

# ANNALS OF THE ACTM

## AN INTERNATIONAL JOURNAL OF TROPICAL & TRAVEL MEDICINE

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ASM / ACTM PARASITOLOGY MASTERCLASS AND  
ACTM / QTHA ANNUAL CONFERENCE: 14-17 JULY 2011

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# ANNALS OF THE ACTM

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JULY 2011

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*Cover photo: The Australian Institute of Tropical Medicine in 1916 (photo courtesy of James Cook University)*

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# WELCOME MESSAGES

## Welcome from the Australian Society for Microbiology (ASM) Parasitology and Tropical Medicine Special Interest Group, and the National Working Group on Strongyloides

### Dr Richard Bradbury

Chairperson, Australian Society for Microbiology (ASM) Parasitology and Tropical Medicine Special Interest Group

### Professor Richard Speare

Chairperson, National Working Group on Strongyloides (NWS)

It is with great pleasure that we would like to welcome delegates to the 3<sup>rd</sup> Australian Society for Microbiology (ASM) / Australasian College of Tropical Medicine (ACTM) Parasitology Masterclass - incorporating the 6th National Workshop on Strongyloides, held this year in the tropical locale of Cairns, North Queensland. This year, our respective groups have joined together to offer a full and exciting program in all areas of Parasitology. We have held this meeting in conjunction with the ACTM / Queensland Tropical Health Alliance (QTHA) Annual Conference, and directly following the Australian Society for Parasitology (ASP) National Scientific Meeting. This will allow delegates to enjoy a full week of Parasitology and Tropical Medicine provided by several eminent societies in the field. We would like to take this opportunity to thank the organising committee for their tireless work in making this meeting a possibility. We would also like to thank all delegates registered for the meeting. It is only through your active support and interest in the field that we can continue to provide events such as this and promote Parasitology and Tropical Medicine as a discipline in our many professions.

## Welcome from the Australasian College of Tropical Medicine (ACTM) and the Queensland Tropical Health Alliance (QTHA)

### Associate Professor David Porter

President, Australasian College of Tropical Medicine (ACTM)

### Professor Louis Schofield

President, Queensland Tropical Health Alliance (QTHA)

On behalf of the ACTM and the QTHA we extend a very warm welcome to Delegates attending the 2011 Cairns Tropical Medicine Conference. May 29th this year marked the 20th Anniversary of the formation of the ACTM, and the past year has also seen the inauguration of the QTHA. As current College President, and QTHA Director, respectively, we feel privileged to work in this field with the range of people who have made this conference possible. This meeting is an important event in both the College and Alliance Calenders, and we appreciate your attendance in order to share your the passion for the health of people in tropical regions. Both institutions are delighted to be co-hosting this conference. We would like to take this opportunity to especially thank Richard Bradbury and his team for their tireless efforts in convening this meeting. This collaborative conference has attracted a range of local, interstate and international delegates, with a wealth of knowledge and experience in tropical health. It presents a great opportunity to discuss the wide variety of Tropical Health topics being presented, and to establish collegiate friendships into the future. We trust the network opportunities will serve the objectives of both ACTM and QTHA, you the delegates, and ultimately the health of people in the tropics. Welcome to Cairns, and enjoy the conference!

## Acknowledgements

We would like to formally acknowledge all the members of the 2011 Organising Committee who kindly assisted in making the conference possible: Richard Bradbury, Andrew Butcher, Tony Jennings, Lisa Jones, Peter Leggat, John McBride, Wendy Page, David Porter, Norbert Ryan, Harsha Sheorey, Jenny Shield, Ross Spark, Rick Speare and Elizabeth Wickham.

## SPONSOR ACKNOWLEDGEMENTS

# ASM/ACTM Parasitology Masterclass ACTM/QTHA Annual Conference

Pullman Reef Hotel, Cairns, Queensland, Australia: Thursday 14 to Sunday 17 July, 2011



# MASTERCLASS PROGRAM

## ASM/ACTM Parasitology Masterclass 2011 (Incorporating the 6<sup>th</sup> National Strongyloides Workshop) Pullman Reef Hotel, Cairns, Queensland, Australia: 14-16 July 2011

Thursday 14 July 2011

MICHAELMAS CAY BALLROOM

URCHINS 2, 3 & 4

TIME	TOPIC	SPEAKER
08:30-09:00	Registration, coffee	
09:00-09:10	Chairman's Welcome	Richard Bradbury
09:10-09:50	<b>Keynote Speaker:</b> <i>Plasmodium knowlesi</i> infection in Humans	Balbir Singh
09:50-10:25	Parasitic and Tropical Diseases with Skin Manifestations	Sujatha Fernando
10:25-11:00	Morning Tea - URCHINS	
<b>Session Chair: Richard Bradbury</b>		
11:00-11:35	Hookworm in Australia	Rick Speare
11:35-12:10	Gnathostomiasis: An Emerging Parasitic Disease in Southern Africa	John Freat
12:10-13:10	Lunch - URCHINS	
<b>Session Chair: Tony Jennings</b>		
13:10-13:45	Epidemiology of a Scabies Outbreak During an Ivermectin MDA in a Remote Aboriginal Community in the Northern Territory	Therese Kearns
13:45-14:20	Diagnosis of Parasitic Infections: The State of Play	Rogan Lee
14:20-14:55	Parasitic Infections in Newly Arrived Refugees in Australia	Thomas Schulz
14:55-15:30	Antiparasitic Treatments - What's Old, What's New?	Harsha Sheorey
15:30-16:05	Afternoon Tea - URCHINS	
<b>Session Chair: Rick Speare</b>		
16:05-16:55	<b>Keynote Speaker:</b> Trematodes in Eastern Asia and the Pacific Islands	David Blair
17:00-17:30	ASM Parasitology & Tropical Medicine Special Interest Group AGM	
19:00-22:00	Conference Dinner - TAMARIND RESTAURANT	

Area available for one on one microscopy and other training. Slides and microscopes to be sourced from industry/JCU/ Others. Preserved specimens of parasites on display. Plus poster display area

TIME	TOPIC	SPEAKER
07:30-08:00	Registration, coffee	
08:00-08:05	NSWG Chairman's Welcome	Rick Speare
<b>Session 1: The Parasite and Its Host and Diagnosis Session Chair: Andrew Butcher</b>		
08:05-08:35	What is Different About <i>Strongyloides stercoralis</i> ?	Rick Speare
08:35-09:10	<i>Strongyloides stercoralis</i> and HTLV-1	Lloyd Einsiedel
09:10-09:45	Case Histories (15 mins) - Lessons from Case Histories - A Piggy Back Journey	Wendy Page Harsha Sheorey
09:45-10:05	The Diagnosis of Strongyloidiasis	Matthew Watts
10:05-10:25	Strongyloides Serology Testing at VIDRL	Jennie Leydon
10:25-10:45	Diagnosis of <i>Strongyloides stercoralis</i> in Different Communities in Dhaka, Bangladesh	Yasmin Sultana
10:45-11:10	Morning Tea - URCHINS	
<b>Session 2: What Can We Do About It? Session Chair: Rick Speare</b>		
11:10-11:30	Ivermectin: Learn from PBS Stats	Rollo Manning
11:30-11:50	Assessing the potential for control of the nematode, <i>Strongyloides stercoralis</i> using a carboxylate/boron based compound	Francis O'Donahoo
11:50-12:10	Developing Educational Tools for a Scabies and Strongyloides Testing and Treatment Program	Jenny Shield
12:10-13:00	Lunch - URCHINS	
<b>Session 3: Epidemiology and Treatment Programs Session Chair: Jenny Shields</b>		
13:00-13:20	Strongyloides Serology, Queensland 2006-2011	Richard Lord
13:20-13:40	Strongyloides Treatment at Nguuu Tiwi Islands	Peter Bowman, Jan Bowman
13:40-14:00	Strongyloides in Kuranda – An Overview Since 2006	Terry Eager
14:00-14:05	Discussion	
14:05-14:25	Epidemiology of Strongyloidiasis and an Ivermectin MDA in a Remote Aboriginal Community in the Northern Territory	Therese Kearns

Area available for one on one microscopy and other training. Slides and microscopes to be sourced from industry/JCU/ Others. Preserved specimens of parasites on display. Plus poster display area

Friday 15 July 2011

MICHAELIMAS CAY BALLROOM

URCHINS 2, 3 & 4

TIME	TOPIC	SPEAKER
14:25-14:45	Strongyloides Infection in Newly Arrived Refugees: The Brisbane Clinic Experience	Megan Evans, Sarah Sheridan
14:45-15:05	Acute Strongyloidiasis in Travellers to Endemic Regions	Miles Beaman
15:05-15:10	Discussion	
15:10-15:40	Afternoon Tea - URCHINS	
<b>Session 4: Towards a National Parasite Control Program Session Chair: Wendy page</b>		
15:40-16:05	Criteria for Notifiability Status for Strongyloidiasis	Rick Speare
16:05-16:30	Developing a National Strongyloides Register: Rheumatic Heart Disease Information Systems and How They Work	Sara Noonan
16:30-17:30	National Strongyloides Working Group Annual General Meeting	Rick Speare / Wendy Page
19:30-21:30	ACTM / QTHA Annual Conference Welcome Mixer - ARLINGTON BAR	

Area available for one on one microscopy and other training. Slides and microscopes to be sourced from industry/JCU/ Others. Preserved specimens of parasites on display. Plus poster display area

Saturday 16 July 2011

URCHINS ROOM 3

TIME	TOPIC
08:30-09:00	Morning Tea - URCHINS
09:00-10:40	National Strongyloides Working Group meeting - Further discussions and open forum
10:40-11:00	Morning Tea - URCHINS
11:00-12:10	National Strongyloides Working Group meeting - Further discussions and open forum

# CONFERENCE PROGRAM

## ACTM / QTHA Annual Conference

### Pullman Reef Hotel, Cairns, Queensland, Australia: 16-17 July 2011

Saturday 16 July 2011

MICHAELMAS CAY BALLROOM		REEF ROOM	
TIME	TOPIC	SPEAKER	TITLE
09:00-09:30	ACTM President's Welcome	David Porter	
09:30-10:40	<b>Keynote Speaker:</b> Elimination of Lymphatic Filariasis from Haiti – Despite the Challenges, a Goal Within Reach?	Patrick Lammie	
10:40-11:00	Morning Tea - URCHINS		
<b>Transformational Technologies Session Chair: Kathy Andrews</b>			
11:00-11:35	Australian Bio-diversity Curing Neglected Diseases	Ron Quinn	<b>Infectious Diseases Session Chair: Ian Wronski</b>
11:35-12:10	Glycomics Approach to Tropical Disease	Mark von Itzstein	11:00-11:35 Dengue Fever: Can We Learn from History?
12:10-13:00	Lunch - URCHINS		11:35-12:10 Leptospirosis in Northern Queensland
<b>Transformational Technologies Session Chair: Don Gardner</b>			
13:00-13:35	Genomes to Vaccines: Translating Genomic Sequence Data into Effective Public Health Interventions	Denise Doolan	<b>Working In the Developing World Session Chair: Rick Speare</b>
13:35-14:10	Development of Vaccines for Blood-Feeding Human Helminths	Alex Loukas	13:00-13:35 The Power is in the Hands of the People
14:10-14:45	The Epidemiology and Control of Schistosomiasis in China and the Future Impact of the Three Gorges Dam	Don McManus	13:35-14:10 Nursing Education in Developing Countries
14:45-15:20	Afternoon Tea - URCHINS		14:10-14:45 Conducting Community Health Research in Tropical Countries: Reflections from Melanesia
15:20-16:30	<b>2011 Ashdown Oration</b> - Can Vaccines Contribute to the Malaria Eradication Agenda?	Louis Schofield	
16:30-17:00	The Future of Tropical Medicine - Panel Discussion	David Porter, Louis Schofield, Patrick Lammie	
17:00-17:30	Poster Presentations and Trade Mixer - URCHINS		
18:00-19:00	QTHA Sponsored Cocktail Mixer - POOLSIDE		
19:00-22:00	Stand Up Poolside Dinner - POOLSIDE		

TIME	TOPIC	SPEAKER	TIME	TOPIC	SPEAKER
08:30-09:00	Registration, coffee		07:00-09:00	ACTM 2011 AGM	Major General Alexander
<b>Disaster Response &amp; Disaster Medicine Session Chair: John Pearn</b>					
09:00-10:40	<b>Keynote Speaker:</b> Disaster Planning and Response - Keynote and Panel Discussion	Maj-Gen Mick Slater			
	Responding to Disasters - The View From North Queensland	Mark Little			
	Flood Related Infections – A Queensland Lab Experience	Smathi Chong			
10:40-11:00	Morning Tea - URCHINS				
<b>Emerging Infectious Diseases Session Chair: Ross Spark</b>					
11:00-11:35	Emerging Viral Diseases and What to do About Them	John Aaskov	11:00-11:20	Aspects of Mental Health and Substance Misuse in Remote Indigenous Communities – Prospects for Population-level Interventions	Alan Clough
11:35-12:10	Chikungunya Virus, Epidemics, Arthritic Disease, Models and Treatments	Andreas Suhrbier	11:20-11:40	Social Determinants of Health: Empowerment Through Increased Financial Capability	Jan Robertson
			11:40-12:10	High Incidence of Cannabis Use and Mental Health Impacts in Remote Cape York Aboriginal Communities	India Bohanna
12:10-13:00	Lunch - URCHINS				
<b>Australian Disease/Immunology Joint Session Session Chair: Natkunam Ketheesan</b>					
13:00-13:35	The Role of Scabies Mite Complement Inhibitors in Scabies and Associated Bacterial Disease	Katja Fischer	13:00-13:35	Community Health Service Delivery and Research at a Remote Solomon Islands Hospital	Humphress Harrington
13:35-14:10	Mosquito-borne Diseases in Australia: A Surprise Every Minute	Scott Ritchie	13:35-14:10	“One Flap of a Seagull’s Wings”	John Pearn
14:10-14:45	Melioidosis: Why is it so Common in Darwin?	Bart Currie	14:10-14:45	Mountains and Medicines: History and Medicines Use in Rural Nepal	Sue Heydon
14:45-15:20	Gut Inflammation: A Question of Immunological Checks and Balances	Nick Smith	14:45-15:20	Assays For Diagnosis Of Lymphatic Filariasis and the Diagnosis of Endemic versus Non-endemic Infections	Hayley Joseph
15:20-16:00	Afternoon Tea - URCHINS				
16:00-16:30	Closing Address	David Porter			

# SPEAKER BIOGRAPHIES

## ASM/ACTM Parasitology Masterclass and ACTM/QTHA Annual Conference Pullman Reef Hotel, Cairns, Queensland, Australia: 14-17 July 2011



### Associate Professor John Aaskov

Dr John Aaskov is Associate Professor of Immunology and Virology at the Institute of Health and Biomedical Innovation, Queensland University of Technology and Director of the World Health Organization Collaborating Centre for Arbovirus Reference and Research. His research interests include population dynamics of dengue viruses, Ross River virus vaccine, emerging infectious diseases, public health in Asia and the Pacific. Current projects include Vietnam Australia Dengue Project and dengue in Myanmar.



### Major General Paul Alexander

Major General Paul Alexander joined the Army in 1976. He has postgraduate qualifications in Sports Medicine, Tropical Medicine and Legal Medicine. He has previously held appointments in Victoria, Papua New Guinea and with the Special Air Service Regiment. He then spent time on exchange with the British Army and the US Army, working in the area of Capabilities, Combat and Doctrine Development and the redevelopment of battlefield hospital systems. He was Senior Medical Officer with the initial peacekeeping force to Bougainville. In 1998 he became Director Reserve Health Services for Army (Qld), and was later deployed to East Timor with the UN Peace Keeping Force. In 2004, he became Assistant Surgeon General ADF-Army, while continuing clinical practice in Queensland. In 2008, he was appointed Commander Joint Health, Surgeon General Australian Defence Force.



### Professor David Blair

David Blair spent some of his formative years in Africa, collecting freshwater fish and tropical diseases in that order. He completed a PhD at the University of Glasgow, Scotland, on trematode diseases of farmed trout. Since then he has held academic positions at Townsville in tropical Australia, and in New Zealand. He continues to investigate parasites, especially trematodes, occurring in all sorts of mainly tropical creatures, from dugongs, turtles and crocodiles to crayfish and isopods. A strong interest in the taxonomy and systematics of trematodes led to his involvement with projects on human lung-flukes (*Paragonimus* species) in various parts of Asia, notably China, Japan and India, and he has a network of collaborators there. This work had a strong molecular component as well as a traditional "morphological" element. Molecules have led on to projects studying schistosomes, liver flukes and other groups of parasites. Molecules have also taken David into the fields of bioinformatics and genomics. Mitochondrial genomics was the starting point of this line of work, but David was part of the team that published the entire genome of *Schistosoma japonicum* and he has also done population-genetic work on this species.



### Associate Professor Alan Clough

Associate Professor Alan Clough, James Cook University, is widely recognised in Australia for his significant contribution to research and practice in the challenging and often neglected field of substance use problems in Indigenous communities. He brings to his work the unique perspective of having lived and worked in remote Indigenous communities in the Northern Territory's 'Top End' for almost 20 years. His research has expand-

ed to include studies of alcohol-related assault around licensed premises in inner-city areas. He is also supporting studies of HIV/AIDS in PNG, research capacity building in the Solomon Islands and studies of containment strategies for H1N1 ('swine flu') in Indigenous communities.



### Professor Denise Doolan

Professor Denise Doolan is a molecular immunologist who heads the Molecular Vaccinology Laboratory at the Queensland Institute of Medical Research. Her research investigates the molecular basis of immunity to disease, with a focus on malaria and model systems that can inform the basic immunology, mechanisms and antigenic targets of immunity, and efficacy of candidate vaccines. She has specific expertise in the preclinical and clinical evaluation of molecular vaccine platforms (including plasmid DNA and recombinant virus vaccines), the delineation of mechanisms of cell mediated protective immunity, and the identification of novel vaccine candidates using immunomics and genome-wide screening approaches. Key interest areas include malaria, vaccine development, immunology and functional genomics.



### Dr Katja Fischer

Dr Katja Fischer is head of the Scabies laboratory at the Queensland Institute of Medical Research. She completed undergraduate training at the University of Freiburg, her PhD at the University of Wurzburg in Germany, followed by post-doc positions at QIMR. Her primary research focus is molecular medical parasitology. After ten years of Malaria research she joined the *Sarcoptes scabiei* Gene Discovery Project, opening entirely new opportunities for research on this neglected infectious disease previously inaccessible to molecular studies. Her laboratory's current focus is on scabies mite proteins interfering with host defence, in particular with complement. Key interest areas are molecular parasitology, parasite proteases, parasites and innate immunity, and immunopathology of bacterial skin infections related to scabies infections.



### Associate Professor John Frean

Associate Professor John Frean holds degrees from the Universities of the Witwatersrand and London. He joined the South African Institute for Medical Research (now the National Health Laboratory Service) as a Microbiology registrar in 1985, and currently holds senior positions in the National Institute for Communicable Diseases. His main interests are parasitic and zoonotic diseases.



### Dr Hayley Joseph

Dr Hayley Joseph is the research officer at the World Health Organization Collaborating Centre for Control of Lymphatic Filariasis and Soil-Transmitted Nematodes. Dr Joseph's research interests focus on the successful elimination of lymphatic filariasis from the central Pacific. In particular, Dr Joseph is collaborating with the Samoan Ministry of Health on a pilot study investigating the feasibility of vector control as an additional strategy for disease elimination.



### Professor Patrick Lammie

Pat is a Senior Staff Scientist in the Disease Elimination and Control Group in the Division of Parasitic Diseases and Malaria at the Centers for Disease Control and Prevention (CDC). Pat received his PhD from Tulane University in 1983 following doctoral research on the immunology of experimental filariasis. He has been at CDC for more than 20 years where his principal focus has been lymphatic filariasis. His lab is heavily invested in efforts to develop new tools and strategies to monitor and evaluate lymphatic filariasis and other neglected tropical diseases (NTDs). He serves on WHO's NTD Monitoring and Evaluation Working Group. He also works on the pathogenesis of filariasis.



