctors and other health workers from elsewhere in PNG, support them to learn how to manage snake bite cases in our PMGH Snake Bite Clinic, and then establish satellite clinics in their own hospitals.

In the laboratory, we still have much to learn about snake venoms and their effects on patients. We are already working to make further improvements to the immunisation protocols used to produce our Papuan taipan antivenom ICP with the specific aim of enhancing the neutralisation of toxins that cause irreversible paralysis. In parallel we want to develop an affordable bivalent antivenom for the treatment of death adder and small-eyed snake envenoming.

In a broader context, we are committed to developing local leadership. We hope to expand the project workforce by recruiting postgraduate and postdoctoral students and to expand the number of postgraduate training places within our project. By developing and fitting out laboratory facilities with modern, cutting edge technologies we hope to expose students and staff to dynamic research environments that are internationally competitive, and will enable them to undertake research that is of significant benefit to PNG.

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<thead>
<tr>
<th>Year</th>
<th>Fatality Rate</th>
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<tr>
<td>2006</td>
<td>14.9%</td>
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<tr>
<td>2008</td>
<td>2.2%</td>
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14.9% dropping to just 2.2%

Educating rural people about snake bite prevention and safe, appropriate first aid is helping to reduce the burden of injury.
AVRU’S GLOBAL AGENDA
AVRU is committed to taking the lessons we have learned in Papua New Guinea and applying them in other settings, throughout the world, to alleviate the burden of injury, disability and death due to snake bites.

Sub-Saharan Africa
In sub-Saharan Africa as little as 2.5% of the amount of effective antivenom needed each year is available, opening doors to a flood of ineffective, unsafe and unscrupulously marketed products that undermine confidence in immunotherapy at the expense of many lives. At least 20,000 people a year die in Africa after snake bites, with many thousands more suffering debilitating local tissue destruction that leaves victims maimed and often permanently disabled.

In sub-Saharan Africa the estimated economic cost of snake bite is US$1.2 billion, with 937,995 lost disability-adjusted life years (DALYS) lost per 100,000 cases. Together with local and international collaborators AVRU is eager to explore new pathways for designing novel antivenoms to address this crisis. Our goal is to create a new generation of biotherapeutic treatments for snake bite which we could deliver at a cost of US$30.68-42.30 for every 100,000 antivenom treatments, averting up to 817,740 DALYS, and preventing 13,600 deaths.

India and Australia
In India where snake bite causes over 45,000 deaths each year, we have begun exploring collaborative research projects to improve the production of antivenoms for use in South Asia which could potentially benefit as many as 2 million people a year.

At home in Australia the venoms of brown snakes can cause sudden cardiovascular collapse and early death. We are embarking on a project focused on producing a new biotherapeutic designed to prevent these pre-hospital deaths.

At the core of AVRU’s vision for revolutionising the treatment of snake bites, is our philosophy that time-critical life-saving medicines such as antivenom must be safe, effective and affordable. We also believe that as a wealthy and resourceful nation, Australia is eminently well positioned to contribute expertise to addressing this scourge of the poor rural tropics, and to devise innovative ways to fund the research and the translation of that research into real solutions.

By using our experience in PNG as a template, and continuing to further refine and test our model through our work there and in new settings around the world we will make Australia a world leader in the treatment of snake bite envenoming, and save many thousands of lives at home and abroad for many decades to come.

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