

Impact Objectives

- Change the landscape of the University and the biomedical precinct of Melbourne, Australia to allow it to become a powerhouse in the field of biomedicine, creating not only knowledge but aiding the formation of the next generation of academics and industrial researchers
- Make advances in chronic respiratory, neuropsychiatric/neurodegenerative and neglected diseases
- Improve the prognosis of snakebite victims worldwide through anti-venom design, development and production

Saving, changing and repairing lives

Professors Daniel Hoyer and Alastair Stewart and Dr David Williams discuss their far-reaching work in biomedicine and their significant impact on the research, policy and practice landscapes



From left to right: Professor Daniel Hoyer, Professor Alastair Stewart and Dr David Williams

Could you begin by introducing yourself?

DH: Since December 2012, I have been Professor, Chair and Head of the Department of Pharmacology and Therapeutics at the University of Melbourne, Australia. In 2013, the Lung Health Research Centre (LHRC) was established under the leadership of Professors Gary Anderson and Alastair Stewart, as a university centre to study and treat lung diseases in collaboration with Royal Melbourne Hospital, schools of Physiotherapy and Nursing and industry partners. In 2014, I reorganised the Australian Venom Research Unit (AVRU), which, under the leadership of Dr David Williams, places a strong emphasis on preclinical and clinical snake venom research, education and engagement; fostering strong links with industry, governments and non-government organisations in Europe, Asia and South America, especially WHO. In 2015, Therapeutic Technologies Research Initiative (TTRI) was established by Alastair Stewart with colleagues across the precinct especially in engineering. Also in 2015, Project Mercury was initiated with Professor Bill Charman at Monash Institute of Pharmaceutical Sciences (MIPS) in Victoria, Australia and support from the Victorian government and as a result, BioCurate PTY Ltd

was established as a joint venture between our two universities in 2016.

What motivates you in your day-to-day work?

DH: My goal is to contribute to new drugs and treatment modalities, impact on public health, and train the next generation of biomedical research professionals to work in industry, biotech, government, hospitals and universities. My inspiration and motivation comes from the very rich environment and capabilities offered by the Melbourne biomedical precinct.

DW: I have been fortunate enough to be given an opportunity to use the skills I have accumulated in the course of my life to both directly and indirectly intervene and help save the lives of snakebite victims, and nothing motivates me more than playing a part in giving someone back their life.

When our Global Snakebite Initiative took the stage at the World Health Assembly in Geneva last May to put the case for global action to ease the burden of suffering due to snakebite envenoming, I realised for the first time that it might really be possible to make a difference in the lives of far more people than I could have ever hoped to reach individually.

What are the key research strands currently underway in the Department of Pharmacology and Therapeutics?

DH: Lung health research is a major strand, venom research is another, with significant

efforts in cardiovascular, childhood, neurological and neurodegenerative diseases, and a special emphasis on clinical translation and drug development efforts in collaboration with Monash University and many other partners.

How do you expect your work to impact on society?

DH: Long term, we hope to turn the Melbourne precinct into a biomedical powerhouse, similar to what is happening in Boston in the US and Cambridge in the UK. In both cases, universities, biotech and big pharma, with the active support of local governments, work together and have completely changed the landscape from a purely academic centre of excellence into an integrated biomedical R&D hub that benefits the creation of knowledge, forms the next generation of academics, industrial researchers and entrepreneurs, and generates high-value drugs and devices and a highly-trained workforce.

DW: We have the ability to save, change and repair the lives of snakebite victims and others affected by venomous bites and stings. Our work can make a difference to an individual's future and to the collective future lives of hundreds of thousands of people in years to come. This is why science exists – to aid and help humanity and to make our lives better; to solve challenges both big and small; and to change the way we think and view our world. AVRU's contribution is growing every year, and my job is to make sure that this growth continues.