### Professor Alex Loukas

Professor Alex Loukas holds an NHMRC Senior Research Fellowship and is editor-in-chief of the International Journal for Parasitology. His major research interest is the molecular basis of host-parasite interactions, with a particular focus on characterising the functions of proteins secreted by helminths (worms) that parasitise humans in developing countries. Research projects include the development of vaccines for human hookworm disease and schistosomiasis, molecular pathogenesis of infection with the carcinogenic liver fluke, characterising the secretomes of parasitic helminths using proteomics, and human helminths as therapies for autoimmune and allergic diseases. His research is supported by international and national funding bodies including the Bill and Melinda Gates Foundation, NHMRC (program and project grants) and NIH. He is the author of more than 150 peer-reviewed publications and has received numerous awards for his research.



### Dr David Maclaren

Dr David Maclaren is Senior Research Officer at James Cook University. His research focusses on HIV prevention in Melanesia (PNG and Solomon Islands), the public health of Kwaio people in Malaita, Solomon Islands, and the social and cultural determinants of health. He has worked for an NGO in post conflict Kosovo and evaluated chronic disease management in Cape York and Torres Strait.



### Professor John McBride

John McBride is Professor of Medicine at James Cook University, and combines his academic and teaching role at the Cairns Base Hospital campus with clinical responsibilities in Infectious Diseases and Clinical Microbiology. His research interests span dengue fever, rickettsial diseases, tropical medicine, clinical trials (including vaccine studies), HIV in resource poor settings, fever investigation, pathogen discovery and infrared thermal imaging. In 2003, he spent three months working with the national HIV AIDS support project in PNG establishing the antiretroviral program for the country, and has continuing research interests in the country relating to the role of male circumcision in the prevention of HIV and the epidemiology of dengue. He is an acknowledged expert on dengue fever.



### Professor Don McManus

Don McManus is Professor at Queensland Institute of Medical Research. Schistosomiasis japonica is a serious parasitic disease in southern China, where infection with *Schistosoma japonicum* remains a public health issue despite intensive control. Our ongoing research involves studies from the bench to the field: determining the effects of the drug artemether

against *S. japonicum* infection and the effectiveness of combined artemether and praziquantel treatment in patients; increasing knowledge of the pathogenesis of advanced schistosomiasis; determining the importance of buffalo infections in the persistence of human schistosomiasis transmission impacting on future integrated schistosomiasis control; undertaking genomics and post-genomics research on *S. japonicum* molecules as new intervention targets; and validation of a mathematical model for improved and sustainable schistosomiasis morbidity control for China. The research has contributed to the design of equitable schistosomiasis control options, promoting local economic development/improved health. Consequently, the Chinese authorities have removed bovines from a number of sentinel villages to determine the long term impact on disease transmission.



### Professor Ron Quinn

Professor Ron Quinn is Director, Eskitis Institute for Cell and Molecular Therapies, Griffith University. Professor Ron Quinn's research interests include: biodiscovery involving high throughput screening against, molecular targets, isolation and structure elucidation of bioactive natural products, design and synthesis of receptor ligands and enzyme inhibitors, understanding of natural product recognition for biosynthetic enzymes and correlation with therapeutic targets as a rational approach to drug discovery. He was elected Fellow of the Australia Academy of Technological Sciences & Engineering (2003) and received the RACI Adrien Albert Award (2004). Professor Quinn initiated collaboration with AstraZeneca (1993) to explore natural products as potential drugs. This collaboration is one of the largest industry/university collaborations in Australia (\$100 million in industry investment). Professor Quinn was appointed Director of the Eskitis Institute for Cell and Molecular Therapies in 2003.



### Professor Scott Ritchie

Professor Scott Ritchie is Professorial Research Fellow at James Cook University, combining this with his role as medical entomologist at the Tropical Public Health Unit in Cairns where key responsibilities are the management of mosquito-borne diseases such as dengue, malaria and Japanese encephalitis. His research interests include the biology and ecology of mosquito-borne diseases, the management and emergency control of dengue, strategies for the surveillance and control of exotic mosquitoes and mosquito-borne diseases, and the impact of climate change on risk of vector-borne disease transmission. He is currently active in field trials of *Wolbachia* in the dengue vector *Aedes aegypti*. Professor Ritchie's work is funded by NHMRC, the Bill and Melinda Gates Foundation, CSIRO and private industry. He is an editor for *Journal of Medical Entomology* and has over 150 peer-reviewed publications.



### Professor Louis Schofield

Professor Louis Schofield is an International Research Scholar of the Howard Hughes Medical Institute and co-founder of Ancora Pharmaceuticals Inc. He shares the Directorship of QTHA with his ongoing research work at the Walter and Eliza Hall Institute. A recognised authority in the immunology and pathogenesis of infectious diseases, he has research programs covering basic molecular sciences, product development and commercialisation, epidemiology and public health. His approach to malaria has resulted in promising vaccine development programs and he is involved in clinical trials in Papua New Guinea and Africa. He has published several key articles, including in *Nature* and *Science*, and has received over 4,000 citations to date.



### Dr Harsha Sheorey

Dr Harsha Sheorey is a Clinical Microbiologist at St Vincent's Hospital in Melbourne. His special interest is in clinical parasitology and tropical medicine and has written a book titled "Clinical Parasitology – a handbook for medical practitioners and microbiologists". He is an invited writer for Parasitology section of the 9th and 10th edition (current) of ASM Manual of Clinical Microbiology. He coordinates the Victorian branch of the Parasitology & Tropical Medicine Special Interest Group of the ASM.



### Professor Balbir Singh

Professor Balbir Singh is the Director of the Malaria Research Centre (MRC), University Malaysia Sarawak (UNIMAS), Kuching, Malaysia. He obtained his PhD degree from the University of Liverpool in 1985. He worked as a Postdoctoral Research Assistant and Beit Medical Fellow on cytoadherence in falciparum malaria at the Liverpool School of Tropical Medicine. He became a lecturer at the School of Medical Sciences, Universiti Sains Malaysia in 1992 and moved to UNIMAS in 1999. Research at the MRC, UNIMAS, focuses on the molecular epidemiology and population genetics of malaria, with funds from local and international funding agencies including the Wellcome Trust and the Medical Research Council, UK. He was instrumental, together with Prof Janet Cox-Singh, in the establishment of state-of-the-art research laboratories and in the formation of an active research group at UNIMAS studying the epidemiology, evolution and population genetics of malaria parasites. His most significant research contribution has been the discovery of a large focus of human malaria cases with *Plasmodium knowlesi*, a malaria parasite normally found in monkeys and morphologically similar to *P. malariae*.



### Major General Michael Slater

Mick Slater, DSC, AM, CSC, is Chair of the Queensland Reconstruction Authority. He was born in Brisbane and after completing his education at St Joseph's College Gregory Terrace, worked and studied surveying through Queensland University of Technology. In 1978 he joined the Australian Army. Following officer training at the Officer Cadet School Portsea, Major General Slater undertook a variety of infantry regimental and instructional appointments in Australia and overseas. Major General Slater's senior staff appointments have included Director General Preparedness and Plans, Director General Personnel, Director General Intelligence Support to Operations and Head of the Defence Personnel Executive. Major General Slater has commanded at all levels from platoon to division, having until 24 January 2011, commanded the 1st Division, based at Gallipoli Barracks, Enoggera, Queensland. His operational commands have included the 2nd Battalion, The Royal Australian Regiment, and the 3rd Brigade on operations in East Timor. Also he served on the staff of the United States 3rd Army Headquarters in Kuwait on Operation POLLARD. He has undertaken formal education in mobilisation planning in the USA, and is a graduate of Command and Staff College Fort Queenscliff, the Joint Services Staff College, and the United States Army War College. Major General Slater holds Masters' Degrees in Strategic Studies and Business Administration.



### Professor Nick Smith

Professor Nick Smith is a Tropical Research Leader at James Cook University. His research is devoted to studying how parasites and their hosts interact, with particular emphasis on immune responses to parasites and developing vaccines to fight parasitic disease. He has been funded by the ARC, the Swiss National Fund, World Health Organisation and the Rural Industries Research and Development Corporation. He is National Convenor of the ASP's Network for Parasitology.



### Professor Rick Speare

Professor Rick Speare is both a Vet and a Medical Doctor. He is currently the Director of the Anton Breinl Centre for Tropical Health and Medicine, James Cook University and was the foundation President for the The Australasian College of Tropical Medicine. His research activities are on control of communicable diseases in humans and other animals with active research programs in both areas. His PhD involved studies on the taxonomy of Strongyloides, and he maintains a strong interest in this parasite. Since 1991 a major activity has been development of a public health workforce to practice in rural and remote tropical populations. Rick also is involved in research into the role of hookworms in the treatment of autoimmune disorders.



### Professor Andreas Suhrbier

Professor Andreas Suhrbier is head of the Immunovirology Group at the Queensland Institute of Medical Research, a Principle Research Fellow with the National Health and Medical Research Council, Professor at Griffith University, and Adjunct Associate Professor at the University of Queensland. He has over 110 publications in the fields of virology, immunology and cancer therapeutics. He is an inventor on 16 patents, 12 have been commercialised, 7 cover products in human clinical trials, 3 cover products in phase III trials. He is, and has been, a consultant for a number of local and international biotechnology companies. Currently funded research projects include chikungunya virus (related to Ross River virus) arthritis, role of SerpinB2 in inflammation, chaperonin 10 as a drug against autoimmune disease, PEP005 as a topical anti-cancer chemotherapy. Key interest areas are alphaviruses, macrophages, immunotherapeutics, cancer.



### Professor Kim Usher

Professor Kim Usher is Professor of Nursing at James Cook University and is Director of Research and Research Training for the School of Nursing, Midwifery and Nutrition, as well as Associate Dean of Research Training for the University. Research interests include psychotropic medications, reflective practice, Indigenous health and mental health, and nursing workforce issues. Interest in the Pacific and tropical areas have led to Fellowship of the Cairns Institute - a centre set up to support research on underserved populations. She is a Fellow of the Australian and New Zealand College of Mental Health Nurses and the Royal College of Nursing Australia and Director of the World Health Organization Collaborating Centre recently established at JCU.



### Professor Mark Von Itzstein

Professor Mark von Itzstein is Director of the Institute for Glycomics, Griffith University. He has won world fame for his design and synthesis of a drug which treats one of the scourges of humanity - influenza. In 1996, he was one of the joint recipients of the Australia Prize for his relational design of the anti-influenza drug. His research interests include the biology and chemistry of carbohydrates, rational drug design, enzymes in organic synthesis, enzyme mechanisms, new synthetic methods, organic synthesis and the biochemistry of carbohydrate recognising proteins. He is an elected Fellow of the Australian Academy of Science and a Fellow of the Royal Australian Chemical Institute.

Space and time has unfortunately precluded the publication of biographies for all speakers and presenters in these conference proceedings. We have therefore included a sample of biographies and apologise to those who could not be included.

# ORAL ABSTRACTS

## ASM/ACTM PARASITOLOGY MASTERCLASS 6TH NATIONAL WORKSHOP ON STRONGYLOIDES

### Parasitology Masterclass

14 July 2011

#### Plasmodium Knowlesi Infection in Humans

Balbir Singh

Malaria Research Centre, Universiti Malaysia Sarawak, Kuching, Malaysia.

*Plasmodium knowlesi* is a malaria parasite that naturally infects long-tailed and pig-tailed macaques (*Macaca fascicularis* and *M. nemestrina*, respectively). It was shown to be infective to humans by blood passage soon after it was first isolated from a long-tailed macaque in 1931. Naturally-acquired human infections were thought to be extremely rare until a large focus of human infections was reported in 2004 in the Kapit Division of Sarawak, Malaysian Borneo. Molecular detection methods have to be employed to correctly identify *P. knowlesi* due to the morphological similarities between the blood stage parasites of *P. knowlesi*, *P. falciparum* (the early trophozoites) and *P. malariae*. Human *P. knowlesi* infections have been described in other parts of Malaysian Borneo and in Peninsular Malaysia, Thailand, Myanmar, Singapore, Vietnam, Cambodia, Philippines and Indonesian Borneo, resulting in the recognition of *P. knowlesi* as the fifth species of *Plasmodium* causing human malaria. Presenting signs and symptoms of *P. knowlesi* malaria are non-specific, with fever, chills and rigor reported by all patients followed by headache, myalgia, anorexia, arthralgia, cough, abdominal pain and diarrhoea. Thrombocytopenia is a universal laboratory finding and infections in humans can be fatal, involving hepatorenal dysfunction and hyperparasitaemia. Uncomplicated cases of *P. knowlesi* malaria respond rapidly to treatment with chloroquine but severe cases require management and treatment as for severe *P. falciparum* malaria. The molecular, entomological and epidemiological data, indicate that *P. knowlesi* malaria is a zoonosis in South East Asia. The widespread distribution of human cases and the high proportion of *P. knowlesi* malaria admissions in certain hospitals, some resulting in fatal outcomes, underscore the public health importance of human *P. knowlesi* infections in this region.

#### Parasitic and Tropical Diseases with Skin Manifestations

Sujatha Fernando

Pathology West-Central West Pathology Service, Orange, Australia

Tropical infectious diseases are now frequently encountered in Australia. Most of these diseases are caused by parasites, but less frequently caused by some bacterial, fungal, rickettsial and viral infections. This is due to the rapidity and ease of relatively inexpensive air travel, transcontinental trains and ocean liners, which have now become within the reach of many. Two-thirds of worldwide travellers visit the tropics and are exposed to these diseases. In addition with the influx of refugees and extensive use of immunosuppressive therapy we need to be familiar with these diseases. This presentation will cover a brief introduction on general features of parasites with examples of these diseases, some of which have been encountered by myself, personally, as an anatomical pathologist in Australia.

#### Hookworm in Australia

Richard Speare

Anton Breinl Centre for Public Health and Tropical Medicine, James Cook University, Townsville, Australia

From a parasite's perspective soil transmitted helminth (STH) communities in Australia are collapsing and fragmented, except for *Strongyloides stercoralis* that is doing very well in rural and remote Aboriginal communities. Hookworms as pathogens have a dismal future in Australia. Three species of hookworm naturally infect humans, *Ancylostoma duodenale*, *Necator americanus*, and *Ancylostoma ceylanicum*. Unlike the other two species *A. ceylanicum* can naturally infect cats and dogs, has been reported from pets in Australia, but no endemic human case has been reported. Although it now appears that only *A. duodenale* is endemic in Australia, the published evidence is so scant that the species infecting humans in Australia is uncertain. Diagnosis is by detection of hookworm eggs in faeces but this does not allow identification of species. Species can be determined by morphology of infective larvae (IL) obtained after 7 days of culture at 25°C, by specific PCR, or by obtaining adults after treatment. Hookworm causes iron deficiency anaemia with *A. duodenale* causing most blood loss per worm. Other clinical effects are itchy papules at the penetration site and central abdominal pain a month after skin penetration, related to the host's attempts to reject worms from the small intestine. Treatment is albendazole or mebendazole. Resistant to these drugs is rare although some resistance to pyrantel was found in the Kimberley. Hookworm vaccines are being researched at JCU. Zoonotic hookworms may now be the major cause of hookworm disease in Australia: *Ancylostoma caninum* from dogs causes eosinophilic enteritis and aphthous ulcers in the small and large intestine respectively while *Ancylostoma braziliense* from cats causes cutaneous larval migrans. *N. americanus* is now being used to explore the role of parasites as immunomodulators for allergic and autoimmune diseases. Perhaps Australian GPs in the future may be able to prescribe a healthy dose of hookworm!

#### Gnathostomiasis: An Emerging Parasitic Disease in Southern Africa

John Frea<sup>1,2</sup>

<sup>1</sup>National Institute for Communicable Diseases, National Health Laboratory Service, Johannesburg, South Africa

<sup>2</sup>School of Medicine, University of the Witwatersrand, Johannesburg, South Africa

Eight residents of Maun, Botswana presented with recurrent episodes of painful migratory skin nodules and transient urticaria after visits to the Okavango Delta in Botswana, where they ate raw bream marinated in lemon juice. Some of the migratory swellings localised to form superficial skin lesions from which several small worms were extracted. They were referred to the National Institute for Communicable Diseases, Johannesburg, for identification. Microscopic examination showed third stage larvae of a *Gnathostoma* species. These nematode parasites have a complicated life cycle involving carnivorous mammals as definitive hosts, and a variety of intermediate and paratenic hosts, including snakes, birds, frogs, eels, crustaceans and freshwater fish. Humans become infected when they eat raw or undercooked fish, crabs, or crayfish. The larvae migrate through skin and subcutaneous tissues (the most common presentation), but also sometimes the internal organs, including the central nervous system in the most serious form of the disease. Gnathostomiasis is well-known in Southeast Asia, and Central and South America, and is regarded as an emerging imported disease resulting from increasing international travel and adventurous eating. The disease has only rarely been described in

Africa; previous cases seen locally acquired the infection via raw bream from the Zambezi River in western Zambia. The Okavango River is a newly-recognised risk area in Botswana. We recommend that freshwater fish caught in southern Africa, especially bream (*Tilapia species*), should not be eaten raw.

### Epidemiology of a Scabies Outbreak During an Ivermectin MDA in a Remote Aboriginal Community in the Northern Territory.

Therese M. Kearns<sup>1</sup>, Ross Andrews<sup>1</sup>, Richard Speare<sup>2</sup>, Allen Cheng<sup>1</sup>, James McCarthy<sup>3</sup>, Jonathan Carapetis<sup>1</sup>, Deborah Holt<sup>1</sup>, Eddie Mulholland<sup>4</sup>, Bart Currie<sup>1</sup>, Wendy Page<sup>4</sup>, Roslyn Gundjirryrr<sup>1</sup>, Janice Djilirri<sup>1</sup>

<sup>1</sup>Menzies School of Health Research, Darwin, Australia

<sup>2</sup>James Cook University, Townsville, Australia

<sup>3</sup>Queensland Institute of Medical Research, Brisbane, Australia

<sup>4</sup>Miwatj Health, Nhulunbuy, Australia

**Background:** *Sarcoptes scabiei* is a microscopic mite whose secondary infection contributes to the world's highest reported rates of heart and kidney disease in Aboriginal and Torres Strait Islander people. This mite, infrequently seen in non-Indigenous Australians is endemic in many remote communities in the northern Australia and is generally spread by close personal contact. Most scabies cases present with a classic infection of profuse pruritis and 5-10 mites burrowed in the skin, however a more severe refractory infection called crusted scabies manifests with thousands of mites that are highly transmissible from fomites as well as close personal contact. **Aim:** To describe an outbreak of scabies in a remote Aboriginal community in May 2011. **Method:** An outbreak team was dispatched to an East Arnhem community to enhance the delivery of an ivermectin MDA after a suspected crusted scabies participant was identified in the community. The response team targeted the houses of identified household and classroom contacts in collaboration with the local researchers who were implementing a population census for scabies and strongyloidiasis prevalence and an ivermectin MDA. Classical scabies infections were diagnosed clinically and crusted scabies from clinical and laboratory investigations. Participants were administered a stat dose of 200µg/kg ivermectin unless pregnant or their weight was <15kg. The alternative medications used were 10% crotamiton daily for 3 days or 1 application of 5% permethrin. Participants diagnosed with classical scabies received 2 treatments 2-3 weeks apart and those diagnosed with crusted scabies were referred to the local health centre for evacuation to the nearest hospital for more intensive treatment. **Results:** One crusted scabies participant was identified clinically who had ~30 classroom and 40 household contacts of whom 11(37%) and 5 (13%) respectively had classical scabies. In total the response team screened 74 participants from 11 (85%) of the 13 priority houses and identified 11 (15%) classical scabies cases. **Conclusion:** Community awareness of the increased scabies prevalence was high and treatment was sought after by individuals and families who were not from the priority houses. The outbreak response is continuing and further results will be reported at this meeting.

