Differences in in vitro sensitivity and accumulation of anthelmintics in Trichuris suis and Oesophagostomum dentatum

24th International conference of the World Association for the Advancement of Veterinary Parasitology, Perth, Australia. 25-29 of August, 2013

Hansen, Tina Vicky Alstrup; Nejsum, Peter; Friis, Christian; Olsen, Annette; Thamsborg, Stig Milan

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OPENING SESSION
Official Welcome to Country
Premier’s Address and other VIPs

Chair: Andrew Thompson
WAAVP: The 50th anniversary in 2013 – history, achievements and future perspectives
Johannes Eckert
University of Zurich

Veterinary parasitology in Australia – a short history
Brown Besier
Department of Agriculture and Food Western Australia

Morning tea

PLENARY SESSION: ONE HEALTH
Chair: Alan Lymbery
One world health: socioeconomic burden and parasitic disease control priorities
Paul Torgerson
University of Zurich

One world health: whose world, whose health?
Yaowalark Sukthana
Mahidol University

VETERINARY PARASITOLOGY IN AUSTRALIA – A SHORT HISTORY
Ian Beveridge
University of Melbourne
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<th>Chair</th>
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<td>11.45-13.00</td>
<td>Achieving veterinary guided parasite control for sustainable veterinary practice</td>
<td>Emily Jenkins</td>
<td>University of Saskatchewan</td>
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<tr>
<td>11.45-13.00</td>
<td>Age-related patterns of infection for an invasive fly in tree-farming wildlife</td>
<td>Stephanie Godfrey</td>
<td>University of Melbourne</td>
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<tr>
<td>11.45-13.00</td>
<td>Somebody’s happier here: Apparent fecundity of Dendrocoelum maculatum in their ant intermediate host</td>
<td>Doug Colwell</td>
<td>Agriculture and Agri-Food Canada</td>
</tr>
<tr>
<td>11.45-13.00</td>
<td>Helminth - getting more out of helminth transcriptome</td>
<td>Stefano Mangiola</td>
<td>The University of Melbourne</td>
</tr>
<tr>
<td>11.45-13.00</td>
<td>The repeatability of FEC of horses and the implications for targeted selective treatment</td>
<td>Robert Doherr</td>
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<tr>
<td>11.45-13.00</td>
<td>Prevalent gastrointestinal parasites and most efficient deworming protocols in horses under hot dry climates</td>
<td>Wenqi Wang</td>
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<td>11.45-13.00</td>
<td>Investigating the suitability of dogs and pigs as animal models of helminth transcriptome</td>
<td>Jose Al-Ghamdi</td>
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<tr>
<td>12.00-12.15</td>
<td>Gut microbiota and the technical efficiency of dairy farming</td>
<td>Inger Hamness</td>
<td>Norwegian Veterinary Institute</td>
</tr>
<tr>
<td>12.00-12.15</td>
<td>Of macroparasites and nematodes: A novel technique for investigating host-parasite population dynamics</td>
<td>Matthew Lott</td>
<td>Macquarie University</td>
</tr>
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<td>12.00-12.15</td>
<td>The Arogranivirus vacuolar transcriptome provides deep insights into the parasite’s biology and immunobiology, and prospects for new interventions</td>
<td>Brendan Ansell</td>
<td>University of Melbourne</td>
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<td>12.00-12.15</td>
<td>The draft Trichuris suis genome</td>
<td>Aaron Jex</td>
<td>The University of Melbourne</td>
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<td>Genetic evaluation of lambs subjected to a targeted selective antimicrobial treatment</td>
<td>Lincoln University</td>
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<td>An investigation into the current transmission pathway of Taenia solium in Australia</td>
<td>Emily Jenkins</td>
<td>Charles Sturt University</td>
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<td>Helminth neurobiology: Identifying the mining targets of dracunculiasis anthelmintics</td>
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<td>Sarah Preston</td>
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<td>Functional characterisation of S. mansoni egg-accreted proteins using spider-silk diablotin microRNA</td>
<td>Bernd Kalina</td>
<td>The University of Melbourne</td>
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<td>13.00-13.15</td>
<td>Sox of a persistent anthelmintic infection to promote stimulation of a host response to intestinal nematodes in calves</td>
<td>Peter Nuttall</td>
<td>Waite Institute New Zealand LSI</td>
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<td>Kristopher Hughes</td>
<td>Murdoch University</td>
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<tr>
<td>14:00-15:15</td>
<td>ACIAR - PARASITE CONTROL AND LIVESTOCK PRODUCTION IN SE ASIA</td>
<td>Room: Riverside Theatre</td>
<td>Exploring the variation of human giardial parasites</td>
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<td>Chair: Douglass Gray</td>
<td>Application of a Geographical Information System to assess the spatial distribution of Fasciola hepatica in dairy cattle herds in Ireland</td>
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<td></td>
<td>Assessing calves as carriers of Cryptosporidium and Giardia with zoonotic potential on dairy and beef farms within a water catchment area by rainfall correlation</td>
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<td>14:15-15:30</td>
<td>Helminth control in Malaysia: Dealing with anthelmintic resistance</td>
<td>Room: Meeting Room 1</td>
<td>Climate and Global Change Impacts on Vector Borne Zoonotic Diseases in Europe</td>
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<td>Chair: Una Ryan</td>
<td>Assessing risk: Spatial trends and environmental risk factors for an emerging plague of syphotic host species in Alberta, Canada</td>
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<td>14:30-14:45</td>
<td>Epidemiology of strongyle infections in small ruminants in three management systems in Malaysia</td>
<td>Room: Meeting Room 2</td>
<td>Prevalence and transmission of Theileria spp in dairy cattle in Queensland, Australia</td>
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<td>Chair: Alvin Gajadhar</td>
<td>Polyparasitism - the ecological complexities and impact of mixed infections</td>
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<td>14:45-15:00</td>
<td>Tachinid flies in pigs and humans in northern Laos</td>
<td>Room: Meeting Room 3</td>
<td>The importance of Soil as a Reservoir of Gastrointestinal Nematode Larvae in Sheep</td>
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<td>Chair: Leith Cuttell</td>
<td>Molecular prevalence of Cryptosporidium infection in Gadwal Murrah buffaloes in Andhra Pradesh, India</td>
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<td>15:00-15:15</td>
<td>Zeotrichida in pigs and humans in northern Laos</td>
<td>Room: Meeting Room 4</td>
<td>The occurrence of Haemonchus placei in cattle in southern Western Australia: an unexpected finding</td>
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<td>Chair: Amanda Ash</td>
<td>Zoonotic Primate Malarias in Peninsular Malaysia: Identifying Hepatozoon infections</td>
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<td>Zeotrichida in pigs and humans in northern Laos</td>
<td>Room: Meeting Room 5</td>
<td>Iron Metabolism in Sarcosporacae: Insights for novel methods for diagnosis</td>
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<td>Chair: Karrie Powell</td>
<td>Zeotrichida in pigs and humans in northern Laos</td>
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</tbody>
</table>