Thinking outside the box

The Department of Pharmacology and Therapeutics at the University of Melbourne, Australia is home to a number of projects and strands encompassed within several broad research themes. It is a lively hub of collaboration, multi-disciplinarity and innovation making impressive headway and leaving its mark

The Department of Pharmacology and the Therapeutics at the University of Melbourne, Australia includes key research groups, among them the Lung Health Research Centre (LHRC), the Therapeutic Technologies Research Initiative (TTRI) and the Australian Venom Research Unit (AVRU). BioCurate PTY Ltd, a major joint venture with Monash University to promote all aspects of drug development in Melbourne and Australia, was conceptualised by Professors Daniel Hoyer and Bill Charman (MIPS).

Professor Daniel Hoyer is Head and Chair of the department, while Professor Alastair Stewart is Head of LHRC and TTRI and Dr David Williams is Head of AVRU in Melbourne. Williams is working in the area of snakebite in Papua New Guinea (PNG) as Head of the Charles Campbell Toxinology Centre at the School of Medicine and Health Sciences at the University of Papua New Guinea.

All of the initiatives underway in the department owe their success largely to the expertise and talent of the team members, and a strong emphasis on collaborations, a key tenet running through the Department. 'LHRC, TTRI, AVRU and BioCurate only work because they are based on multiple collaboration between preclinical and clinical researchers, colleagues from different faculties, schools, universities, academic and industrial researchers, and strong international networks,' Hoyer explains. AVRU, for example, has major collaborators in Australia, the UK, Spain, Costa Rica, Brazil, India, Singapore, PNG, Columbia, Thailand, Vietnam and Kenya, among others.

BREAKING BARRIERS

Hoyer has extensive experience overseeing collaborations across Europe and the US, and has proactively worked to break down the barriers between industry and academia by forging collaborations between learned societies, big pharma and biotech and established institutions. He was successful in bridging the gap between preclinical and clinical researchers at Novartis when he started a translational research team, and has also seen lasting success in his incorporation of centres and initiatives such as LHRC and TTRI. 'These include a mix of researchers from very different preclinical and clinical backgrounds, and also colleagues from engineering, physiotherapy and nursing, population health and industry,' he explains.

Hoyer's research ranges from cardiovascular to neuropsychiatry, gastrointestinal and oncology. His most recent work has been on epilepsy and sleep disorders. He has also played a pivotal role in training the next generation of researchers in the field: 'I am proud to have trained a number of honours, masters, PhDs and postdocs of very diverse backgrounds and who followed very successful careers in academia, industry, biotech or various government agencies,' he extrapolates.

SAVING LIVES

In addition to being head of AVRU, Williams is also the CEO of the Global Snakebite Initiative, an NGO endorsed by the International Society on Toxinology (IST) to promote direct action to improve the prognosis of snakebite victims around the world. His speciality areas are the design, development and production

of antivenoms; clinical trials; first aid for snakebites; and health worker training and education. 'I am fascinated by venoms and toxins, the animals that produce them, and the effects they exert on the envenomed individual,' he reveals.

The team he heads up is focused on preclinical and clinical toxinology research and venomous injury surveillance, medical and community education. He has led several epidemiological and clinical snakebite trials in PNG, and forged numerous successful research collaborations. He has contributed new and innovative strategies to improve life-saving access to antivenoms, particularly in the developing world.

Williams is active in educating people in PNG about the dangers of snakebites, teaching prevention, first aid and appropriate treatment-seeking behaviours, and was successful in developing an antivenom at a significantly lower cost than the standard, and that has a long shelf life in jungle heat.

'Snakebite envenoming isn't a disease that should kill anyone,' says Williams. 'For more than 120 years we have had the ability to produce effective treatments for snakebite envenoming, but the harsh reality is that for many people these treatments are either unavailable or unaffordable. Snakebite affects over five million victims each year, and at least 125,000 people lose their lives.' Williams wants to shine the spotlight on this issue which he believes demands a much greater focus: 'I

LHRC, TTRI, AVRU and Project Mercury only work because they are based on multiple collaborations between preclinical and clinical researchers, colleagues from different faculties and schools, academic and industrial researchers, and strong international networks

would like to save hundreds of thousands of lives through my efforts to get the world to sit up and take notice of a problem that is so neglected at present,' he explains.