### Diagnosis of Human Parasitic infections in Australia; State of Play Rogan Lee

Institute of Clinical Pathology and Medical Research, Westmead Hospital, Sydney, Australia

Many parasitic diseases are not major players in the human health stakes in Australia and they can be regarded as 'novelties' which clinical microbiologists come across from time to time. The level of expertise in Australia is minimal and scattered since there is no centralised laboratory that specialises in diagnosis of parasitic diseases. We therefore rely on our collegial networks in making a diagnosis when it comes to parasitic infections. Some cases of parasitic infections will be raised to demonstrate the deficiencies in our capacity to make rapid diagnosis so that treatment can be instigated.

### Parasitic Infections in Newly arrived Refugees in Australia

Thomas Schulz

Victorian Infectious Diseases Service, Royal Melbourne Hospital, Parkville, Victoria, Australia

Internationally over 12 million people are currently refugees. Of this group Australia has a humanitarian intake of 13500 refugees annually. These arrivals are largely from undeveloped countries and have often lived in circumstances of extreme poverty. Some pre-departure health screening has occurred however this does not routinely include screening for parasites. Refugees, however, as a group have been exposed to, and continue to have, high rates of parasitic illnesses. Guidelines in Australia recommend screening newly arrived refugees for parasitic infections including schistosomiasis and strongyloidiasis. This presentation will provide an overview of the epidemiology of infections that are seen in this newly arrived refugee group, with a focus on parasitic infections. The experience of a large tertiary referral hospital immigrant clinic will be presented. Clinical challenges faced when dealing with this group will be discussed with reference to particularly difficult management problems. Amongst the most challenging decisions is the clinical management of neurocysticercosis and the appropriateness of therapy for small numbers of cerebral lesions. Diagnostic uncertainty related to eosinophilia without clearly identified cause also remains a common problem in refugees. Two cases will be presented to illustrate these two clinical challenges and to outline the complexities faced when working with this patient group.

### Antiparasitic Treatments – What's Old, What's New?

Harsha Sheorey

Department of Microbiology, St Vincent's Hospital, Fitzroy, Australia

Parasitic diseases are neglected infections in the world. While new drugs are being produced for viral, fungal and bacterial infections, discovery and production of new anti-parasitic drugs has been very slow. However, some progress has been made in management of parasitic diseases in the past decade or so since WHO recognised parasitic diseases amongst the top neglected diseases in the developing world. Some very simple measures eg safe and clean water for controlling Dracunculiasis has been very effective. Drugs known for centuries eg Artemether derivatives have become first line treatment for severe malaria. As molecular work progresses, pathogenic parasites are being differentiated from non-pathogenic and recognition of treatment modalities are becoming more targeted. On the other hand, like other microbes, resistance and non-response to treatment is becoming an issue in parasitic infections. Managing these infections for want of newer agents is becoming difficult and a challenge. This talk will outline the progress and advances made in areas of management of parasitic infections.

### Trematodes in Eastern Asia and the Pacific Islands

David Blair

School of Marine and Tropical Biology, James Cook University, Townsville, Australia

About 70 trematode species are known to infect humans in Eastern and Southern Asia. Almost all of these are zoonotic and therefore have the potential to remain in animal reservoirs. Despite rapid and massive social, economic and environmental changes in the region, many of these trematodes remain a problem. Reasons for this will be discussed. For selected groups of trematodes, the modes of transmission, sites occupied within the human body and disease caused will be discussed. Methods for diagnosis and public health measures aimed at control will be reviewed. Taxonomic questions abound, making identification to species near-impossible in some taxa of trematodes. For the genera Fasciola and Paragonimus, strongly contrasting evolutionary histories have produced very different problems for biologists seeking taxonomic resolution. In contrast to the situation in Asia, few trematode species infect humans in the Pacific islands. The main exception is *Fasciola gigantica* in Hawaii.

# 6th National Workshop on Strongyloides

15 July 2011

## What's Different About *Strongyloides Stercoralis*?

**Richard Speare**

*School of Public Health, Tropical Medicine and Rehabilitation Sciences, James Cook University, Townsville, Australia*

The unusual characteristics of *Strongyloides stercoralis*, a nematode parasite of the small intestine, are i) it is essentially a tissue parasite living in tunnels in the mucosa; ii) there is only one sex (female) in the gut; and iii) it has autoinfective larvae (AIL) that penetrate back into the body, mainly via the large intestinal wall. The AIL are of immense clinical significance leading to lifelong infections due to replenishment of old females without reinfection (the record is 65 years); appearance of skin signs due to an allergic reaction to wandering AIL (urticaria and larva currans); and increase in numbers of adults in the gut and AIL in tissues with severe disease (disseminated strongyloidiasis) resulting in death. Strongyloidiasis occurs as acute, chronic and disseminated strongyloidiasis. The latter is typically due to immunosuppression, either iatrogenic or disease-related.

A good range of very specific diagnostic tests are available: for fresh faeces the agar plate test is more sensitive than direct microscopy and faecal DNA tests may offer the highest sensitivity, but are in the research phase. Using blood the strongyloides-ELISA is the best diagnostic test for chronic strongyloidiasis with good sensitivity and specificity and is an essential test for monitoring cure.

Unlike other soil transmitted nematodes oral ivermectin (0.2 mg/kg) is the best treatment, but for disseminated disease treatment of severe pathophysiological changes is also essential. Repeat doses of ivermectin are required for cure.

Infective larvae that develop from faeces deposited on soil or other protected areas do not survive beyond 4 weeks in the environment. Although strongyloidiasis is far too prevalent (15->30%) in rural and remote Aboriginal communities in Australia, its impact has not been assessed. In Australia strongyloidiasis also occurs in humanitarian entrants, peacekeeping personnel who have served in South East Asia and the Solomon Islands, and immigrants from rural Italy.

## Strongyloides Stercoralis and HTLV-1

**Lloyd Einsiedel**

*School of Medicine, Flinders University, Alice Springs, Australia*

## Strongyloides Stercoralis Case History

**Wendy Page**

*Miwatch Health Clinic, Nhulunbuy, Australia*

Strongyloidiasis in Australia is caused by *Strongyloides stercoralis* and is remarkably persistent in the human body. *S. stercoralis* is unique amongst helminths because of its ability to replicate within the body through an auto-infective cycle. Furthermore auto-infective larvae are capable of carrying bacteria from the bowel and invading any organ of the body including the central nervous system. A few brief case histories highlighting the variety of clinical presentations and the challenges of diagnosis and treatments will be presented with the outcomes. One of the cases tracks an adult male with diagnosis of acute strongyloidiasis confirmed on faecal specimen. His initial *Strongyloides* IgG serology was negative (0.22). He was treated with three courses of albendazole (400mg daily for 3 days) at 0, 2 and 4 weeks. Recurrent episodes of cutaneous, gastrointestinal and non-specific unwellness persisted and his serology 5 months later was 1.06 (positive). He was treated with ivermectin 12mg daily for 2 days and his symptoms resolved and serology declined to negative. This case suggested the window period for seroconversion in a new case may be less than 5 months and

that albendazole was not effective in this case, but ivermectin was effective. Another case history of an adult female treated with 3 doses of ivermectin for chronic strongyloidiasis required re-treatment 12 months later for recurrence of larva currans. The goal of therapy is eradication to prevent recrudescence as one remaining parasite can continue the cycle due to parthenogenesis which enables infection from one worm. This differs from the approach to other intestinal helminths whereby reducing the worm load is considered adequate as they do not have an autoinfective cycle. As failure to eradicate the parasite with adequate treatment may result in recrudescence, follow up of the patient after treatment is considered best practice.

## A Piggy Back Journey

**Harsha Sheorey**

*Department of Microbiology, St Vincent's Hospital, Fitzroy, Australia*

A case of a 65 year old woman being treated for lymphoma, presenting with confusion and fall and noted to have mild persistent eosinophilia will be presented. CT of the brain showed multiple enhancing lesions. A lumbar puncture revealed Gram negative meningitis which was treated with Ceftriaxone. Faeces examination revealed *Strongyloides* larvae. However the strongyloides serology was negative at this stage. She was diagnosed with disseminated Strongyloidiasis and commenced on Ivermectin and she slowly responded. One of the golden rules in infectious diseases is: meningitis due to Gram negative bacilli in an adult (in the absence of instrumentation/ surgery) suggests *Strongyloides* infection. The epidemiology of the case and some management issues will be discussed. Screening for Strongyloidiasis has now become routine and some guidelines for certain patients have been suggested which will be presented.

## The Diagnosis of Strongyloidiasis

**Matthew Watts**

*Centre for Infectious Diseases Microbiology Laboratory Services, Institute of Clinical Pathology and Medical Research, Westmead Hospital, Westmead, Australia*

Diagnostic testing for *Strongyloides stercoralis* is important for screening prior to immunosuppression, the diagnosis of suspected infection, and as a component of research studies. The laboratory diagnosis of *S. stercoralis* is based on serological techniques or the detection of the organism.

Serology detects antibodies specific to *S. stercoralis*. The sensitivity and specificity is generally greater than 90%. Sensitivity is reduced in the setting of immunosuppression and acute infection. The most common specimen used for the detection of the parasite is stool, but parasites may be seen in gastric and intestinal biopsies. In severe disease, *S. stercoralis* larvae may also be found in respiratory secretions, soft tissues, and cerebrospinal fluid. The least sensitive method of *S. stercoralis* detection in stool is a direct smear. More sensitive methods include formalin ether concentration, the Baermann technique, Harada culture and agar plate culture. The Baermann and culture methods require live larvae. The detection in stool is limited by variable larval output. This also impacts upon the evaluation of serology, as the identification of larvae in stool is the gold standard. Multiple stool collections increase larval detection. Nucleic acid tests have been applied for the detection of *S. stercoralis*. The use of stool specimens preserved in ethanol facilitates transportation and removes the risk of laboratory-acquired strongyloidiasis. However, the extraction of DNA from stool is relatively complex. An understanding of the methods used for the diagnosis of *S. stercoralis*, and their limitations, is important for individual patient care, the assessment of research findings, and the design of future research projects.

## Strongyloides Serology Testing at VIDRL

**Jennie Leydon**

*Victorian Infectious Diseases Reference Laboratory, North Melbourne, Australia*

**Background:** The Victorian Infectious Diseases Reference Laboratory performs serology for the diagnosis of *Strongyloides Stercoralis* for most of Victoria and Tasmania. Retrospective analysis was performed to establish the number of positive results obtained and the clinical categories of these patients. **Results:** Since testing began in 1997 involving 250 samples, there has been a noticeable increase in the number of tests performed over time. In 2004 over 1000 tests were performed and since 2006 over 2000 samples have been tested per annum. By 2010, a total of 2809 samples were tested. The proportion of positive results detected per year has ranged from 3% to 7% of the total number of samples tested. A high proportion of patients tested had no clinical details recorded. For those where clinical details were available, the largest groups were refugee/immigrant screening and returned travellers. **Conclusion:** Between 2003 and 2010, positive *Strongyloides* serology in refugees/immigrants has ranged from 6 – 13% per annum; the average being 10%. Prior to 2003 the number of samples tested was low, with the exception in 2002, where a survey of refugees was incorporated into the routine testing, giving a higher than average positive rate of 22%. The percentage of returned travellers with positive results has been analysed from 2003 to 2010. The percent of positives ranged from 0 – 13% per annum, the average being 8%.

## Diagnosis of *Strongyloides Stercoralis* in Different Communities in Dhaka, Bangladesh

Yasmin Sultana, Rogan Lee

Centre for Infectious Diseases and Microbiology Laboratory Services, ICPMR, Westmead Hospital, Westmead, Australia

Residents from two different urban slums (Korail- Group A, Adabar-Group B) in Dhaka, Bangladesh were screened for the *Strongyloides stercoralis* antibody and compared to a third group (n=299) of established residents living in the city center (Group C). Seroprevalence to IgG in groups A (n=1004), B (n=147) and C (n=299) was 15%, 52% and 5%, respectively. Lower number of reactive sera in the established city dwellers in Dhaka were significantly different to those living in slums (p<0.0005). Significant differences have also been observed in between groups in detecting subclass IgG1 (p<0.001). Individuals from both slums were then divided into age groups (in 5 and 10 years intervals) and the presence of antibodies to *S. stercoralis* was significantly (p<0.005) higher in the younger age group (16-25). Analysis showed that gender, education level, occupation and household factors are not related to positive serology. However, a recorded history of diarrhoea in a family member rather than diarrhoea in the respondent was associated with detection of antibodies to *S. stercoralis* in group A only (p=0.014). Besides, life style factors (wearing shoes, washing hands and trimming nails) were significantly (p<0.05) linked to positive culture of *S. stercoralis* in stools collected from group B. Faecal samples (209 single specimens) from respondents of group B were collected. *S. stercoralis* larvae identified by culture methods (Agar plate and Harada-Mori) had a prevalence of 22%. No significant relationship is observed between positive serology and positive culture (p=0.113). Other enteric parasites (*Trichurus trichiura*, *Ascaris lumbricoides*, *Iodamoeba bütschlii*, *Entamoeba coli*, hookworms, *Blastocystis hominis*, and *Enterobius vermicularis*) were also detected in stools from group B. RT (Real Time) PCR has recently been optimized to detect *S. stercoralis* using in stool specimens collected from group B. Various extraction methods were compared for efficiency and the sensitivity of the assay was also assessed.

## Ivermectin - Learn from Pharmaceutical Benefits Scheme Statistics

Rollo Manning

RWM Consultancy for Centre for Chronic Disease, School of Medicine, University of Queensland, Herston, Australia

1999 saw the introduction of a streamlined way of supplying remote Aboriginal Health Services with items listed on the Pharmaceutical Benefits

Scheme. Since that time all supplies have been routed through hospital or retail pharmacists with the costs claimed back through Medicare Australia. It had been promised by the Commonwealth that data relating to the supplies would be an advantage emanating from the program when it (Commonwealth) was advocating it to States and Territory governments but this has not eventuated. The example in this presentation will show how PBS Stats from a variety of sources (including Medicare) can be utilised to identify pockets in Australia where Crusted Scabies or *Strongyloides* is a problem. This should allow follow up with those places which show a high volume of use to ascertain the extent of the problem and the success of the treatment regimes. The obtaining and utilising of PBS supply data is still being sought through agencies such as the Centre for Chronic Disease in Brisbane (School of Medicine, UQ) and this study will be used by it to demonstrate the extent to which more widely available data on a range of therapeutic agents can aid evaluation of treatment regimes and protocols.

## Assessing the Potential for Control of the Nematode *Strongyloides Stercoralis* Using a Carboxylate / Boron Based Compound

Francis O'Donahoo, Richard Bentham, Kirstin Ross

Environmental Health, Northern Territory Department of Health, Darwin, Australia

Climatic conditions within the southern Barkly region of the Northern Territory are diverse and do not correspond with the climate in areas where *Strongyloides sp.* has previously been described as endemic. The long dry periods have not resulted in eradication of the disease from communities in the Barkly region, which suggests that methods to eradicate from those communities in the Barkly may need to be different from those in tropical and/or sub-tropical regions. The control and/or elimination of nematodes using nematicides is widely undertaken within the agriculture sector. In contrast *Strongyloides* has no known nematicide that can be used to kill or treat the parasite in situ; namely soil treatment. Currently, a compound mixture of boron (0.37%) and carboxylate (10%) is being used to control nematodes in grapevines that has allow toxicity to humans. We propose to evaluate the mixture's efficacy in killing *Strongyloides sp.* with the eventual aim of being able to treat the off host reservoir (soil) in addition to the on host reservoir (humans) as a method of treating strongyloidiasis. We propose to do a series of laboratory scale toxicity tests to determine the concentration of the nematicide required to kill/control the nematode, followed by field validation testing. Control of the nematode and the disease could be greatly accelerated by the availability of such a compound. The evidence indicates that the compound is efficacious in controlling nematodes, although there is no published evidence to support this. Environmental toxicology has well established protocols for assessing the efficacy of new compounds that will be followed, both in the laboratory and field trials. A more effective method of reducing the incidence of the disease might be achieved by reducing or eliminating nematodes from the soil in addition to ivermectin, albendazole and other clinical treatments. The first step therefore is to investigate the efficacy of the product already in use in controlling other nematodes, which has shown to have a low toxicity to humans.

## Developing Educational Tools for a Scabies and *Strongyloides* Testing and Treatment Program

Jenny Shield

Aboriginal Resource and Development Services, Winnellie, Australia

The scabies and strongyloidiasis testing and treatment program at Galiwin'ku, North East Arnhem Land was preceded by a community education program so that the people participating in the program would have a clear understanding of scabies and *Strongyloides*, how these organisms affect people and how they can participate in the program. Education focused primarily on adults, and involved a partnership between mainstream educators and local educators in determining the approach, developing the materials and the delivery of the education. The main

educational tool was a flip chart, one version in plain English, the other in Djambarrpuyngu language (a lingua franca of North East Arnhem Land). The main method of delivery was by visiting people in their homes and discussing the diseases and the project in language. The health story began with the good news story that one medicine called Ivermectin can get rid of scabies and *Strongyloides* at the same time. It then used the principle of magnification by a microscope to explain germ as living reproducing organisms that make people sick, as a foundation to explaining the life cycles of scabies mites and *Strongyloides* and also secondary infection as well as how these organisms cause the symptoms of these diseases. It also included how the diseases are transmitted and how we can get rid of them, concluding with a description of how they could participate voluntarily in the program.

## Strongyloides Serology, Queensland: 2006-2011

**Richard Lord**

*Department of Microbiology, Pathology Queensland, Rockhampton, Australia*

As *Strongyloides stercoralis* is not a notifiable disease, overall numbers of people infected are difficult to ascertain. Although a number of diagnostic methods for Strongyloidiasis such as eosinophilia and faecal culture are useful, serology remains the most convenient and reliable diagnostic method. Numbers of positive *Strongyloides stercoralis* Serology throughout Queensland and varying trends from between 2006 to 2011 are presented. Trends in sampling rates and positive serology numbers are discussed.

## Strongyloides Treatment at Nguiu Tiwi Islands

**Pat Bowman, Jan Bowman**

*Tiwi Health Service, Northern Territory Department of Health, Nguiu, Australia*

Drs Jan and Peter Bowman as resident GPs at the aboriginal community of Nguiu since January 2009 have been opportunistically testing for strongyloides by serology, then treating positives and “equivocals” with a stat dose of ivermectin and a second dose after seven days. Follow-up serology after 6 months allowed retreatment of persistent positives. There are no previous reports of the effectiveness, on a community basis, of the effect of prolonged opportunistic screening and treatment of strongyloides. Serological data for all tests done has been obtained from Western Pathology. The initial prevalence of strongyloides [as diagnosed by positive serology] was about 40%. Data is presented for population, numbers tested, serology results, treatment successes, re-treatments, treatment failures, and prevalence after two years of the program. Most cases treated showed reduced or negative serology at follow-up. There were no reported adverse effects from the ivermectin treatment.

resident GPs

## Strongyloides at Kuranda – An Overview

**Terry Eager**

Kuranda is situated in the mountain rainforest 30 minutes from Cairns, North Queensland. The data provided has been collected from patients at the Kuranda Medical Centre since we began testing in 2006.

## Epidemiology of Strongyloidiasis and an Ivermectin MDA in a Remote Aboriginal Community in the Northern Territory

**Therese M. Kearns<sup>1</sup>, Ross Andrews<sup>1</sup>, Richard Speare<sup>2</sup>, Allen Cheng<sup>1</sup>, James McCarthy<sup>3</sup>, Jonathan Carapetis<sup>1</sup>, Deborah Holt<sup>1</sup>, Eddie Mulholland<sup>4</sup>, Bart Currie<sup>1</sup>, Wendy Page<sup>4</sup>, Joseph McDonnell<sup>1</sup>, Jenny Shield<sup>5</sup>**

<sup>1</sup>Menzies School of Health Research, Darwin, Australia

<sup>2</sup>James Cook University, Townsville, Australia

<sup>3</sup>Queensland Institute of Medical Research, Brisbane, Australia

<sup>4</sup>Miwatj Health, Nhulunbuy, Australia

**Background:** *Strongyloides stercoralis* is a neglected tropical disease that is endemic in many Aboriginal communities in northern Australia and contributes to the high morbidity experienced by Aboriginal and Torres Strait Islander people. We hypothesized that an ivermectin mass drug administration (MDA) program would be an effective public health measure to reduce the endemic prevalence of strongyloidiasis in remote settings.