**Lunch**

Sponsored by Bayer Healthcare

**International Commission on Trichinellosis**

Room: Meeting Room 6
Chair: Una Ryan

**Clinical Parasitology**

Room: Meeting Room 7
Chair: Santiago Mas-Coma

**Commercial Livestock - Cattle**

Room: Meeting Room 8
Chair: Brenda Ralston

**SCYNEXIS - The Innovative Solutions for Parasiticide Drug Discovery**

Room: Meeting Room 9
Chair: David Emery
Prevention of tick-borne diseases in dogs using an imidacloprid / flumethrin collar
Filipe Dantas-Torres
Agau Magalhães Research Centre (FioCruz-PE)

Detection of vector-borne pathogens by molecular methods in ticks and fleas; tick control in dogs in Albania
Cornelia Sligl
LMU Munich

It’s easy being green: carbon utilisation in a photosynthetic sister of the apicomplexan parasites
Christa Fossey
The University of Sydney

PLATINUM SPONSOR SESSION: BAYER
Long term efficacy of an icosapent eicosapentaenoic acid / fluvastatin combination in dogs and its potential to prevent canine leishmaniasis in a hyper-endemic setting
Dominic O’Brien
University of Bath

Prevention of tick-borne diseases in dogs using an icosapent / fluvastatin combination
Filipe Dantas-Torres
Agau Magalhães Research Centre (FioCruz-PE)

Iron deposits in spleens and livers of mares and sholosoma infected mice
Tim III Paris
The University of Western Australia