EXPERT ADVOCACY

LHRC conducts leading research to promote further understanding of the mechanisms of fibrosis and tissue remodelling. 'New small molecule and protein drugs discovered by collaborative activities involving LHRC are advancing towards clinical evaluation,' Hoyer explains. The centre performs advocacy work that seeks to improve lung health through excellence in basic and translational research.

It has an output of 70 published papers every year and its members operate in leadership roles in professional organisations including the Thoracic Society of Australia and New Zealand and the American Thoracic Society, as well as consulting with pharma and biotech industry. 'Our efforts are multi-layered and involve working within our professional bodies to promote lung research, as well as engaging through media with the public to raise awareness of the importance of lung disease,' Hoyer explains.

LHRC focuses on research training and offers an expanded teaching curriculum. Its goal is to attract and retain the best researchers, enhancing the centre's competitiveness on an international level.

DRUG DISCOVERY

TTRI is seeking to transform drug screening processes through the development of new applications of organ-on-a-chip technology and incorporating principles from mechanopharmacology (a discipline at the interface of biology and engineering that examines the effects of physical forces on the response of cells, tissues and organs to drugs). 'This approach seeks to apply and integrate knowledge of lung (patho)physiology, mechanobiology and pharmacology to establish the effects of cellular mechanics on the response of cells, tissues and organs to drug treatment,' Hoyer explains. Ultimately, the TTRI

team is working to improve how drugs are qualified to progress to clinical trials, thereby reducing the number of expensive failures in phase II.

TTRI's goal is to bring together the expertise that is needed to achieve drug screening in microfluidic environments, with a focus on the use of human cell culture. Its steering committee helps facilitate collaborative and interdisciplinary research, by involving staff from across the university and also helping facilitate connections and introductions externally. TTRI collaborates with LHRC to develop relationships with groups interested in air quality.

BLOSSOMING COLLABORATIONS

Project Mercury is a historic collaboration between the Universities of Monash and Melbourne that led to BioCurate PTY Ltd. The working group was established with a view to exploring a deeper collaboration between the two universities in the field of biomedical research and drug development. The team is presently focused on pharmaceuticals and has plans to address other aspects in the biomedical space in the future. The goal of the collaboration is to provide a drug development catalyst and it is attracting talent from across the globe, as well as the interest of pharmaceutical companies.

Looking ahead, the teams hope their collaborative, multidisciplinary work will continue to blossom, yielding impressive results. 'I expect that the combined efforts in LHRC and TTRI will lead to new medicines and tools to treat, explore and better understand lung diseases primarily, but not only,' Hoyer concludes. 'I expect AVRU to be a major player in snakebites globally and that a number of initiatives will come through in partnership with WHO to improve the production, quality control and dissemination of antivenoms in developing countries. I expect BioCurate to contribute to better quality clinical trials and new treatments.'

Project Insights

FUNDING

NHMRC • ARC • DOH • DFAT • WHO • University of Melbourne, Australia and Victorian State Government

PARTICIPANTS

University of Melbourne, Australia
• University of Papua New Guinea •
Monash University, Australia

CONTACT

Professor Daniel Hoyer
Project Coordinator

T: + 61-3-9035 7119

E: d.hoyer@unimelb.edu.au;
pharmacology-info@unimelb.edu.au

W: [biomedsciences.unimelb.edu.au/
departments/pharmacology](http://biomedsciences.unimelb.edu.au/departments/pharmacology)

PROJECT COORDINATOR BIO

Professor Daniel Hoyer Professor Daniel Hoyer, a French national born in Switzerland, is Chair and Head of the Department of Pharmacology and Therapeutics and Deputy Head of the school of Biomedical Sciences, at the University of Melbourne. He is also an honorary professorial fellow at the Florey Institute of Neuroscience and Mental Health, and adjunct Professor at the Scripps Research Institute In La Jolla, California, US. He has contributed to over 335 publications, and is an ISI highly cited scientist with more than 26,500 citations. Hoyer worked over 30 years with Sandoz/Novartis.