**Method:** A population census for prevalence and MDA was conducted at months 0 and 12 followed by a cross sectional survey for disease acquisition and treatment failures at month 6 and 18. Strongyloidiasis was diagnosed by parasitology through faecal microscopy and/or agar plate culture or by serology. Participants were administered a stat dose of 200µg/kg ivermectin unless pregnant or their weight was <15kg. The alternative medications used for those not eligible for ivermectin was 200mg or 400mg albendazole daily for 3 days. All participants received 1 course of the eligible medication and those diagnosed with strongyloidiasis were given a 2nd treatment 2-3 weeks after the first medication was administered. **Results:** The month 0 population census and MDA #1 was conducted from March – August 2010, enrolling 1011 (80%) participants from 127 (80%) houses and 7 (78%) surrounding homelands. Strongyloidiasis was common across all age groups with an overall prevalence of 21% (95% CI 17.9,23.4) and a median age of 20 (IQR12-30). A single dose of ivermectin was administered to 97% of eligible participants at MDA #1, with 87% of those with equivocal or positive results receiving 2 doses 17 (IQR 13-23) days apart. At the 6 month cross sectional survey conducted from September 2010 – March 2011, 360 (36%) participants were followed up (132 positive, 87 equivocal and 141 negative for strongyloidiasis) of which 21 (16%) were treatment failures and 4 (3%) new acquisitions. **Conclusion:** The study is due to be completed later this year but the early indications for the success of the MDA are encouraging and could have national and global implications for informing public health programs and guidelines.

## Strongyloides Infection in Newly Arrived Refugees: The Brisbane Clinic Experience

**Megan Evans<sup>1</sup>, Sarah Sheridan<sup>2</sup>**

<sup>1</sup>Refugee Health Queensland, Woolloongabba, Australia

<sup>2</sup>Queensland Health, Division of the Chief Health Officer, Brisbane, Australia

Approximately 1600 refugees arrive in Queensland every year. Refugees settling in Queensland come from African, Asian and Middle Eastern countries. Refugees have some pre-arrival health screening, in line with standard Department of Immigration and Citizenship (DIAC) requirements, however, this does not routinely include testing for parasites, including *Strongyloides stercoralis*. In the knowledge that refugees often have had long periods of limited access to health care and poor nutrition, Refugee Health Queensland (RHQ) was established at Mater Health Service in 2009 in order to provide initial health assessments to newly arrived refugees settling in Queensland and to assist in the transition to mainstream primary health care. RHQ has six clinics throughout the state in the key areas of refugee settlement, including Cairns, Logan, Toowoomba, Townsville, South Brisbane and Zillmere. The South Brisbane Clinic, which provides health assessments to refugees settling in the South Brisbane area, sees approximately 50 per cent of refugees arriving in Queensland. The South Brisbane Clinic undertakes pathology testing including testing for *Strongyloides* infection. In this presentation Dr Evans and Dr Sheridan will describe: the process of refugee health assessment in Queensland; the testing and treatment regimes followed for *Strongyloides* within Refugee Health Queensland South Brisbane Clinic; and the results on *Strongyloides* testing undertaken through the South Brisbane Clinic. These results will be presented by region of birth for the first two years of the South Brisbane Clinic.

## Acute Strongyloidiasis in Travellers to Endemic Regions

**Miles H Beaman<sup>1,2,3</sup>**

<sup>1</sup>Department of Microbiology, Western Diagnostic Pathology, Myaree, Australia

<sup>2</sup>Department of Medicine, University of Notre Dame Australia, Fremantle, Australia

Clinical characteristics in 16 cases presenting to a western Australian outpatient infectious diseases practice were collected. Eight cases (50%) occurred in travellers to areas endemic for *Strongyloides* (age range 20-53 yr, median 39.5), whereas eight cases were identified in long-term residents of these regions *Strongyloides* (age range 18-85 yr, median 48.5). All (100%) non-resident travellers presented after an acute gastrointestinal illness, similar to non-specific traveller's diarrhoea. Two (20%) of this group also had Pruritic skin eruptions. Seven (87.5%) non-resident travellers were seropositive (OD 0.17-1.42, median 0.44), and all endemic residents (OD 0.28-1.19, median 0.595). All travellers had stool examination (1-3 specimens) and none had larvae seen on microscopy after stool concentration. Three (37.5%) of the endemic cases reported chronic GI symptoms (cramps) and two (25%) had recurring skin eruptions. Eosinophilia (>400 x 10<sup>6</sup>/L) was present in three (37.5%) travellers (range 100-7300, median 900) and three (37.5%) endemic cases (0-2700, 350). Conclusion: Travellers to areas endemic for *Strongyloides* usually present with acute GI symptoms. This suggests that such traveller with acute diarrhoea not associated with documented pathogens, especially if they don't respond to empiric antibiotic therapy, should have the possibility of strongyloidiasis considered.

### Criteria for Notifiability Status for Strongyloidiasis

**Richard Speare**

*Anton breinl Center for Public Health and Tropical Medicine, James Cook University, Townsville, Australia*

Cross sectional surveys of a communicable disease provide a snapshot of the prevalence in a population, but they need to be repeated to indicate the trend over time. Since non-government actors usually do these surveys, they have no outcomes guaranteed except the responsibility to disseminate the results. Notifiable disease data are collected in an ongoing fashion and the interpreted results are distributed in a timely fashion so that public health authorities can use this data to guide interventions. This is data collected for action. Particular communicable diseases are made notifiable for a range of reasons. At the Federal level 65 diseases and conditions are notifiable. All states report on these conditions and some states notify additional diseases (eg, melioidosis in Queensland and Northern Territory). Data from surveys for strongyloidiasis in remote Aboriginal communities show horrific prevalences of greater than 15,000/100,000. Should strongyloidiasis be made notifiable? Strongyloidiasis should be made notifiable because it is a serious disease with occasional mortality and significant chronic morbidity; it is easily treated (interventions will reduce incidence) and on a population level the incidence of strongyloidiasis indicates living circumstances unacceptable to Australians. The lifelong nature of untreated strongyloidiasis means missed diagnosis can have long term consequences. When a disease is notifiable, geographic hotspots can be identified and local or regional interventions implemented. This will be the case with strongyloidiasis as rural and remote Aboriginal communities will stand out like beacons. Notification will allow trends to be seen and the effects of interventions determined. Strongyloidiasis has a clear case definition based on laboratory criteria; hence laboratories can notify as for the majority of notifiable diseases. NT has recently led the way by making disseminated strongyloidiasis notifiable, a very positive step, but short of what is needed. The case to make strongyloidiasis a nationally notifiable disease is strong.

### Developing a National Strongyloides Register: Rheumatic Heart Disease Information Systems and How They Work

**Sara Noonan**

*Menzies School of Health Research, Darwin, Australia*

How might a national *Strongyloides* register improve patient management and reduce the burden of disease in Australia? What governance

arrangements need to be considered for collecting and reporting disease information at a national level? The Menzies School of Health Research has experience with establishing and supporting information systems for acute rheumatic fever (ARF) and rheumatic heart disease (RHD) in Australia and internationally. Through the World Heart Federation we have designed a number of basic RHD registers for general use and we have developed national RHD registers in collaboration with the Ministries of Health in Fiji, Samoa and Tonga. We have also supported the development of RHD program registers in Australia. The national RHD coordination unit RHD Australia has developed a recommended ARF/RHD dataset based on best practice which complies with core data required by the National Notifiable Diseases Surveillance System (ARF component). The dataset was developed through the Australian Institute of Health and Welfare's METeOR Online Metadata Registry and adopted by jurisdiction registers to help standardise data and definitions across Australia. We are also developing a national data repository to support national reporting of ARF and RHD. We will describe the process of developing a national dataset and data repository and demonstrate a range of RHD register models including their impact on health outcomes for people with ARF and RHD.

## ACTM/QTHA ANNUAL CONFERENCE

### Transformational Technologies

16 July 2011

#### Australian Bio-Diversity Curing Neglected Diseases

**Ron Quinn**

*Eskitis Institute for Cell and Molecular Therapies, Griffith University, Brisbane, Australia*

We have established an electrospray ionization Fourier Transform Mass Spectrometry (FTMS) method to identify natural product fragments that bind to *Plasmodium falciparum* and *P. vivax* proteins. We assembled compounds from our existing collection of pure natural products that satisfied fragment criteria of MW < 250, cLogP ≤ 4, rotatable bonds ≤ 6, H-bond donors ≤ 4, H-bond acceptors ≤ 5, % PSA < 45. The approach has the advantage that the function of the expressed protein does not need to be known. The timeline for a typical FTMS assay was 3 hours for buffer exchange and preliminary analysis that established if the protein was observable in the folded state and could be subsequently analysed. It took 2 days to undertake FTMS analysis of 331 fragments in 42 pools of 8 compounds and 2-3 days for confirmatory testing. In comparison, HTS requires considerable screen development relying on the prior identification of known substrates or binding partners before undertaking any screening. This label-free method appears to be the fastest methodology for assay development currently available. The lecture will report a successful proof-of-concept and identification of several promising hits with cellular activity that can be used as probes to understand pathways in latent and sexual stages of the malaria parasite and as drug leads. It is now possible to examine a more comprehensive set of proteins expressed by various life cycle stages of the malaria parasite.

#### Glycomics Approach to Tropical Disease

**Mark von Itzstein**

*Institute for Glycomics, Griffith University, Gold Coast Campus, Southport, Australia*

Carbohydrates play diverse roles in the lifecycle and on many occasions cell wall make-up of microbial pathogens. In microbial pathogenesis carbohydrates and microbe-associated carbohydrate-recognising proteins are used to target the tropical disease-causing pathogens to the host cell of choice. For example as an essential part of its lifecycle, Dengue virus uses its membrane-bound surface located glycoprotein, E-glycoprotein to target

and adhere to host cells that are decorated with specific carbohydrates. Sialic acids play diverse and sometimes essential roles in the life cycle of many microbial pathogens as well as in human biology. In the case of some parasites such as trypanosomes and plasmodia it is well known that sialic acids are utilised to either establish or support infection of host cells. *Trypanosoma cruzi* utilises host cell surface sialic acids to survive in the host bloodstream and to facilitate invasion of host cells. *Plasmodium falciparum* uses the erythrocyte-binding antigen 175 (EBA-175) to recognise host cell sialic acid-containing glycoconjugates such as Glycophorin A. Our interest in sialic acid chemistry and biology has led us to study, using NMR spectroscopic techniques and molecular modelling, the malaria parasite-associated sialic acid recognising protein, EBA-175. We have used a number of neuraminic acid derivatives to explore their capacity to be recognised by recombinant EBA-175 RII. Aspects of these studies will be presented.

## Infectious Diseases

16 July 2011

### Dengue Fever: Can We Learn from History?

John McBride<sup>1,2</sup>

<sup>1</sup>School of Medicine and Dentistry, James Cook University, Cairns, Australia

<sup>2</sup>Cairns Base Hospital, Cairns, Australia

Dengue virus, and its' vector, *Aedes aegypti*, were likely to have been introduced into Australia by sailing ships in the 1800's. Early epidemics including an 1897 epidemic in Charters Towers were described in great detail. It is clear that Dengue fever was rarely subclinical, multiple serotypes were circulating, and that deaths due to Dengue Haemorrhagic fever were common. Later in 1904/5, there was a major epidemic in Brisbane with up to 200 deaths. Thomas Bancroft first postulated that *Aedes aegypti* was the vector for Dengue during this epidemic, and this was confirmed in 1918 by Cleland and Bradley by experiments conducted in Sydney. After World War II, dengue epidemics occurred very infrequently, but since 1990 there have been 42 outbreaks of Dengue fever – with some significant epidemics. The scale of these epidemics is comparatively minor from an historical perspective and deaths have, to date, been rare. The frequent importation of dengue virus into north Queensland is a major challenge for authorities and is occurring against a back drop of burgeoning dengue activity internationally fuelled by increasing travel. Increased exposure to dengue in the population of North Queensland may increase the acuity of disease.

### Leptospirosis in Northern Queensland

Lee Smythe<sup>1,2</sup>

<sup>1</sup>Communicable Disease, Forensic & Scientific Services, Queensland Health Pathology Service, Brisbane, Australia

<sup>2</sup>WHO/FAO/OIE Collaborating Centre for Reference and Research on Leptospirosis, Western Pacific Region, Brisbane, Australia

The recent flooding and cyclone events in Queensland resulted in a notable increase in the number of leptospirosis cases and surge in testing requests. The reference laboratory has introduced a TaqMan assay to support serology and culture investigations. The availability of the nucleic acid based testing and volume of uptake of the test for the flooding events resulted in valuable diagnostic outcomes but has also identified issues with the test uptake and understanding of the best diagnostic "window" for its use. The surveillance and diagnostic work of the laboratory has recently identified the emergence of a new serovar and further highlights the need for culture to support serology and nucleic acid based testing. This serovar, Arborea, is now accounting for the majority incidence of leptospirosis in Australia, and having an impact on the northern parts of Queensland. The

move towards a vaccine for the disease continues with significant work being done and information now available on potential protein candidates but not without problems for researchers.

## Transformational Technologies

16 July 2011

### Genomes to Vaccines: Translating Genomic Sequence Data into Effective Public Health Interventions

Denise Doolan<sup>1</sup>, Angela Trieu<sup>1</sup>, Joanne Roddick<sup>1</sup>, Bruno Douradina<sup>1</sup>, Leanne Robinson<sup>2</sup>, Ivo Mueller<sup>2</sup>, Philip Felgner<sup>3</sup>, Alessandro Sette<sup>4</sup>

<sup>1</sup>Molecular Vaccinology Lab, Queensland Institute of Medical Research, Brisbane, Australia

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<sup>3</sup>University of California, Irvine, United States

<sup>4</sup>La Jolla Institute of Allergy and Immunology, San Diego, United States

Vaccines are one of the most cost effective and efficient health care interventions for infectious diseases, but vaccines against many diseases caused by complex pathogens are not available. Most licensed vaccines are based on whole organism approaches and candidate subunit vaccines based on one or a few target antigens have generally proved poorly effective. A significant advance of the past decade has been the elucidation of the genome, proteome and transcriptome of many pathogens; these data provide a foundation for a new approach to vaccine development. Using the *Plasmodium* spp. parasite, the causative agent of malaria, as a model, we are mining genomic, proteomic and transcriptomic datasets in pursuit of a rational approach to vaccine design for infectious diseases caused by complex pathogens. Using technology platforms such as protein microarrays, high throughput protein production, and epitope prediction algorithms with specimens from individuals naturally or experimentally exposed to the causative pathogen, we are identifying and prioritizing those antigens and epitopes most likely to be effective as vaccine targets by using biologically relevant selection criteria. Functional significance is assessed by immunogenicity (governed by the capacity of the antigen to be recognized by recall *Plasmodium*-specific immune responses in protective human models) and biological activity. We have shown that host immune responses are broadly dispersed among the *Plasmodium* proteome and have identified a large number of novel *Plasmodium* antigens that are more antigenic than current vaccine antigens. Our studies have established proof-of-concept for both T cell and antibody based immunomic approaches to identify antigens and epitopes which represent promising candidates for next generation vaccine development. These strategies may overcome the problem of poorly immunogenic, poorly protective vaccines that has plagued vaccine developers for many years.

### Development of Vaccines for Blood-Feeding Human Helminths

Alex Loukas

School of Public Health and Tropical Medicine, James Cook University, Cairns, Australia

Parasitic helminths infect more than 2 billion people. Hookworms and schistosomes are two such helminths, belonging to separate phyla but sharing similarities in terms of their percutaneous infection routes, reliance on human blood for nutrition, and anaemia that results from chronic blood loss. Combined, these two parasites are responsible for hundreds of thousands of deaths annually. Anthelmintic drugs are effective at eliminating existing worm burdens but do not protect against rapid reinfection, so there is therefore a pressing need to develop vaccines that stimulate long-term protective immunity against these parasites. Recent advances in the "omics" have facilitated characterization of hookworm and schistosome secretomes, and this information has accelerated the discovery of new vaccine target antigens. Discovery and current state of development of the lead antigens for schistosomiasis and hookworm vaccines will be discussed.

## The Epidemiology and Control of Schistosomiasis in China and the Future Impact of the Three Gorges Dam

Donald McManus

*Molecular Parasitology Laboratory, Infectious Diseases Division, Queensland Institute of Medical Research, Brisbane, Australia*

Schistosomiasis japonica is a serious parasitic disease and a major health risk for more than 60 million people living in tropical and sub-tropical zones of south China. Unlike the African forms of schistosomiasis, the disease is a zoonosis and its cause, the trematode blood fluke, *Schistosoma japonicum*, has a range of mammalian reservoirs, making control efforts difficult. Current control programs are heavily based on community chemotherapy with a single dose of the highly effective drug praziquantel but vaccines (for use in bovines, particularly water buffaloes) in combination with other control strategies are needed to make elimination of the disease possible. In this paper I will provide an overview of the epidemiology, transmission and prospects for the integrated control of schistosomiasis japonica in China. The recently completed Three Gorges Dam across the Yangtze River may undermine these control efforts because it will change the local ecology and associated schistosomiasis transmission risks over the next decade and beyond.

## Working in the Developing World

16 July 2011

### The Power is in the Hands of the People

Maxine Whittaker, Jo-an Atkinson

*Australian Centre for International and Tropical health, School of Population Health, University of Queensland, Herston, Australia*

Sustaining change is a challenge in health behaviour programmes. The Ottawa Charter on health promotion identified the important role of the supportive environments, community action and health service reorientation as well as building personal skills as important elements towards healthy communities and enabling people to increase control over, and to improve their health. The Pacific Malaria Initiative Support Centre (PacMISC), funded by AusAID, was established to provide flexible response support to Vanuatu and the Solomon Islands to implement their malaria programmes. In addition to the objective of intensified malaria control and improved access to malaria diagnosis and treatment, both countries have identified elimination of malaria as a medium term objective. Lessons learnt from other infectious disease elimination activities, including the unsuccessful eradication of malaria activities of the 1950s, is the importance of community engagement and participation in the efforts. However, community and people are one point of the triad –and of vector/parasite/human - that is the "poor cousin" and neglected element. This paper will report on the activities that have been requested in both countries to be developed to address community participation, human behaviour change and ultimately reaching and holding the line of malaria elimination within their countries. The paper will provide examples of the various health services research activities underway in these Pacific islands, the public health actions that have resulted from this evidence, and the implications for scaling up intensified malaria control and reaching the goal of elimination.

### Nursing Education in the Developing World

Kim Usher

*James Cook University, Cairns, Australia*

The report of the Mapping Exercise undertaken in 2007 indicates that the standard of nursing across the Pacific island countries is varied according to entry level, qualification offered, length of study, pedagogy, and content. The use of education and performance competencies also

varied across the region. Further, the mapping exercise revealed that some courses are only recognised in the particular country in which they are taught; an impediment to cross regional movement by qualified nursing staff. Not surprisingly, the report also described how the services and resources available at the schools in the region varied greatly, and that many are poorly resourced. The lack of personnel, classroom and other infrastructure necessary to conduct initial nurse education often hampers efforts to maintain standards. In contrast, other schools have undergone rapid expansion over the last few years and been offered the opportunity to upgrade their facilities such as clinical teaching laboratories, classroom resources, library facilities and teaching staff. The Enhancing the Quality of Nursing and Midwifery Education Programs and Services in the Pacific is a key project for the Pacific Human Resources for Health Alliance (PHRHA), with the overall aim of improving nursing and midwifery education and services. It is envisioned that the project will result in a regional approach to improving nursing education and result in the delivery of high quality nursing services in the region. The paper will provide an overview of nursing education in the developing countries of the Pacific and the outcomes of the PHRHA project.