Babesia koepflii possibly incriminated causing false babesiosis in South Africa
Bavie Pemerson
University of Pretoria

Vaccination of pigs and lambs against T. gondii and T. gondii infection in sheep and goats
Steffen Rehbein
Ecole Nationale Vétérinaire de Lyon

Clearance in Melanesian Children
Stephan Karl
University of Western Australia

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PLENARY SESSION: COMPANION ANIMALS - CHALLENGES FOR THE FUTURE
Chair: Robin Gasser
Future challenges for parasitology: vector control and one health in the Americas
Susan Lütje
Oklahoma State University
Future challenges for parasitology: vector control and one health in Europe
Horst Mercke
Bayr - Germany

TUESDAY 27 AUGUST
8.30-9.45
PLENARY SESSION: COMPANION ANIMALS - CHALLENGES FOR THE FUTURE
Chair: Robin Gasser
Future challenges for parasitology: vector control and one health in the Americas
Susan Lütje
Oklahoma State University
Future challenges for parasitology: vector control and one health in Europe
Horst Mercke
Bayr - Germany

10.15-11.30
GENETIC IMMUNITY
Room: Riverside Theatre
Chair: Dieter Palmer

10.15-10.30
Giasson-intestinal parasite species change in response to selection in the fly/flygonad Metriophasis
John Karlsson
Dept. Agri. & Food NIA

10.30-10.45
Variation and high Linkage Disequilibrium among DQ2A, DQ4A and DQ8 in the Ixodid tick
Michel Bialaplace
Nur Maliza Bld Bia
University of Glasgow

10.45-11.00
Functional investigation of a QTL region affecting resistance in Haemaphysalis leporispalustris in sheep
Philippus Jacquier
Veterinary School of Toulouse, France

11.00-11.15
Comparison of tick resilience of cross-bred Sanglep and the locally infected with pasture-bred Limulusi
Thomas Hui
Institut Agronomique Néo-Calédonien

11.15-12.00
Breeding for break strike resistance in Merino sheep
Johan Gouett
Department of Agriculture and Food NIA