## Conducting Community Health Research in Tropical Countries: Reflections from Melanesia

David MacLaren<sup>1</sup>, Humpress Harrington<sup>1,2</sup>

<sup>1</sup>*School of Public Health, Tropical Medicine and Rehabilitation Sciences, James Cook University, Cairns, Australia.*

<sup>2</sup>*Atoifi College of Nursing, East Malaita, Solomon Islands.*

Conducting community health research in the tropical countries of Melanesia can be filled with reward, frustration, satisfaction, exasperation and exhilaration - and that's just the first day! This presentation will reflect on lessons learned by a nurse educator from Solomon Islands and a public health researcher from Australia who have collaborated over the past two decades in community health service delivery and research. From their respective standpoints, these two men will discuss successes and challenges experienced when working with community leaders, faith-based organisations, government and non-government donors, health services and research institutions to implement community health research in remote locations across Solomon Islands and Papua New Guinea. Emphasis will be given to the importance of participatory methodologies with diverse and often disparate groups. Successes and challenges of working with and for people and communities not on or to people and communities will be discussed. Examples of how enduring relationships and mutually negotiated methodologies with community partners have enabled a range of projects to succeed will be discussed from the areas of culturally appropriate health care, tuberculosis treatment and management, soil transmitted helminth detection and control, and HIV prevention.

## Ashdown Oration

16 July 2011

### Can Vaccines Contribute to the Malaria Eradication Agenda?

Louis Schofield<sup>1,2</sup>

<sup>1</sup>*Queensland Tropical Health Alliance, James Cook University, Douglas, Australia*

<sup>2</sup>*Walter and Eliza Hall Institute, Royal Parade, Parkville, Australia*

Ongoing malaria transmission worldwide constitutes one of the greatest challenges to global health and development. Recent scale up of control has used available tools and strategies, particularly the integrated deployment of long-lasting Insecticide-treated bed nets (LLINs), Artemisinin-Combination Therapies (ACTs) and rapid Diagnostic tests (RDTs). Massive reductions in transmission and significant changes to the global epidemiology of malaria have ensued eg, *Plasmodium vivax*, more

resistant to these interventions, may partially replace *P. falciparum* in our own regional SE Asia and SW Pacific setting. Nonetheless, elimination of *P. falciparum* from certain regions may be in sight. Consequently, global malaria eradication has been embraced by the Bill and Melinda Gates Foundation. Current control strategies appear insufficient to achieve this end, as evidenced by ongoing incidence of *P. vivax*. Thus a malaria eradication research agenda has evolved to complement the traditional focus on reducing morbidity and mortality, to define the strategies and tools required to reduce the reproduction rate for all malaria species to <1. Antimalarial drugs and anti-vector measures will be essential at all stages of intervention, including the early control/“attack” phase to reduce transmission, and later stages of consolidation, preventing malaria reintroduction, and eliminating the final foci of infection. In theory, vaccines could contribute to malaria eradication. In the smallpox, poliomyelitis and measles campaigns, vaccines were the critical intervention, and no major infectious disease has been eliminated without a vaccine. However, for 35 years malaria vaccine research has focused on reducing morbidity and mortality due to *P. falciparum*. An ideal “vaccine that interrupts malaria transmission” (VIMT) target product profile envisages a vaccine against all species and life-stages of malaria that prevents morbidity while reducing transmission. Glycosylphosphatidylinositol is a target carbohydrate antigen conserved across all species and life-stages of malaria. The development of GPI as a VIMT will be discussed.

## Disaster Response and Disaster Medicine

17 July 2011

### The Queensland Floods – Disaster Response

Michael Slater

Queensland Reconstruction Authority, Brisbane, Australia

### Responding to Disasters: The View from North Queensland

Mark Little<sup>1</sup>, Peter Aitken<sup>2</sup>

<sup>1</sup>Department of Emergency Medicine, Cairns Base Hospital

<sup>2</sup>Department of Emergency Medicine, The Townsville Hospital

Health staff in Queensland have had an extremely busy 12 months responding to natural disasters. Staff have deployed to Pakistan after the floods, South East Queensland after the floods, Cyclone Yasi and the Christchurch earthquake. As some say, “business has been booming” in the Queensland disaster world. This presentation will look at the impact of Cyclone Yasi on Cairns and the surrounding North Queensland region. This resulted in the evacuation of Cairns Base Hospital, meaning the ongoing provision of health care, during a major natural disaster occurred without a hospital facility. The closest major hospital (Townsville) was also evacuating >200 patients from nursing homes likely to be flooded by the cyclonic storm surge with many other smaller facilities also affected. What do you do when told you are evacuating a major Australian hospital and transferring patients to Brisbane (2000km away)? How do you provide tertiary care when your hospital is closed and a “killer cyclone” (as described by the Courier Mail) is heading towards your city? The impact of infrastructure damage, including the potential loss of power, road and airport closure and damage to staff housing also need to be considered in any planning and response. Only a few weeks after this, health staff from North Queensland, were deployed as part of a Qld based Australian Medical Assistance Team (AusMAT) to Christchurch in response to the earthquake. Although a developed country, many of the approaches adopted were learnt from both deploying to developing world disasters such as Pakistan and the Cairns experience. What lessons can we learn from responding to these disasters in both the developed and developing

world? What challenges do we face as individuals, health professionals and a health system to better respond to the next crisis?

### Flood Related Infections – A Queensland Lab Experience

Smathi Chong

Department of Microbiology, Sullivan Nicolaides Pathology, Brisbane, Australia

Floods are the commonest natural disaster worldwide and may increase with climate change. Climatic conditions and extreme weather events affect the epidemiology of many infectious pathogens through the interactions of the biology of the microorganisms, increase in exposure and changes in human activities. Heavy rains during the summer of 2010/11 resulted in flooding in large areas of Queensland. This presentation will focus on a number of small studies performed in the period immediately following the major flood in Brisbane that peaked on 13 January 2011. The floods presented an opportunity to observe any changes to a number of water-related organisms diagnosed in both public and private microbiology laboratories. Compared to a similar period in the preceding two years, the main increase seen was in *Aeromonas* infections from wound swabs. Data on skin and soft tissue infections related to flooding from one private laboratory however also showed that the commonest pathogenic bacterial isolates were *Staphylococcus aureus* and *Streptococcus* spp, with *Aeromonas* spp making up a significant minority. An important subset of infections related to this period is that of Leptospirosis, which showed a notable increase around the state. A comprehensive set of data of laboratory diagnosis has been made available via the Leptospirosis Reference Laboratory. Comparisons would also be made to infections related to other natural disasters like cyclones and tsunamis. Other flood and water-related infections will also be reviewed. Despite the limitations of the data collected, it is hoped that this information would help inform future public health responses and advice to the general population. For doctors, this information would also be a basis for selecting appropriate empirical treatment of flood-related infections and injuries.

## Emerging Infectious Diseases

17 July 2011

### Emerging Viral Diseases and What to do About Them

John Aaskov

Institute of Health and Biomedical Innovation, Queensland University of Technology, Brisbane, Australia

Many of the emerging viral diseases are zoonoses or the viruses have “emerged” from non-human hosts. This often suggests that changes in social practices alone will not be adequate to prevent or control these infections. Similarly, there may be little that can be done to limit human exposure to these agents even when they have been identified. A final confounder is the acute nature of many of these infections such that the viraemia may have peaked before the patient first seeks medical assistance, i.e. medication, will have limited impact in either limiting symptoms or preventing spread. It is in these situations that vaccines are the obvious solution – the host takes their protection with them. Why don't we have more vaccines against these infections? (1) The people most commonly affected are poor or live in less developed countries, (2) Much of the cost of immunisation lies in the delivery of the vaccine, (3) Too little thought is given to immunisation strategies that might enhance the effectiveness of the vaccine. Is it time to revisit killed vaccines as a simpler, safer, route to protection against diseases that aren't a global threat? How close are we to a genuine alternative to the needle and syringe? Do we know as much as we need to know about each virus to develop effective immunisation strategies? We didn't when polio vaccines were first taken to countries where the disease was hyper-endemic. Is it time to re-visit the clinical trial paradigm?

## Chikungunya Virus, Epidemics, Arthritic Disease, Models and Treatments

Andreas Suhrbier<sup>1,2</sup>

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Chikungunya virus (CHIKV) has recently produced the largest recorded epidemic ever known for this disease, with >1.6 m cases in India, ≈270,000 cases in Reunion Island, and ≈200 cases in Italy. The recent epidemic was associated with the emergence of a new clade of viruses that are efficiently transmitted by *Aedes albopictus*, a mosquito vector that has seen a dramatic global expansion in its geographic distribution. CHIKV, like its relative Ross River virus, usually causes a self-limiting rheumatic disease that lasts from weeks to months. However, during the recent epidemic some cases were associated with severe disease and mortality. Current evidence suggests viral arthritides are due to the presence and/or persistence in the joints of virus or viral products that stimulate inflammatory innate and/or cognate immune responses. Although frequently used to explain rheumatic disease, no good evidence for molecular mimicry has emerged. CHIKV arthritic disease is associated with prolific monocyte/macrophage infiltrates and increased levels of MCP-1/CCL2, TNF $\alpha$ , IFN $\gamma$  and IL-6; inflammatory mediators also prominent in rheumatoid arthritis. Chronic disease appears to be due to persistent infection of macrophages, with virus persisting despite robust immune responses directed at the virus. A monkey and a wild-type adult mouse model of CHIKV disease have been established, which mimic many aspects of human disease. The mouse model has been used to test a number of prophylactic CHIKV vaccines, with simple vaccines shown to be highly effective and only low levels of antibody required to provide complete protection. Although IFN $\alpha/\beta$  is highly effective at preventing alphavirus infections, it has limited value as a therapeutic as CHIKV infected cells are resistant to the anti-viral effects of IFN  $\alpha/\beta$ . Targeting inflammatory pathways must avoid disrupting anti-viral responses and/or worsening immunopathology. For instance, anti-TNF agents, although highly effective for rheumatoid arthritis, can exacerbate alphaviral disease.

## Indigenous Health Forum

17 July 2011

### Aspects of Mental Health and Substance Misuse in Remote Indigenous Communities – Prospects for Population-level Interventions

Alan Clough

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Community action is required to reduce psychosocial distress and social exclusion linked with substance misuse in remote Indigenous communities. The causal links between ‘addiction’ and its psychological consequences, ‘social exclusion’ and poor mental health are widely recognised. If Indigenous Australians suffered the same rate of disease burden as the rest of Australia, it has been estimated that 59% of the total burden of disease, mostly non-communicable diseases, could be avoided. Indigenous Australians living in remote areas experience a disproportionate amount of the health gap compared with non-remote areas. Substance misuse is prominent among the risk factors. Significant resources are being invested under the National Partnership Agreement on Closing the Gap in Indigenous Health Outcomes. These historically important initiatives possibly are working, but the limited available evidence for evaluating their success is not convincing. There is a gap in our knowledge to accurately estimate the occurrence of many diseases and risk factors, especially factors which are linked with poor mental health, with data for remote

Indigenous communities available only from small epidemiological studies, mainly from the Northern Territory (NT). Generally, causal links between psychosocial distress, poverty and social exclusion, substance misuse and poor health have been theorised but not yet quantified in ways that are useful for evaluating outcomes of significant national-level interventions for Indigenous Australians<sup>18</sup>. We require robust systems of outcome measures and sound ways to assess intervention quality and delivery to ensure that the effectiveness of intervention programs promised under the National Partnership Agreement such as the NT Emergency Response and the COAG initiatives is maximised, with program components faithfully delivered to the populations that need them and with measurable outcomes. In this presentation, I will outline a research program aimed at meeting the need for improved evaluation methods and outcome measures to ensure that credible evidence is available for assessing the implementation and effectiveness of programs at the remote community level with a particular focus on substance misuse and mental health.

### Social Determinants of Health: Empowerment Through Increased Financial Capability

Jan Robertson, Alan Clough

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Recent research has found that social inclusion is supported by improving ‘financial literacy’, i.e. ‘the ability to make informed judgments and to take effective decisions regarding the use and management of money’. It may better be expressed as ‘financial capability’. The Australian Government has implemented a range of financial management initiatives in Indigenous communities, including conditional income management components. In contrast, other initiatives aim to improve financial knowledge and skills through financial education. Using an action research approach, we evaluated financial literacy programs delivered by local Aboriginal community members in two remote Far North Queensland sites for the Cairns-based Indigenous Consumer Assistance Network. This evaluation captured client outcomes and identified successful components of financial literacy programs that could be replicated elsewhere. The evaluation also found evidence of increased financial capability congruent with domains described in the body of international evidence. These domains included increased ability to manage money, plan ahead, make choices about financial products and access financial help. However, unexpected findings related to empowerment, an important element of the social determinants of health. Some clients expressing a sense control over financial matters also demonstrated increased empowerment in other areas of well-being. These included improved lifestyle choices relating to substance misuse and dealing with demand sharing.

### High Prevalence of Cannabis Use and Mental Health Impacts in Remote Cape York Aboriginal Communities

India Bohanna, Veronica Graham, Jan Robertson, Bernadette Rogerson, Ray Genn, Celia Demarchi, Yana O'Brien, Alan Clough

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**Introduction and Aims:** High rates of cannabis use and dependence are significant issues in remote Indigenous communities. We have previously shown extremely high rates of cannabis use, dependence and adverse mental health impacts in Arnhem Land. This study reports the first data on cannabis use and its mental health impacts in Cape York. **Design and Methods:** We interviewed over 300 Aboriginal people aged 16-40 years in three remote Cape York communities. Data was gathered on rates of cannabis use, mental health impacts including dependence and withdrawal, and reasons for quitting. **Results:** One in two individuals interviewed was using cannabis, with most using cannabis daily or weekly. Approximately 70% reported cannabis dependence. Encouragingly, more than 70% of current users were considering quitting/cutting down or had made previous attempts. In current users, seeking or starting employment was the most common motivation for wanting to quit, whilst former users quit

primarily for family reasons. Users reported negative mental health impacts of cannabis. One in four reported 'stressing out' when cannabis was unavailable, suggesting withdrawal. Anger/irritability, paranoia, auditory hallucinations thoughts of suicide/self-harm, and memory impairment were reported in up to 10% of users. **Discussion and Conclusions:** Rates of use and dependence are much higher than national rates (4.9% of males and 2.2% of females nationally used cannabis in the past week, 21% exhibiting dependence), and are similar to Northern Territory rates. One in four Aboriginal users in remote communities may be suffering mental ill health. Interventions should enhance quit support and employment opportunities and strengthen families.

## Australian Disease / Immunology

17 July 2011

### The Role of Scabies Mite Complement Inhibitors in Scabies and Associated Bacterial Disease

**Katja Fischer**

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It has long been recognized that in tropical settings scabies predisposes to secondary bacterial skin infections, commonly caused by *Streptococcus pyogenes* (GAS) or *Staphylococcus aureus*, and hence its trivial name "itch mite" disguises a more serious situation in populations where scabies is highly prevalent. Particularly in northern and central Australia skin damage due to scabies mite infestations has been postulated to be an important link in the pathogenesis of acute rheumatic fever and heart disease, post-streptococcal glomerulonephritis and systemic sepsis. Treatment of scabies decreases the prevalence of infections by bacteria; however emerging resistance to current therapeutics emphasizes the need to identify novel targets for protective intervention. Complement plays a major role in scabies mite biology. We described several distinct classes of scabies mite intestinal proteins, each expressed as multi-copy family, which are excreted into the epidermis and interfere with the human complement system at various stages. Detailed functional analyses of catalytically inactive serine proteases (SMIPP-Ss) and serine protease inhibitors (SMSs) revealed that both of these mite protein families inhibit the three pathways of the human complement system. Thus scabies mites exert a complement evasion machinery disrupting the complement cascade at several levels and presumably simultaneously. Aiming to identify the molecular mechanisms underlying the link between scabies and associated bacteria we demonstrated that scabies mite complement inhibitors strongly enhance bacteria survival in whole blood assays. *S. pyogenes* and *S. aureus* have both evolved specific mechanisms to evade complement attack which may in combination with scabies mite complement inhibitors result in cumulative consequences for the host. We propose that the complement-inhibitory properties of scabies mite proteins promote growth of bacterial pathogens in the microenvironment of epidermal burrows.

### Mosquito-borne Diseases in Australia: A Surprise Every Minute

**Scott Ritchie**

*School of Public Health, Tropical Medicine & Rehabilitation Sciences, James Cook University, Cairns, Australia*

Australia is increasingly subject to outbreaks of vector-borne diseases. The incidence of dengue has grown with over 1,000 cases occurring in an outbreak in north Queensland in 2009. This past year, record rainfall associated with the 2010-11 *La Nina* event led to high populations of

mosquitoes in southern Australia, and the first significant outbreak of Murray Valley encephalitis since the 1974 outbreak. And an outbreak of malaria occurred in the Torres Strait during March and April 2011. This talk will explore the latest outbreaks of mosquito-borne disease in Australia, and highlight new research aimed at minimising the impact of these diseases. In particular, I will discuss the use of the bacteria *Wolbachia* to 'dengue proof' Australia.

### Melioidosis; Why Is It So Common in Darwin?

**Bart Currie**

*Menzies School of Health Research and Northern Territory Clinical School, Royal Darwin Hospital, Australia*

Melioidosis is caused by the soil and water bacterium *Burkholderia pseudomallei* and was first documented from Australia in an outbreak in sheep in 1949 in Winton, north Queensland. The first human case described in Australia was a 32 year old diabetic from Townsville who developed fatal septicaemic melioidosis. The first case reported in the Northern Territory was in 1960. The Darwin Prospective Melioidosis Study began in October 1989 and has documented 687 culture-confirmed cases of melioidosis in the Top End of the Northern Territory over the last 21 years, with 96 (14%) being fatal. The risk factors for both disease and a fatal outcome are diabetes, hazardous alcohol use, chronic lung disease, chronic renal disease and malignancy +/- immunosuppression. To date there has been no fatality at Royal Darwin Hospital in a previously healthy individual. Since the onset of the 2009/10 wet season there has been an unprecedented increase in melioidosis in the Top End, with 152 cases from October 1st 2009 until May 19th 2011. The increase has been predominantly cases from urban Darwin and is likely to be only partly explained by the heavy rainfall of the last two northern Australian monsoons. Other postulated contributing factors include changing population demographics, with increasing people with risk factors in the urban Darwin region and evidence emerging of an anthropogenic driven increase in *B. pseudomallei* in the local environment. The latter has important implications for future planning and development across northern Australia.

### Gut Inflammation: A Question of Immunological Checks and Balances

**Nick Smith**

*School of Public Health, Tropical Medicine and Rehabilitation Sciences, James Cook University, Smithfield, Australia*

Diarrhoea is responsible for 17% of all deaths of children under 5 years old – that is more than double the mortality rate due to malaria, four times that of measles and eight times that of HIV/AIDS. Like malaria, measles and HIV/AIDS, it is particularly problematic in the poorest nations. It is mostly caused by infections of the gut and the inflammatory responses to them; though the causative agents of diarrhoea are diverse bacteria, viruses or parasites, the underlying pathogenesis may be quite similar. Moreover, intestinal inflammation is not just the result of infection. In the developed world, it is often associated with syndromes collectively termed Inflammatory Bowel Disease (IBD) of which Crohn's Disease is a particularly important example; and, its incidence is on the increase. Oral infection with the common protozoan parasite, *Toxoplasma gondii*, causes an inflammatory disease in the small intestine of C57BL/6 mice that has all the hallmarks of intestinal inflammation in general, whether caused by other infectious agents or associated with IBD. It is an excellent model system for investigating the molecular pathogenesis of intestinal inflammation. Susceptible mice show a marked, acute inflammatory pathology in the intestines characterised by oedema and angiogenesis, blood and pus in the ileum, with villous atrophy and infiltration of inflammatory cells into the submucosa and muscle layers of the gut. This is accompanied by acute weight loss, unusually high levels of inflammatory cytokines and, most particularly, excessive levels of reactive nitrogen intermediates. The

apparent inability of the host to switch off production of reactive nitrogen intermediate production represents a failure in immune regulation resulting in immunopathology.

## Tropical and Geographic Medicine

17 July 2011

### Community Health Service Delivery and Research at a Remote Solomon Islands Hospital

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Atoifi Adventist Hospital and Atoifi College of Nursing are located on the remote Eastern coast of Malaita, Solomon Islands. The hospital primarily serves the mainly subsistence villagers in surrounding communities. The College of Nursing is one of two in the country and the only one in a remote provincial location. There are many community health issues including malaria, pneumonia, fungal infections, tuberculosis, child and maternal mortality, intestinal parasites and sexually transmitted infections. There is much capacity and willingness to improve service delivery and public health research at Atoifi. However, constraints such as limited financial resources, training opportunities, support to conduct research, transport (no roads) and physical infrastructure (including limited electricity and communication) are restricting health professionals from working to their potential on these important areas. Humphress Harrington, Principal of Atoifi College of Nursing and hospital administrator, will report upon health service conditions as they impact the service delivery and education of health professionals at Atoifi Hospital. Harrington will discuss health challenges and how they are being addressed in communities near the hospital. In particular, he will discuss recent public health research capacity building efforts which are enabling hospital and college staff to systematically gather evidence in partnership with surrounding communities to address health issues in the area. This will be exemplified by outlining how, for the first time, a soil transmitted helminth survey was conducted in a nearby village and how results are informing community health interventions including village-wide treatment, education and plans for improvement of sanitation infrastructure. Humphress Harrington will discuss Atoifi Hospital's plans to further develop health service delivery and research in this challenging tropical and resource-poor environment.

### One Flap of a Seagull's Wings

John Pearn<sup>1,2</sup>

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Small things can have unimagined consequences. The French mathematician, Poincare (1854-1912), quantified how the long-term results of trivial variations at the beginning of a sequence could lead to huge end-point differences. In 1963, Edward Lorenz (1917-2008), working in meteorological forecasting, suggested that "a flap of a seagull's wings might alter the course of the weather forever". Another meteorologist, Philip Merilees, developed the metaphor further—"Does the flap of a butterfly's wings in Brazil set off a tornado in Texas?" Thus Chaos Theory was born. The concept has had profound implications for humankind in many fields including climate change, economics and medicine. It is amusing to imagine the links of a Chaos Sequence in reverse—that is, to run the sequence backwards. From an arbitrary feature point, the tornado in Texas, it is possible to trace the reversed path back through many nodes

to the butterfly's wing in Brazil. Take one of the most important papers in the history of science; Watson's and Crick's paper in the April 1953 issue of Nature, entitled "Molecular Structure of Nucleic Acids". Crick was funded by the National Foundation of Infantile Paralysis. Proceeding backwards, President Roosevelt's establishment of the Foundation in 1938 followed the advocacy and renewed vigour in polio treatment promoted by Sister Elizabeth Kenny (1880-1952) in her 1937 book, "Infantile Paralysis and Cerebral Diplegia". Proceeding backward, Sister Kenny began her rehabilitation of polio patients in North Queensland, opening the Kenny Clinic at the Queen's Hotel in Townsville in March, 1934. From small beginnings fine things may eventuate.

### Mountains and Medicines: History and Medicines Use in Rural Nepal

Susan Heydon

School of Pharmacy, University of Otago, Dunedin, New Zealand

This presentation highlights the value of an historical approach for current health research into access and use of medicines. It focuses on the rugged Mt Everest region of Nepal and the mainly Sherpa inhabitants from the 1960s through to the present. It draws on an in-depth historical case study of Khunde Hospital, the main provider of health services in the area, and an exploratory study of medicines use over time. The research employs a variety of qualitative methods and uses a wide range of written and oral, primary and secondary, published and unpublished sources as well as participant observation and further fieldwork. Multiple separate and interconnected factors have influenced medicines use over time. The study identifies the importance of medicines in the introduction and spread of 'modern' medicine in the area, but like elsewhere in the Himalayan region modern health care and its medicines are used within a plural medical environment. The Mt Everest region has become a major tourist destination which has led both to considerable economic development in the area but has also influenced the supply and use of medicines. While medicines use unsurprisingly is different today, this development overall has occurred within a framework of both continuity and change that underpins Sherpa life more broadly.

### Assays For Diagnosis Of Lymphatic Filariasis And Their Applicability In Diagnosing Endemic Versus Non-Endemic Infections

Hayley Joseph

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In Australia there are an increasing number of migrants, refugees, visitors and returning travellers from filarial-endemic countries. Understanding how to diagnose lymphatic filariasis (LF) requires knowledge of the diagnostic methods available, knowledge of the lifecycle of the parasites *Wuchereria bancrofti* and *Brugia* sp., and obtaining a detailed case history of the individual. There are three main diagnostic markers for lymphatic filariasis: microfilaraemia, antigenaemia, and antibodies. Detection of these markers is not only a product of the sensitivity and specificity of the available diagnostic assays, but also is dependent on the stage of the lifecycle of the parasite. Furthermore, the limits of sensitivities of the assays will also be affected by the worm burden of the patient. The previous history of the patient will also affect the diagnostic assay of choice, depending on the time period spent in an endemic country. Test results from an individual who has emigrated from an endemic country should be interpreted differently to that of an individual who has travelled to an endemic country for a short period of time. This oral presentation aims to review the available diagnostic assays for detection of microfilaraemia, antigenaemia and antibodies and, in addition, their appropriateness in diagnosing "endemic individuals" versus "non-endemic individuals".

# POSTER ABSTRACTS

## ASM/ACTM PARASITOLOGY MASTERCLASS AND ACTM/QTHA ANNUAL CONFERENCE: 14-17 JULY 2011

### A Gnathostomiasis Outbreak in Beijing Acquired from Eating Fish or Eel at a Banquet

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In 1997, 50 Australians went on an organised trip to Beijing for 4 days and Singapore for 5 days. Several people became ill on return and investigations in the index patient finally led to a diagnosis of gnathostomiasis (positive immunoblot - Bangkok). Questionnaires were sent to all 50 people around Australia - 34 replied. 34 were tested for gnathostomiasis by immunoblot. 13 were positive- all were then treated with albendazole 400mg bd for 28 days. Of the 34 who replied all wondered about the "seafood" banquet on day 2 in Beijing. Most did not recognise what they were eating. Only 8 did not eat fish or eel and all were negative on immunoblot. Of the 26 who did eat fish or eel 13 (50%) were positive. Symptoms occurred in 11 on returning to Australia and 7 (64%) of these were immunoblot positive. Of the 13 positive immunoblot patients - 6 (46%) were asymptomatic, 2 had mild gastrointestinal upset and 5 (38%) were unwell. Of the five unwell patients, illness began between days 7- 48 days after the banquet (mean incubation period 17 days). Symptoms consisted of fevers/sweats in 5, headaches 4, epigastric pain 3, cough 3, mild rash 3, diarrhoea 3, nausea 2, subcutaneous nodules 3 and neck swelling in 2. Investigations revealed atypical lymphocytes in 3, abnormal liver function 2, raised C reactive protein in one and eosinophilia in only one patient. Disease manifestations included no localising signs in one, subcutaneous nodules in 2, spinal cord lesions in 1, and in the index patient - cerebral, subcutaneous, cardiac pulmonary and abdominal foci. Gnathostomiasis is a risk in anyone eating fish or eel in Beijing.

### A Review of Microscopic and Culture Positive *Strongyloides stercoralis* Faecal Samples from Alice Springs Hospital - January 2004 to December 2010

James McLeod

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Strongyloidiasis is caused by the nematode *Strongyloides stercoralis*. The life cycle of strongyloides requires a free living stage in the soil and is an infection of tropical and subtropical areas. Central Australia is characterised by a hot, dry desert environment. Central Australia is serviced by the Alice Springs Hospital. A review of the Alice Springs Hospital LIS system demonstrates that the tropical disease strongyloidiasis is prevalent in a non-tropical, desert environment. While microscopy and culture lack sensitivity with respect to identifying patients infected with *S. stercoralis*. A review of the Alice Springs Hospital LIS system between January 2004 and December 2010 has shown that 72 patient faecal samples were either microscopically or culture positive for *S. stercoralis*. The laboratory only receives samples collected by the Alice Springs Hospital and does not process samples collected from the many Indigenous Communities within the hospital's patient catchment area. This demonstrates the presence of *S. stercoralis* in a semi-arid/ desert environment. The figures are a gross under estimate of the organism's true prevalence due to the limited sampling of specimens received by the laboratory. All the patients were identified by the hospital's computer system as being indigenous. Children 5 and under comprised 57% of the patients with the next largest group being the 40 to 50 years age group comprising 15% of patients.

### A Serological Survey of Papua New Guinea Blood Donors for Hepatitis B and Related Co-infections

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Hepatitis B (HBV) infection is a serious problem both globally and nationally. Earlier studies in certain areas of Papua New Guinea (PNG) reported high prevalence of infection, especially in the Highlands of PNG and in the Autonomous Island of Bougainville. These studies were done using insensitive tests and before an expanded immunization program. The current HBV status is therefore uncertain. A retrospective study to investigate the current HBV status was carried out using blood donor data at Nonga General Hospital, East New Britain Province, PNG from January 2003 to December 2010. Additional data for HIV and syphilis were also analysed. HBsAg status was determined by using both the Hepa S Ag Test kit and SB-Bioline Hepatitis, while HIV and Syphilis status were determined using the Serodia HIV 1 & 2 Kit and Syphilis RPR Carbon Antigen respectively. Samples initially positive for HIV were repeated, and if still positive, were confirmed by Determine and Immuno-Comb. Data for 13, 142 donors were collected. Of these, 3, 872 (29.46%) were excluded and 9, 270 (70.54%) were analysed. Analysed samples included 66.18% (6, 135) males and 33.8% (3, 135) females. There were more new donors 57.7% (5, 3465) than old donors 42.3% (3, 924). Of the male donors, 71.8% (1, 689) were HBsAg positive while 28.2% (663) of the females were HBsAg positive. In both genders, a high percentage (32.2%) of HBsAg positive was between the ages of 20-24 years. Co-infections with syphilis and HIV were also observed, with co-infection with syphilis being higher (33.3%) than with HIV-HBsAg co-infection (0.9%). The paper discusses the significance of these and other population trends seen in the results.

### Animal Reservoirs of Q Fever in Tropical Australia

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**Background:** Q fever is a zoonotic disease characterised by an acute febrile disease lasting for two to three weeks with fatigue, chills and headaches. The causative agent is *Coxiella burnetii*, an obligate intracellular bacterium, endemic across Australia. Cattle, sheep and goats are the primary sources of human Q fever. Although, domestic animals have been implicated in some cases, very few investigations of carriage in native animals have been performed. **Methods:** Human serum and a variety of domestic and feral animals from the Townsville region were screened for serological evidence of *C. burnetii* exposure using conventional indirect ELISA. Serum samples from a variety of wildlife were also screened using a variety of ELISA methods, including indirect ELISA, competitive ELISA and phage-displayed ELISA. To date, phage display has only been used for the generation of primary antibodies. In this study, secondary antibodies were generated using phage display. The technique was optimised by producing recombinant chicken anti-murine IgG antibodies and validated by their successful use in ELISA. Libraries were then constructed for various Australian native animals including macropods, common northern bandicoot and brushtail possum. **Results:** Seroprevalence across various species was found to be 3.5% in the human population, 15.9% in cattle, 18.9% in domestic dogs, 17.3% in dingoes, 6.1% in domestic cats, 38.7% in feral cats, 43.8% in foxes, 21.1% in feral pigs, 26.9% in bandicoots, 25.9% in macropods and 19.6% in possums. **Conclusions:** Results from

ongoing studies demonstrate a high possibility of domestic animals, feral animals and wildlife being reservoirs for *C. burnetii*.

## Cutaneous Leishmaniasis in a Returning Traveller with HIV

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Infections in HIV infected returning travellers often present a diagnostic and therapeutic challenge. There is an increased incidence of leishmaniasis in this population, which may present atypically and respond poorly to therapy. A 34 year old male diagnosed with HIV in 2006 at seroconversion, left for a 2 year trip to South America in 2008 with a CD4 count of 312 (30%). He had never been on antiretrovirals. 4 weeks after his return in 2010, he presented with dyspnoea and dry cough. His CD4 count was 209 (22%). He completed 3 weeks of oral cotrimoxazole for Pneumocystis jiroveci pneumonia, with resolution of his symptoms and was commenced on antiretrovirals (tenofovir/emtricitabine/efavirenz). Around this time he was noted to have a small purulent nodule on his left leg. Routine swabs revealed no growth, and there was no response to oral clindamycin. Over the next month the ulcer enlarged and displayed lymphangitic spread. A biopsy revealed dermal and subcuticular active chronic inflammation with areas of necrotising and suppurative granulomatous inflammation. Stains for organisms were negative. Bacterial, fungal and mycobacterial cultures were negative. The progression of the ulceration over the month correlated with restoration of his CD4 count to 322 (37%). A biopsy repeated at this point showed marked increase in the granulomatous response. This was thought to be compatible with his immune reconstitution. On closer review of the histology, intracytoplasmic bodies less than 1µm (amastigotes) were seen. He was commenced on liposomal amphotericin 3mg/kg day 1 to 5, and again on days 14 and 21 with complete response. *Leishmania* PCR was subsequently positive. With increasing globalisation and with most HIV infected individuals living normal healthy lives, we are likely to see more infections in the returning HIV infected traveller. These may present atypically, be more severe, and not respond to therapy as expected.

## Effect of Thermal Processing on the Allergenicity of the Tropical Black Tiger Prawn (*Penaeus Monodon*)

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Increased production and consumption of tropical seafood has resulted in more frequent reports of adverse reactions highlighting the need for more specific diagnosis and treatment of crustacean allergy. While cross-reactivity between related crustaceans is often demonstrated there is a poor correlation of IgE reactivity among and between fresh and processed species. This study aims at identifying allergenic proteins in raw and thermally processed prawn species for improved diagnosis and management of patients with crustacean allergy. Two types of protein extracts were prepared; raw (R) and heat treated (HT) extracts from Black tiger prawns. The major shellfish allergen, Tropomyosin was purified using ion-exchange chromatography. In addition, recombinant Tropomyosin was generated in *E.coli* and purified using affinity chromatography. Serum samples of sixteen patients with clinical reactivity to ingested prawns were tested for IgE reactivity by immunoblotting. The allergenic proteins from the various extracts were identified using mass spectrometric analysis. Allergenicity of the proteins was confirmed by patient basophil activation assay. Several major IgE-reactive proteins were identified in the prawn species. Thermal processing of prawn proteins increased the IgE binding reactivity to different proteins in the Black tiger prawn. The

higher molecular weight IgE reactive proteins in the raw extract seem to be more heat sensitive whereas the lower molecular weight proteins seem to be heat resistant with an increase in IgE reactivity. The heat stable allergens were identified as Tropomyosin, Arginine kinase, Myosin light chain and Sarcoplasmic calcium binding protein. Moreover, IgE reactivity to recombinant Tropomyosin was confirmed using immunoblotting. Current diagnostic methods do not take into account the effect of thermal processing of shellfish which we demonstrated; has a significant impact on their allergenicity. The nature and clinical relevance of these proteins needs to be further characterized.

## Eosinophilia in the Northern Territory: A Missed Parasitological Opportunity?

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Eosinophilia is frequently detected by our laboratory in residents of the Northern Territory. We analysed diagnostic approaches in such patients with moderate to severe eosinophilia (defined as >15%) documented by our laboratory in calendar year 2010. 212 cases were identified, 112 (52.8%) were male and 110 (47.2%) female. Age range was 2 months to 92 years with a median of 39 yr. 45 cases (21.2%) were in the paediatric age range (<14 years). The level of eosinophilia ranged from 15-54% (median 221%) or absolute count 600-6200 x 10<sup>6</sup>/L (median 1800). The duration of eosinophilia was 0 – 19 years with a median of 6 years. Only 65 cases (30.7%) had relevant investigations (stool microscopy or serologies) to look for a parasitological cause of eosinophilia. 20/38 (52.6%) cases who had *Strongyloides* serology performed were reported as positive and 2/38 (5.3%) were in the equivocal range. 28 cases had stool microscopies performed (range 1-3, median 1) with 4 (14.3%) having *Giardia lamblia* detected and single reports (3.6%) of *Hymenolepis nana*, *Chilomastix mesnili*, *Retortamonas intestinalis* and *Blastocystis hominis* documented on microscopy, but none had *Strongyloides* larvae seen. We conclude: (1) Eosinophilia is frequently documented in residents of the Northern Territory, (2) The documented duration of eosinophilia in such patients is usually prolonged, (3) Few patients with eosinophilia appear to have investigations to rule out a parasitological cause, (4) Strongyloidiasis is the commonest documented cause of eosinophilia in this setting.

## Faecal Parasitology of Human Specimens Collected From a Remote Aboriginal Community in the Northern Territory

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**Background:** Parasite infections diagnosed by examination of faecal specimens often go undetected if fresh specimens are not examined within several hours of collection. In remote Aboriginal communities in the Northern Territory it is generally not possible to get faecal specimens to a laboratory on the day of collection, thus making diagnosis difficult. A study conducted 15 years prior to ours examined faecal specimens on site in the same community and found that 15% were positive for *Strongyloides stercoralis*, 88% for *Trichuris trichiuria*, 15% for *Rodentolepis (=Hymenolepis) nana* and 24% for hookworm. **Aim:** To describe the parasites detected in human faecal specimens collected in the same remote community between April and June 2010. **Method:** Faecal

specimens were collected from children aged <15 years for the diagnosis of *Strongyloides stercoralis* infection during a population census and ivermectin mass drug administration study that was being conducted in a remote Aboriginal community in the Northern Territory. Diagnosis of *Strongyloides stercoralis* infection was undertaken by direct microscopic examination of faecal smears within 4 hrs of collection and inoculated onto a Mueller Hinton agar plate and cultured at room temperature for 5 days. Agar plates were transported to Menzies School of Health Research in Darwin and were assessed on days 2, 3, 4 and 5 post inoculation. A faecal sample was also transported to Menzies for the detection of *S. stercoralis* Deoxyribonucleic acid (DNA) by polymerase chain reaction (PCR). **Results:** Forty six faecal specimens were collected of which 7% were positive for *S. stercoralis* by microscopy, 9% by culture and 35% by PCR. Other parasites identified by microscopy included 52% *T. trichiuria*, 28% *R. (=Hymenolepis) nana* and 26% *Giardia lamblia*. No hookworm was detected in any of the faecal specimens. **Conclusion:** Intestinal parasites are highly prevalent in faecal samples collected and tested in remote communities. However, undertaking faecal microscopy and culture is logistically extremely difficult in this setting. PCR may become a useful alternative for on site diagnosis as it appears to be more sensitive in detecting infection not identified using other methods.

### Leptospirosis in American Samoa 2010 – Epidemiology, Environmental Drivers, and Risk Prediction

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Leptospirosis has recently been reported as an emerging disease worldwide, including the Pacific Islands. The environmental determinants of disease transmission vary between places, and include climate change, extreme weather, land use, international trade, animal reservoirs, and farming practices. We undertook a seroprevalence study in American Samoa to better understand the drivers of emergence. Antibodies indicative of leptospirosis were found in 15.5% of 807 participants, caused predominantly by three serovars that were previously unknown from American Samoa. Questionnaires and spatial epidemiology were used to assess behavioural and environmental risk factors. Many risk factors were consistent with the literature (male gender, outdoor occupations, low income, recreational water exposure, and poor knowledge of the disease), but we also demonstrated a significant risk associated with living at lower altitudes (OR = 1.53), and having higher numbers of piggeries around the home (OR = 2.63). An absolute risk prediction chart was generated using four variables: gender, occupation, knowledge about leptospirosis, and 'piggeries within 250m & above house'. These variables were chosen because they were statistically significant for overall seroprevalence, likely to be of practical use for identifying those at-risk, and for directing potential public health interventions. Our findings support a multi-faceted approach to combating the emergence of leptospirosis, including modification of individual risk but importantly also managing the evolving environmental drivers of risk. At the regional level, our findings are likely to apply to other Pacific Islands with similar climate, culture, lifestyle, and animals. With global climate change, predictions of increasing frequency and severity of cyclones in the Pacific can potentially worsen flooding risk, and exacerbate the disease burden from leptospirosis. Communities should prepare for the need to manage such rapidly evolving environmental drivers of risk, and we hope that the findings of our analysis provide a contribution to their ability to do so.