11.40-12.40
ORAL POSTER SESSION
A walk on the wild side
Chair: Susan Lütje

12.00-12.30
SPEAKERS’ BREAK

12.30-13.15
LUNCH
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<tr>
<td>13:30-14:45</td>
<td><strong>DRUG RESISTANCE SMALL</strong></td>
<td>Room: Meeting Room 1 Chair: Rebecca Trisbor</td>
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</tbody>
</table>
|            | Can combination anthelmintics be used once resistance to multiple actives has developed?  
Tania Waghorn, AgResearch | Room: Meeting Room 2 Chair: Anja Jastolin |
|            | Results of a nationwide coelocidiosis survey using a simple, one-tube assay for the simultaneous detection and diagnosis of the four Australian Eimeria species.  
Rosemary Goodall, DARP, QGGO Government | Room: Meeting Room 3 Chair: Christian Epe |
|            | Recent Dirofilaria spp. distribution information in northern Europe  
Antti Oksanen, Queensland Institute of Medical Research | Room: Meeting Room 4 Chair: Roger Pritchard |
| 13:30-14:15| **DIAGNOSTICS - APICOMPLEXA**               | Room: Meeting Room 4 Chair: Roger Pritchard |
|            | Lack of efficacy of monoparaternal against T. Oviris and T. circumcincta in sheep in Australia  
Ian Scott, Massey University | Room: Meeting Room 5 Chair: Ryan O'Harelli |
| 13:45-14:00| **DOG AND CAT PARASITES 1**                 | Room: Meeting Room 5 Chair: Ryan O'Harelli |
|            | Advanced studies on coelocidiosis-parasitic infections of cattle  
Muhammad A. El-Selly, Murdoch University | Room: Meeting Room 6 Chair: Aaron Jex |
|            | The efficacy of a topical applied  
1%  
imidacloprid / moxidectin  
2.5% formulation (Advocate®) against immature and adult Spirocerca lupi in experimentally infected dogs  
Clifton Austin, Bayer Animal Health South Africa | Room: Meeting Room 7 Chair: Edwin Claerebout |
| 14:00-14:15| **DRUG DISCOVERY**                          | Room: Meeting Room 7 Chair: Edwin Claerebout |
|            | New insights into diagnosis and epidemiology of Angiostrongylus cantonensis.  
Manuela Schnyder, University of Zurich | Room: Meeting Room 8 Chair: Susan Katz |
|            | In vitro and in vivo activities of diadenosine-5'-pentaphosphate against Enterococcus faecalis  
Andrew Hemphill, University of Bern | Room: Meeting Room 8 Chair: Susan Katz |
| 14:15-14:30| **FUNCTIONAL GENOMICS 2**                   | Room: Meeting Room 8 Chair: Susan Katz |
|            | Resistance to monoparaternal in two nematode species in goats  
David Leathwick, AgResearch | Room: Meeting Room 9 Chair: Laryssa Howe |
|            | A comparison of sequencing technologies for the screening of Cryptosporidium infections in biological samples  
Andrea Paparoni, Murdoch University | Room: Meeting Room 10 Chair: Massey University |
|            | Host-parasite interactions from canine faecal samples  
Francesca Joness, Murdoch University | Room: Meeting Room 10 Chair: Massey University |
| 14:30-14:45| **IMMUNOLOGY GENERAL**                     | Room: Meeting Room 10 Chair: Massey University |
|            | A survey investigating gastro-intestinal nematode egg output in sheeps  
Ben Brown, Novelco Animal Health | Room: Meeting Room 11 Chair: Liz Keel |
|            | Phylogenetic analysis of Toxoplasma gondii and T. cruzi  
Michael Takeet, Federal University of Agriculture | Room: Meeting Room 11 Chair: Liz Keel |
|            | Metabolicomic tohrulbiz treatment of dairy cows at risk of coeliacosis.  
Per Skallerup, Technical University Of Denmark | Room: Meeting Room 11 Chair: Liz Keel |
| 14:45-15:15| **ONE HEALTH 3**                            | Room: Meeting Room 11 Chair: Liz Keel |
|            | Update of current knowledge of toxoplasmosis in Australia  
Jenna Corian, Food Standards Australia New Zealand | Room: Meeting Room 11 Chair: Liz Keel |
15:15-16:30
**ELANCO GOLD SPONSOR**
- **Room: Riverside Theatre**
  - Chair: Paul Riga
  - **Consortium and Wildlife**
    - Global diversity of parasitic isopods of the family Cymothoidae
    - Review of taxonomy and biology of asialid nematodes in Australia
    - Characterization of cytokine alterations during experimental Babesia gibsoni infection in dogs
    - Reappearance of Taenia ovis krabbei
  - **Parasites of Aquatic Wildlife**
    - Baricervax’, a potential commercial vaccine for Haemonchus contortus
    - Field trial of MRI Haemonchus vaccine efficacy in Merino lambs
  - **Dog and Cat Parasites**
    - Treatment of Dirofilaria repens microfilariaemia with a combination of doxycycline and ivermectin
    - Simulation study to estimate the minimum vaccine protection required to control Haemonchus contortus in a high risk region of Australia
  - **Vaccines – Haemonchus**
    - Molecular characterization and phylogenetic analysis of Fasciola hepatica from Guanacaste, Peru
    - Molecular epidemiology of Blastocystis isolates from pre-school children and their own domestic animals
  - **Molecular Epidemiology**
    - Molecular characterization and epidemiology of Tropilochromys mustelina on the northern brown bandicoot, Isoodon macrourus
    - Preliminary result of a large-scale field trial to evaluate the efficacy of Milbemycin oxime on the northern brown bandicoot, Isoodon macrourus

15:15-16:30
**NOVARTIS SPONSORED SESSION**
- **Room: Meeting Room 1**
  - Chair: Brent Wagner
  - **Consortium and Wildlife**
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    - Review of taxonomy and biology of asialid nematodes in Australia
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15:30-15:45
**Room: Meeting Room 2**
- **Chair: Andrew Thompson**
  - The Efficacy of Spinosad for the Control of Pests Infesting Poultry
    - Spinosad: Development and field use for fly control
  - The Spinosyns: Discovery and Background, mechanism of action and efficacy studies with housed lambs
  - Review of the fish tongue biter Cymothoa Fabricius, 1793 (Crustacea: Isopoda:Cymothoidae) in Australian waters