### Partial Intestinal Obstruction Due to *Strongyloides stercoralis*

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*Strongyloides stercoralis* is a common parasite in the Top End of Australia. We describe a case of partial intestinal obstruction in a child due to heavy infestation with *S. stercoralis*. A 27-month-old indigenous girl was brought into the Emergency Department with three weeks of diarrhoea and lethargy, and one day of abdominal distension and pain. She was dehydrated with a distended abdomen, active bowel sounds and moderate malnutrition. Abdominal radiograph showed faecal loading in the ascending colon and moderate distension of the small bowel. Laboratory results showed mild normochromic anaemia (108 g/L), mild thrombocytopenia (120 x10<sup>9</sup>/L), neutrophilia (9.8 x10<sup>9</sup>/L), hypoalbuminaemia (13 g/L) hypokalaemia (2.04 mmol/L) and hypomagnesaemia (0.50 mmol/L). Eosinophilia was absent. She was diagnosed with a partial bowel obstruction and nasogastric drainage was commenced. She was treated with intravenous rehydration, electrolyte replacement and albendazole. Faecal microscopy performed on faeces collected one day prior to albendazole demonstrated a heavy infestation with *S. stercoralis*. Adult females measuring 2-2.5mm (parasitic form) and rhabditiform stage larvae were seen. In addition, typical thin-shelled *Strongyloides* eggs showing varied stages of developing embryos were seen but were larger than previous reports (64-76um x 49-54um). Eggs usually hatch within the intestinal mucosa and are very rarely seen in faeces, but heavy infections with mucosal ulceration and sloughing may cause embryonated eggs to be seen in the diarrhoeic stool. Neither filariform stage larvae nor hookworm eggs were seen. In 2010, 9.2% of faecal specimens at Royal Darwin Hospital were positive for > 1 parasite. *S. stercoralis* rhabditiform larvae were found in 15% of positive specimens (35/234). While most infections with strongyloides are asymptomatic, heavy *S. stercoralis* infestation in young Indigenous children can infrequently lead to partial bowel obstruction; the "swollen belly syndrome", which is well recognised but now rarely seen in the Top End.

### Targeting Innate Immune Recognition Against *Salmonella* Infections in Immunocompromised Hosts

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Clearance of clinical and experimental *Salmonella enterica* infections requires CD4 T cells and IFN- $\gamma$  and non-typhoidal *Salmonellae* are responsible for many of the fulminant infections seen in HIV infected individuals in Sub-Saharan Africa and other parts of the developing world. T cells not only respond to antigenic stimulation, but also exert significant functions independently of cognate antigen. The precise mechanisms and involved cell types governing this exciting aspect in the biology of T cells remain largely unexplored. In the present study, we have dissected the mechanisms operating during antigen-independent CD8 T cell responses following exposure of naïve mice to heat-killed bacteria. Evidence is presented that flagellin is the major structural component in *Salmonella* Typhimurium responsible for evoking IFN- $\gamma$  secretion in memory CD8 T cells. Using a combination of knockout mice and bone marrow chimeras, our data reveal that bacterial flagellin recognition occurs in dendritic cells in vivo, involving the NLR4 inflammasome, caspase-1 and IL-18. We have identified that innate IFN- $\gamma$  secretion in response to heat-killed *Salmonella* Typhimurium is an exclusive function of central memory CD8 T cells in vivo, which respond directly to IL-18 and demonstrate that non-cognate memory CD8 T cells improve survival following *Salmonella* Typhimurium infection. These findings establish a novel functional link between inflammasome-mediated recognition of flagellin and T cell function in vivo and may contribute to new immunomodulatory or vaccine strategies for use in immunocompromised individuals.

## The Australasian College of Tropical Medicine: 20 Years On

Peter Leggat

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**Background:** The Australasian College of Tropical Medicine (ACTM) was established in 1991 and an ACTM Faculty of Travel Medicine (FTM) was established in 2000. A Joint Faculty of Expedition and Wilderness Medicine was also founded in 2011. The College aims to provide professional representation for those working in tropical and travel medicine in Australasia. In 2011, the ACTM celebrates 20 years since the foundation of the College on 29 May 1991 at a meeting attended by 10 people at the old Australian Institute of Tropical Medicine building in Townsville. **Methods:** The poster describes the major activities of the ACTM and its Faculties, which include: College and Faculty membership accreditation to Fellowship level; networking and scientific meetings of the College; publications; development of policies in travel medicine; advocacy, public awareness and community outreach; standing committees; representation on external committees related to tropical and travel medicine; and a website. **Results:** The ACTM and the FTM publishes feature newsletters, the ACTM Bulletin and the Travel Medicine Briefcase, twice per year, which is sent to all. It also published a journal, the Annals of the ACTM. The College has a secretariat based at the Australian Medical Association in Brisbane, Queensland, Australia (email. actm@tropmed.org). The ACTM has developed a website: <http://www.tropmed.org>, where information on the College is provided. Content and links to the website continue to be enhanced. The FTM also has a website: <http://www.travelmedicine.org.au> and a website for community information, namely: <http://www.welltogo.org.au>, hosted by the Travel Health Advisory Group. Membership applications are accepted from doctors, nurses, medical scientists and other appropriate health professionals. There is some flexibility in the academic qualifications required. The ACTM and the FTM also accept some external examinations conducted by other professional organizations, such as the American Society of Tropical Medicine and Hygiene, as an option to an academic qualification required for Fellowship. The ACTM publishes both online and print textbooks, including the Dictionary of Tropical Medicine, the Primer of Travel Medicine and also a developing Primer of Tropical Medicine. The ACTM and the FTM are also represented on various external committees and also contributes to scientific meetings conducted by the College and other organisations. **Conclusions:** The ACTM and the FTM provide a useful platform and recognition for those professionals working in tropical and travel medicine in Australasia. The ACTM and FTM are also making a useful contribution to the support of their respective fields. Promotion of membership remains one of the ACTM's major activities.

## The First Australian Case of Babesiosis in a Returned Traveller

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Human babesiosis is an emerging intra-erythrocytic infection caused by tick-borne protozoa *Babesia*. We report the first Australian case of human babesiosis in a returned traveller. A previously well 60-year-old woman presented with a febrile illness of 7 days duration. Ten days prior she had returned from an extensive 5-week holiday which included New York, Europe, Scandinavia and Singapore. Her first symptoms were nausea and lethargy before developing daily fevers with rigors, myalgia, headaches and a dry cough. Scleral icterus and mild hepatomegaly were present. Laboratory investigations showed a normocytic normochromic anaemia, thrombocytopenia, hyperbilirubinaemia and mildly elevated liver transaminases. Unexpectedly, parasites were seen on Giemsa-stained blood thick and thin films with approximately 2% of red blood cells infected with ring forms suggestive of *Plasmodium falciparum*. However immunochromatography was negative for *P. falciparum* and *P. vivax*. Given her history of travel to Singapore, *P knowlesi* was provisionally diagnosed.

However, she did not improve following treatment with artemether/lumefantrine and subsequent PCR for *Plasmodium* species was negative. A more detailed travel history revealed travel to Eastern Long Island, New York. Review of Giemsa-stained thin films showed extracellular parasites including the pathognomonic "Maltese cross" of *Babesia microti*. Treatment for babesiosis was commenced with quinine and clindamycin. She became more anaemic and required blood transfusions. Her anti-parasitic agents were changed to atorvaquone and azithromycin due to refractory nausea. Parasitaemia was not detected after 8 days of *Babesia* treatment. *Babesia microti* infection was confirmed by PCR. She has remained well. Babesiosis is an increasing problem globally due to enlarging endemic areas as well as increased travel of the elderly and those with immunosuppression. The diagnosis of babesiosis can be challenging in countries where malaria in returned travellers commonly occurs.

## The Immunopathology of *Burkholderia Pseudomallei* Infection in an Animal Model of Type 2 Diabetes

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Type 2 diabetes is the most common risk factor for melioidosis, a life-threatening tropical infection caused by the Gram negative bacterium, *Burkholderia pseudomallei*. The immunological mechanisms behind this co-morbidity are unclear. A model of type 2 diabetes and melioidosis co-morbidity is essential to investigate early host-pathogen interactions underlying susceptibility to *B. pseudomallei* infection and to identify therapeutic targets relevant to this high risk population. Susceptibility and disease progression was compared in homozygous db/db (diabetic) and heterozygous db/+ (non-diabetic) B6.Cg m +/- Leprdb/J mice infected with *B. pseudomallei*. Diabetic mice are obese, hyperglycaemic and dyslipidaemic compared to their non-diabetic littermates and were significantly more susceptible to both intranasal and subcutaneous *B. pseudomallei* infection. Despite similar organ bacterial loads at day 1 post-infection, cytokine expression and tissue pathology was exacerbated in diabetic mice suggestive of a hyperinflammatory response leading to overwhelming sepsis and increased mortality by day 3 post-infection. Altered immune responses in the early stages of *B. pseudomallei* infection contributes to increased pathology and earlier mortality in hosts with diabetes. These studies are the first to characterise an animal model of co-morbidity between two diseases of significance in the tropics, melioidosis and type 2 diabetes.

## The Role of Invertebrate Proteases in Allergic Diseases and Inflammation

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**Background:** IgE antibody mediated pathways are considered as the major route for allergic reactions to seafood. However, there is growing evidence of non-IgE mediated reactions triggered by active proteases in consumers exposed to seafood as well as workers in the seafood industry, probably through the protease activation pathway of cells. Serine proteases can activate a set of four distinct receptors (protease activation receptors, PAR), which are found on virtually all cells involved in allergic and inflammatory reactions. This study investigates and compares the different roles of proteases derived from closely related invertebrate species known to cause severe allergic and inflammatory reactions. **Method:** Tiger prawn (*Penaeus monodon*) and Rock lobster (*Jasus edwardsii*) and as well as the parasitic fish parasite - *Anisakis pegreffii* were analysed for their proteolytic activity using specific substrates for trypsin and trypsin-like enzymes. Protein extracts were purified by reverse HPLC (C18 column) and tested for their PAR reactivity using human lung epithelial cells (A549). **Result:** Several different proteases were identified in all samples. The

major protease however in all the invertebrates was serine protease with a low molecular weight. Importantly protease activity was stable in all heat treated samples. We successfully obtained 90% pure serine protease from reverse HPLC, retaining enzyme activity. Activation studies with A549 cells demonstrated interleukin 8 (IL-8) release even at very low protease concentrations with about five picogram (5pg). **Conclusion:** This study confirms that closely related crustacean and nematode possess a range of active proteases. Serine proteases in particular seem to be heat stable, very active at physiological conditions similar to that of the lung environment and activate 'PAR receptors' on epithelial cells. Serine protease activity is to be considered in inflammatory reactions towards exposure to crustaceans and nematodes.

### Travel Health Advisory Group: Travel Health Promotion Activities of a Joint Travel Industry and Travel Health Special Interest Group

Peter Leggat<sup>1</sup>, Bernard Hudson<sup>2,1</sup>, Nicholas Zwar<sup>3</sup>, Tony Gherardin<sup>4</sup>, Ian Cheng,<sup>2</sup> for the Travel Health Advisory Group.

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**Background:** The Travel Health Advisory Group (THAG), established in 1997, is a joint initiative between the Australian travel industry and travel medicine professionals that aims to promote healthy travel. THAG seeks to promote cooperation in improving the health of travellers between the travel industry and travel medicine professionals and to raise public awareness of the importance of travel health. **Methods:** The poster describes the major activities of THAG which include: networking and exchange among groups interested in travel health; undertaking travel health research; travel health promotion targeting travel service providers and the public; and the redevelopment of an increasingly popular travel health public website. **Results:** THAG is currently affiliating with the Australasian College of Tropical Medicine (ACTM) as a Special Interest Group and is seeking support from various travel industry and health groups. An updated travel health bookmark is now available for distribution through travel agents and THAG members. The welltogo.com.au website was developed in 2004 and has recently been updated and relaunched. THAG has published several papers in the leading travel medicine journals. An extensive program of health promotion is planned in 2011. **Conclusions:** A partnership approach between the travel industry and travel medicine professionals can effectively support a range of activities to promote the health of travelers. The welltogo website is now making an important contribution in providing

information to the Australian public on travel health. Travel Health Advisory Group (THAG): Member organizations are the Anton Breinl Centre, James Cook University (Peter Leggat), Australian Federation of Travel Agents (Jayson Westbury), Faculty of Travel Medicine, ACTM (Tony Gherardin). Jetset Travelworld Group (Karen McGee), MASTA Australia (Bernie Hudson), Qantas Airways (vacant), Royal Australian College of General Practitioners (Nick Zwar) and Members at large (Ian Cheng; Ms Bronwyn Claxton).

### Trends in Antimalarial Prescriptions in Australia: 2005-2008

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**Background:** Malaria continues to represent a significant risk for some travelers and malaria chemoprophylaxis has remained an important countermeasure for travel health prescribers. The aim of this study was to investigate the trends in prescription of antimalarial drugs, particularly those recommended for chemoprophylaxis in Australia, from 2005-2008.

**Methods:** In 2010, data were extracted from the online Australian Statistics on Medicines reports published by the Pharmaceutical Benefits Advisory Committee, Drug Utilization Committee, on antimalarials used in Australia for the period 2005-2008. **Results:** Among the drugs solely used as antimalarial drugs from 2005-2008, atovaquone plus proguanil and mefloquine were the most commonly prescribed antimalarials. Mefloquine prescriptions have increased by 38%. The numbers of prescriptions for atovaquone plus proguanil have nearly trebled during the period. Proguanil alone was no longer reported to be prescribed. The diaminopyrimidines, pyrimethamine-containing antimalarials, have also all but disappeared. Prescriptions for chloroquine have reduced by 66%. Artemether plus lumefantrine combination has been used in relatively small quantities, but no data was reported for 2007-2008. Quinine prescriptions have reduced by 63%. Although a considerable quantity of doxycycline was prescribed, it was unknown how much was prescribed for malaria chemoprophylaxis. **Conclusions:** Apart from the possible use of doxycycline, the most commonly prescribed antimalarials have been atovaquone plus proguanil and mefloquine, which have both increased during 2005-2008. The prescription of chloroquine has continued to decrease. Pyrimethamine plus sulfadoxine and proguanil alone are no longer recorded. The prescriptions of quinine may be becoming displaced by newer antimalarial drugs for treatment, but this needs further investigation. Trends in antimalarial use may be influenced by a number of factors, including the availability of antimalarials, increasing resistance, the issuing of updated guidelines for malaria chemoprophylaxis, and continuing education.

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# DISCUSSION PAPER

## Contact Lenses and Travel: Blessing or Nightmare?

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### ABSTRACT

A large number of travellers wear contact lenses. Generally, a lack of hygiene is one of the main causes of contact lens-related infections, especially microbial keratitis with potentially severe complications. During travel, inappropriate short-cuts to lens care, and changes to wear patterns increase the risk of infections. This paper identifies a travel health issue in need of more attention, illustrated by a wide range of practical problems that travelling contact lens wearers face. One possible solution for some travellers is suggested. The article concludes with the recommendation that travel health advice needs to consider real-life travel situations and, together with ophthalmological advice, find acceptable and safe compromises in the use of contact lenses to ensure optimal eye health during travel.

**Keywords:** Contact lens, microbial keratitis, travel medicine, ophthalmic, eyes

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Approximately 140 million people worldwide wear contact lenses.<sup>1</sup> They are worn for a number of reasons, often for their convenience over spectacles. The concept has been around for almost 200 years with acceptable products manufactured during the 20th century. Over time, lens material progressed from glass, hard synthetics, and rigid semi-permeables to soft hydrogel lenses. Some newer lenses (silicone hydrogel) also cater for overnight and extended wear.<sup>2</sup> Unfortunately, contact lens wearers are exposed to an increased risk of infections, mainly microbial keratitis with severe complications, including loss of vision.

Causative organisms are viruses, fungi, free-living amoebae,<sup>3</sup> but most commonly bacteria, predominantly Gram-negative *Pseudomonas aeruginosa* and Gram-positive *Staphylococcus aureus*. Climatic, especially tropical, conditions seem to influence infection and the severity of disease.<sup>4</sup> If not treated promptly, infections can lead to corneal scarring, perforation, and corneal ulcers which require in-patient treatment and possibly, eventually, a corneal transplant.<sup>5</sup> Some risk factors include extended wear (wearing the lens through several sleep cycles), epithelial microtrauma through inserting, wearing and removing of lens, and non-compliance with care and wear guidelines.<sup>1,5,6</sup> Being male, a smoker, of general good eye and body health,<sup>6,8</sup> and young (16-22)<sup>9</sup> - coincidentally perhaps the prime adventure traveler - seems to increase the risk of corneal infections. Lack of hygiene has been a major contributor to complications.<sup>1,5,10</sup> Interestingly, the location of corneal infiltrates indicates the type of handling of lenses (and subsequently the type of lens used) from removing the lens from its blister pack to the diverse cleaning techniques.<sup>7</sup>

Over the decades, several cleaning methods have been introduced to minimise the risk, ranging from heating gadgets and home-made saline solutions, and peroxide systems to, finally, the multipurpose solutions used currently which clean, disinfect, remove deposits, wet, soak and store in one go. Despite (or, perhaps, because of) the simplified procedure of caring for contact lenses, the risk of infections is considerable,<sup>5</sup> especially since multipurpose solutions may be ineffective in killing microorganisms responsible for microbial keratitis.<sup>11</sup> Poor general personal hygiene, lack of handwashing before handling lenses, contamination of solution and storage cases, and ill-advised wear patterns contribute to the problem.

Naturally, many millions of contact lens wearers travel. In the 1970s, contact lenses rated a mention in relation to air travel considering the dry air on planes combined with the less than comfortable lenses of the time. Later, corneal ulcers were reported from travelers to exotic destinations.<sup>12</sup> Responsible contact lens wearers will need little change to their routine when travelling to destinations similar to their home environment, and where the journey maintains their normal sleep-wake pattern. However, things change when wake periods are extended or altered, for example, on overnight or long-haul flights and car or bus journeys, or unforeseen delays, or when the infrastructure does not provide convenient clean running water in sanitary surroundings. This applies to a range of situations, such as adventure travel, trips to remote wilderness areas, stays with local families or in very basic accommodation in resource-poor countries, extended research trips to areas without infrastructure, or when itineraries clash with a person's habit of wear. These issues concern especially those whose uncorrected eyesight is poor enough to make functioning in unfamiliar environments problematic and potentially unsafe.

Considering the potentially serious complications, ophthalmologists and optometrists on the conservative end of the spectrum will, with good reason, prefer the use of spectacles over contact lenses. However, travellers for whom lenses are an integral part of life will insist on using them, possibly unaware of the impact of the changed circumstances on lens wear and care. The aim is to find a reasonably safe compromise and make travelers, especially those with a history of non-compliance, aware of the increased risk of complications.

Spectacles have disadvantages. They can fall and break; rain or sweat can let them slip off. They may be stolen. They may be knocked off during sporting or outdoor activities, or simply when trying to put on a heavy backpack. They can steam up leading to moments of incapacity. Even more importantly, people who depend on visual correction may have their ability compromised to act appropriately in case of an emergency on an airplane, ship or other transport. At night, unexpected adverse events that need an immediate response, such as a fire or break-in, animal attacks on camping trips, violence in unsafe neighborhoods, or personal assaults, are much more challenging if spectacles have to be located in a hurry.

These are convincing reasons for travelling with contact lenses. However, this still leaves the hygiene problem. In many destinations, and with many types of travel, the supply of clean water for handwashing in a clean environment is limited. Even if travellers are meticulous, *P. aeruginosa* contaminates commonly wet areas<sup>6</sup>. Worn taps and broken sinks, tiles, and concrete slabs in which water pools are found commonly in basic places. To care for lenses properly, it is necessary (1) to be able to clean one's hands, (2) to have sufficient clean space to place case and solution bottle so that neither can be contaminated by other objects, and (3) sufficient light. Practical problems mount on overnight travel, especially when using local transport with local rest stops where none of the above is available. Boiling or filtering water, or handling lenses with clean hands, is virtually impossible in situations such as, for example, breaking camp at 5am in the dark. Also, limited space or being in a hurry are just some of the reasons why, on occasions, lenses are mixed up. The error may only become evident sometime later, and the lenses have to be removed and placed in the correct eye, another unnecessary and potentially unsafe handling.

Where people sleep creates further problems. Examples are: staying with local families without water and sufficient reliable light when needed; sleeping in a tent in hot and humid conditions, such as on jungle trips, with hands still covered with sweat and traces of repellent; living with local people where the need for special considerations would cause great inconvenience to the hosts and embarrassment to the traveller; or in a very restricting physical environment, such as a hanging bivouac in a rock wall at high altitude. Although daily disposable lenses have low complication rates<sup>13</sup> and no cleaning is involved, those lenses are very thin, prone to fold and turn inside-out when trying to insert them, and hard to see in poor light even with handling tint. They then need to be handled extensively, and their initial benefit, which is having a fresh clean lens without a deposit build up, may be lost very quickly.

It is clear, overnight stops pose hygiene and safety problems for users of conventional contact lenses because (1) the lenses need care and (2) spectacles, with their disadvantages, need to be used to bridge the time between contact lens wear and sleep. The following suggestions may be suitable for some travelers and are based on 40 years of personal contact lens experience, having graduated through many types of lenses and care regimes, and remote travel. Concerns with unattainable hygiene and security/safety suggest that responsible contact lens wearers with a history of good experience may be candidates for refitting with modern 30-day high O<sub>2</sub> permeable lenses (silicon hydrogel lenses - SHL). This must be done under the supervision of an ophthalmologist or optometrist at least two months before a planned trip to test suitability. SHL are the most widely prescribed extended wear lenses.<sup>14</sup> Extended wear lenses largely eliminate the need to touch them. There is no need to use questionable water sources, and lenses are safe from fingers carrying traces of repellent, sweat, cream/moisturiser, hand sanitisers, sunblock, and grime. Should a traveller reach a safer destination, these lenses can be used like conventional lenses and still offer much greater comfort due to their superior material.

Many contact lens providers recommend that lenses should be removed after two weeks or so for a night. Following this advice would reduce the usual risk of infection due to extensive handling considerably. Alternatively, one could consider using lubricating eye drops liberally if removal seems ill-advised. Extended wear lenses also allow the wearer to get up at night in the case of an emergency and be fully functioning. Of course, travel with contact lenses makes it even more important to be mindful of potential irritants to the eye, such as dusty dirt roads or sandstorms, and wandering through shrubs and bushes. Other problems are: rubbing sweat off the eyes, getting cosmetic substances too close to the lenses, getting one's own or another traveler's spray-on repellent in the eyes, especially in windy conditions, or swimming in warm / hot springs, lakes and pools contaminated potentially with *Acanthamoeba*.

A traveller would need to carry spare lenses (depending on the length of stay), cleaning solution (preferably in the smallest bottles available (60mL) to reduce further the risk of contamination, and also to meet 'carry-on' luggage restrictions), a generous amount of eye drops in single-dose packages (being mindful of responsible disposal), possibly sterile eye-wipes, conventional sunglasses large enough to protect also somewhat from foreign bodies, and prescription glasses with transition lenses (to avoid the need for additional prescription sunglasses should the lenses have to be removed to maintain eye health). It has been suggested that travel kits should contain topical antibiotics<sup>12</sup> which is useful since the majority of keratitis are bacterial. On the other hand, most travellers would not be able to diagnose correctly the cause of an infection and, in the case of fungi or amoebae, much harm would be done if the incorrect treatment were applied and so medical treatment delayed due to a false sense of security. This is just one scenario supporting the encouragement of a closer cooperation between Travel Medicine and Ophthalmology / Optometry.

At present, there is no perfect lens and no perfectly safe hygiene regime. The suggestion of extended wear lenses for suitable travelers is based on the principle that the less a lens is handled, the lower the risk of contamination. In addition, these lenses add convenience and safety to travellers who need refractive corrections. Hydrogel extended wear lenses have a higher potential for infection,<sup>15</sup> a recent study<sup>16</sup> suggested an Odds Ratio of over 8, though these studies did not differentiate lens material. SHLs had a 5 times lower incidence of corneal infections ( $p < 0.04$ ) and less severe events ( $p < 0.04$ ) compared to hydrogel lenses.<sup>7</sup> The Relative Risk for severe keratitis was 3.1 compared to 15.2 for hydrogel lenses.<sup>17</sup> These favorable figures may relate to the higher oxygen transmittability of SHLs. The remaining risk may well be counterbalanced by removing the twice daily unsafe physical contact with regular lenses.

It appears that Travel Medicine does not include normally advice on contact lenses. Individuals are assumed to have their own way of dealing with them. It is unlikely that many travellers visit their ophthalmologist or optometrist pre-travel, when many travellers barely make it to a travel clinic. However, travel health professionals should be knowledgeable on this aspect and



advise travellers to discuss these issues with their contact lens provider. This is particularly important for travellers to remote areas, be this a 3-day jungle tour during a 5-star resort holiday, or an extended stay in basic circumstances for research or other purposes. It would be prudent to publish an ophthalmologist's or optometrist's expert review on eye health during travel considering real life situations experienced by travellers, not textbook guidelines. Such a review should take into consideration especially those travellers who have a casual approach to their lenses. Contact lenses are improved constantly, not least for commercial reasons. Until the perfectly safe lens is available, travel health professionals together with ophthalmologists or optometrists need to suggest consumer friendly solutions that safeguard travellers' eyesight and provide a positive travel experience.

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## Oseltamivir and its Role in Influenza Prevention and Treatment

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### ABSTRACT

Influenza is a major cause of morbidity and mortality worldwide. Mortality is particularly high in young infants and older adults. Apart from immunisation, which has some limitations, especially in certain groups like the immunocompromised, antiviral agents such as oseltamivir are being increasingly used in treatment and prophylaxis for influenza. Oseltamivir appears to be well tolerated and has become the mainstay of treatment of influenza infections in all age groups. Oseltamivir has been approved in Australia and other jurisdictions for the treatment of infections due to influenza A and B viruses in adults and children aged one year and older. A number of special approvals have seen oseltamivir fast-tracked into service to combat diseases, such as avian influenza, as well as pandemic (H1N1) 2009, especially in younger children (including children aged 6-12 months). A recent Cochrane systematic review has raised uncertainties concerning its usefulness in preventing complications requiring antibiotics in influenza in adults.

**Keywords:** Oseltamivir; Influenza; Prevention; Treatment; Pandemic (H1N1) 2009; Australia

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### Introduction

The World Health Organization (WHO) states that influenza is a major global cause of morbidity and mortality, especially amongst children, older adults and other at risk individuals, who are chronically ill or who have other serious medical conditions.<sup>1</sup> Around 5-15% of the population is affected by annual influenza epidemics, which results in between 250,000 and 500,000 deaths per year.<sup>1</sup> Influenza virus is highly contagious, affecting people of all ages and all socioeconomic backgrounds, and has a particularly profound effect on children.<sup>2</sup> Amongst children, mortality is highest amongst children aged 0-12 months.<sup>3</sup> In industrialized countries, most deaths occur in the elderly age groups greater or equal to 65 years of age, although much less is known about the impact of influenza in developing countries.<sup>1</sup> In Australia, vaccination has been the mainstay of prevention of morbidity and mortality due to influenza.<sup>4</sup> Antiviral drugs are also said to be an important adjunct to influenza vaccine for the treatment and prevention of influenza.<sup>1</sup> Amongst these, only neuraminidase inhibitors, such as oseltamivir and zanamivir, have been recommended for use against Pandemic (H1N1) 2009.<sup>5</sup> Oseltamivir is an effective drug for treating uncomplicated acute illness due to influenza A and B infection and appears to be one of the most important drugs effective against the novel influenza viruses.<sup>6</sup>

### Influenza Vaccination

Annual influenza vaccination is recommended for any person aged 6 months or older, especially amongst those at risk of complications from influenza infection, such as various cardiac, chronic respiratory conditions and other chronic conditions discussed elsewhere.<sup>4</sup> Currently, an intramuscular (IM) vaccination offers protection against influenza and reduces the risk of death and hospitalization from complications. However, immune response to vaccination decreases with age, because of immunosenes-

cence.<sup>7</sup> Antibody response to influenza vaccination in people aged greater or equal to 65 years has been found to be significantly lower than in young adults.<sup>8</sup> Intradermal (ID) vaccination may be a useful option in addressing this issue.<sup>9</sup> In the elderly individuals, ID vaccines may better present the vaccine antigen to the dermal or interstitial dendritic cells, which are able to induce an efficient immune response.<sup>10</sup> The WHO<sup>1</sup> makes the following recommendations with respect to vaccination: 'It is recommended that elderly persons, and persons of any age who are considered at "high risk" for influenza-related complications due to underlying health conditions, should be vaccinated.' The Australian National Health and Medical Research Council (NHMRC)<sup>4</sup> recommendations for vaccination can be found in Table 1. Vaccination rates tend to be quite high amongst elderly individuals greater than or equal to 65 years of age, but quite low amongst the younger adult population.

### Neuraminidase Inhibitors and Influenza Prophylaxis and Treatment

Neuraminidase inhibitors (NAIs), oseltamivir and zanamivir, are effective for treatment of symptomatic influenza infections in adults, although it is unclear how effective they are in preventing complications requiring antibiotic treatment of influenza cases.<sup>11</sup> Oseltamivir (Tamiflu) is also effective for prevention of secondary complications associated with influenza in healthy children and possibly also for influenza prophylaxis in this group, and it appears to be effective in shortening illness duration in healthy children with influenza.<sup>12</sup> Oseltamivir also reduces the duration of influenza by a median of 36 hours, with nausea and vomiting as the primary reported adverse effects.<sup>2</sup> Early initiation of treatment with oseltamivir provides greater clinical benefits. Infection with oseltamivir-resistant viruses significantly reduced the effectiveness of oseltamivir and reduced effectiveness of oseltamivir has been found to be more prominent in children aged 0 to 6 years than in those aged 7 to 15 years.<sup>13</sup> It was reported that the appearance of NAI-resistant strains was as high as 30% in both H1N1 and H3N2 influenza A subtypes, but such viruses were less transmissible.<sup>14</sup>

During the recent Pandemic (H1N1) 2009, the WHO recommended oseltamivir as first-line treatment for Pandemic (H1N1) 2009,<sup>15</sup> including for travellers,<sup>16</sup> with the use of zanamivir only for suspected or confirmed oseltamivir resistance.<sup>15</sup> In preparation for Pandemic (H1N1) 2009, several countries, including the United States, Canada, United Kingdom and the European Union, published interim orders permitting the expanded use of oseltamivir for treatment or prophylaxis for children younger than 1 year of age.<sup>17-19</sup> This action has provided additional experience and data on this younger age group.

Oseltamivir is currently registered for the treatment of infections due to influenza A and B viruses in adults and children aged 1 year and older. Table 2 has summarised the currently available neuraminidase inhibitors currently described in Therapeutic Guidelines-Antibiotic in Australia for treatment of influenza.<sup>20</sup> Table 3 lists the high risk groups where treatment should be prioritized. Ideally, treatment and prophylaxis should be commenced within 48 hours of symptom onset or after the exposure.<sup>20</sup> In addition to prophylaxis for unprotected and exposed health care workers, Australian guidelines<sup>20</sup> also suggest that: "Prophylaxis should be considered for close contacts of proven cases, particularly if those contacts are themselves in high-risk groups" (p262). There has been a move towards general widening of the indication for oseltamivir in the treatment of children aged 6-12 months, as well as clarifying the indication for the prophylaxis of immunocompromised children and adults with oseltamivir.

### Pharmacologic Action of Oseltamivir

The neuraminidase enzyme is responsible for cleaving sialic acid residues on newly formed virions and this is essential for the release of recently formed viral particles from the infected cell.<sup>6</sup> Thus the enzyme helps in the spread of the virus to other cells. Oseltamivir blocks the enzyme's ability to cleave sialic acid residues on the surface of the infected cell, thereby inhib-

**Table 1** Current groups recommended for influenza vaccination in Australia\*

People at increased risk of complications from influenza infection, including all individuals $\geq 65$ years of age
People who may potentially transmit influenza to those at high risk of complications from influenza
People involved in the commercial poultry industry or in culling poultry during confirmed avian influenza activity
People providing essential services
Workers in other industries and travellers

\*Adapted from the NHMRC<sup>4</sup>

**Table 2** Neuraminidase inhibitors listed in Australian antibiotic guidelines\*

AGENTS	AGE GROUP / WEIGHT RANGE	DOSAGE
Oseltamivir	Child, 1 year or more and <15 kg	30 mg, 12 hourly for 5 days
(Oral)	Child, 15-23 kg	45 mg, 12 hourly for 5 days
	Child, 23-40 kg	60 mg, 12 hourly for 5 days
	Child >40 kg; adults	75 mg, 12 hourly for 5 days
Zanamivir**	Adults and children >5 years	10 mg, 12 hourly for 5 days

\*Adapted from the Antibiotic Expert Group,<sup>20</sup> \*\*By inhalation using diskhaler

iting the release of progeny virions from the infected cells.<sup>6</sup> When exposed to oseltamivir, the influenza virions aggregate on the surface of the host cell, limiting the extent of infection within the mucosal secretions.<sup>6</sup> This helps in reducing the infectivity, as well.

### Pharmacokinetics of Oseltamivir

After dosing, the prodrug (oseltamivir phosphate) is readily absorbed from the gastrointestinal tract and rapidly converted into the active metabolite, oseltamivir carboxylate (OC).<sup>21</sup> The active metabolite is detectable in plasma within 30 minutes with maximum plasma concentrations after 3 to 4 hours.<sup>6</sup> After attaining the plasma concentrations, the concentration of the active metabolite declines with a half-life of 6-10 hours. The plasma protein binding of OC is only 3%.<sup>6</sup> Co-administration with food has no significant effect on the peak plasma concentration of the drug and can enhance the tolerability in some patients. In all patient groups, OC has high bioavailability and is systemically distributed to infection sites at concentrations sufficient to inhibit a range of influenza virus neuraminidases.<sup>21</sup> The OC rate of clearance per kg of body weight in children decreases with advancing age, such that exposure in children aged 13 years or older is similar to that in adults.<sup>22</sup> Oseltamivir has a predictable linear PK profile and is suitable for a variety of patient populations and age groups. The potential for clinically relevant drug interactions is low.<sup>21</sup> These characteristics underpin the use of oseltamivir in the diverse patient populations that are likely to be affected by seasonal and pandemic influenza viruses.

### Use of Oseltamivir in Special Groups

The efficacy of oseltamivir in treatment of influenza in those with chronic cardiac disease and/or respiratory disease has not been established.<sup>23</sup> The efficacy of oseltamivir in the prevention of influenza in immunocompromised patients has also not been established.<sup>23</sup>

#### Use in the Elderly and Young Children

In the elderly population, exposure to the active metabolite at steady state is about 25% higher compared with young individuals; but this does not necessitate dosage adjustments.<sup>6</sup> Young children (1 to 12 years of age) clear the active metabolite OC at a faster rate than older children and adults; infants as young as one-year can metabolize and excrete oseltamivir efficiently.<sup>6</sup>

#### Use in Pregnancy and Lactation

Oseltamivir is a pregnancy Category C drug in Australia and sufficient data is not available to assess the risk to the pregnant woman or developing foetus. Hence, it should be used during pregnancy, only if the potential benefits justify the potential risks to the fetus.<sup>6</sup> However, if treatment or chemoprophylaxis is required for pregnant women during the current pandemic, oseltamivir could be preferred over zanamivir because more information is available on the safety profile of oseltamivir in pregnancy.

A letter to the editor detailing concentration profiles of oseltamivir and OC in breast milk over five consecutive days of sampling suggests that oseltamivir is not expected to cause significant concentrations in the suckling infant.<sup>24</sup> The dose of oseltamivir that a 3 kg infant nursing on breast milk would be exposed to is 0.012 mg/kg/day.<sup>24</sup> Otherwise, little information is available in lactation. It should, therefore, be used in lactating mothers, only if the benefit for the mother justifies the potential risk of exposure of the drug to the nursing infant.<sup>6</sup>

### Impaired Hepatic Function and Renal Failure

As the metabolism of oseltamivir is not compromised in those with liver impairment, dose adjustment is not required in these cases.<sup>6</sup> The drug and its active metabolite are excreted by glomerular filtration and active tubular secretion. In patients with renal impairment, the metabolite clearance decreases linearly with creatinine clearance and averages about 23 hours after oral administration in individuals with a decreased creatinine clearance (< 30 ml/min). Hence a dosage reduction to 75 mg once daily is recommended for patients with a creatinine clearance less than 30 ml/min.<sup>6</sup>

**Table 3** High risk groups to be considered for treatment and prophylaxis with Neuraminidase inhibitors\*

Pregnant women
The morbidly obese
Those with underlying chronic diseases
The immunosuppressed
Homeless people
Nursing home residents
Indigenous Australians
The Elderly (>65 years) and the very young (<5 years)

\*Adapted from the Antibiotic Expert Group<sup>20</sup>

### Safety of Oseltamivir

Most of the reported adverse events (AEs) associated with oseltamivir are predominantly mild to moderate in severity and gastrointestinal. The most frequent side-effect of oseltamivir (5-6%) is mild to moderate nausea and vomiting, usually within the first two days of treatment.<sup>6</sup> Other relatively frequent adverse events include diarrhoea, abdominal pain, headache, dizziness, but a range of infrequent side effects have been reported from various studies.<sup>6</sup> If gastrointestinal symptoms are of concern, particularly if they affect efficacy, then the use of an inhalational antiviral drug, such as zanamivir, may be an option. It should also not be used in anyone who is allergic to the drug. In the past few years, there have been concerns regarding two studies of oseltamivir conducted in Japan and funded by the Japanese Government. The first study was in 2846 children during the winter of 2005–06. This study found evidence of unusual behaviour in recipient children within the first day of infection.<sup>25,26</sup> The second larger (>10 000 children) cohort study done the following winter failed to find any positive association. However, the analysis was criticised in this latter study.<sup>25,26</sup>

A detailed independent review of eight serious cases concluded that three sudden deaths during sleep and two near-deaths, as well as two deaths from accidents resulting from abnormal behaviour in older children and adolescents shortly after taking oseltamivir, were probably related to the central depressant action of oseltamivir.<sup>27</sup> In an industry-sponsored review, no plausible genetic explanations for neuropsychiatric AEs were found.<sup>28</sup> One retrospective study reported no increase in the incidence of insurance claims for neuropsychiatric events in patients receiving oseltamivir compared with those with no antiviral prescribed.<sup>29</sup> It has been suggested that the neuropsychiatric events reported were actually a result of viral illness.<sup>2</sup> Since the Japanese experience has not been replicated, the neuropsychiatric AEs from this earlier study have been largely put aside.



### Summary

Influenza is a major cause of morbidity and mortality worldwide. Mortality is particularly high in young infants and older adults. Apart from immunisation, which has some limitations, especially in certain groups like the immunocompromised, antiviral agents such as oseltamivir are being increasingly used in treatment and prophylaxis for influenza. Oseltamivir appears to be well tolerated and has become the mainstay of treatment of influenza infections in all age groups. Oseltamivir has been approved in Australia and other jurisdictions for the treatment of infections due to influenza A and B viruses in adults and children aged one year and older. A number of special approvals have seen oseltamivir fast-tracked into service to combat diseases, such as avian influenza, as well as pandemic (H1N1) 2009, especially in younger children (including children aged 6-12 months). A recent Cochrane systematic review has raised uncertainties concerning its usefulness in preventing complications requiring antibiotics in influenza in adults.

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