15:45-16:00
**Room: Meeting Room 3**
- **Chair: Byron Blagburn**
  - The Efficacy of Spinosad for the Control of Pests Infesting Poultry
    - Spinosad: Development and field use for fly control
  - The Spinosyns: Discovery and Background, mechanism of action and efficacy studies with housed lambs
  - Review of the fish tongue biter Cymothoa Fabricius, 1793 (Crustacea: Isopoda:Cymothoidae) in Australian waters

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**Room: Meeting Room 4**
- **Chair: Norbert Mencke**
  - The Efficacy of Spinosad for the Control of Pests Infesting Poultry
    - Spinosad: Development and field use for fly control
  - The Spinosyns: Discovery and Background, mechanism of action and efficacy studies with housed lambs
  - Review of the fish tongue biter Cymothoa Fabricius, 1793 (Crustacea: Isopoda:Cymothoidae) in Australian waters

16:00-16:15
**Room: Meeting Room 5**
- **Chair: Robert Dobson**
  - Why history matters? A tale of large nematodes and their hosts
  - Reappearance of Taenia ovis krabbei
  - Field trial of MRI Haemonchus vaccine efficacy in Merino lambs

16:15-16:30
**Room: Meeting Room 6**
- **Chair: Alex Mathis**
  - Why history matters? A tale of large nematodes and their hosts
  - Reappearance of Taenia ovis krabbei
  - Field trial of MRI Haemonchus vaccine efficacy in Merino lambs
  - Characterizing population structure and diversity of Australian Eumera and Vespula species

16:30-17:30
**Room: Meeting Room 7**
- **Chair: Beate Schnitzer**
  - Why history matters? A tale of large nematodes and their hosts
  - Reappearance of Taenia ovis krabbei
  - Field trial of MRI Haemonchus vaccine efficacy in Merino lambs
  - Characterizing population structure and diversity of Australian Eumera and Vespula species

17:30 - 18:30
**Happy Hour (POSTER VIEWING)**
- Sponsored by SCYNEXIS
## Plenary Session: Prophylactics and Therapeutics - New Approaches

**Chair:** Peter Holdsworth  
**Immunomodulatory molecules of *F. hepatica*: candidates for both vaccine and immunotherapeutic development**  
**John Dalton**  
McGill University  
*Worms - a license to kill*  
**Ronald Kaminsky**  
Novartis - Switzerland

### Wednesday 28 August

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<tr>
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<td><strong>ASP/ELSEVIER Session</strong></td>
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|              | Filling the gaps: expression profiling of zoonotic Apicomplexa in definitive hosts  
|              | **Adrian Hehl**  
|              | University of Zurich |
|              | Specific and/or unspecific mechanisms of anthelmintic resistance: how could we tackle this conundrum?  
|              | **Georg von Samson-Himmelstjerna**  
|              | Freie Universität Berlin |
|              | Wildlife parasitism in a changing climate: shifting boundaries, barriers, and paradigms  
|              | **Susan Kutz**  
|              | University of Calgary |
|              | Presidential address  
|              | **Denise Doolan**  
|              | President of the ASP |
| 13.15-14.15  | Lunch                                                                 |
| 14.15-16.30  | **ASP AGM**                                                             |
|              | Venue: Perth Zoo                                                      |
PLENARY SESSION ANIMAL PRODUCTION AND FOOD SECURITY
Chair: Brown Besier
Parasitology for the hungry, warmer, riskier world
Doug Grey
ACAR
Global food security – the impact of veterinary parasites and parasitologists
Julie Fitzpatrick
Monash Research Institute
WAAVP 2015
Lord Tree
University of Liverpool

THURSDAY 29 AUGUST
8:30-10:00

PLENARY SESSION: ANIMAL PRODUCTION AND FOOD SECURITY

ROOMS FOR DISCUSSION:
- Room 1: Riverside Theatre
- Room 2: Meeting Room 1
- Room 3: Meeting Room 2
- Room 4: Meeting Room 3
- Room 5: Meeting Room 4
- Room 6: Meeting Room 5
- Room 7: Meeting Room 6
- Room 8: Meeting Room 8

ORAL POSTER SESSION: ANIMAL PRODUCTION AND FOOD SECURITY

10:15-11:30

- Room 1: Riverside Theatre
- Room 2: Meeting Room 1
- Room 3: Meeting Room 2
- Room 4: Meeting Room 3
- Room 5: Meeting Room 4
- Room 6: Meeting Room 5
- Room 7: Meeting Room 6
- Room 8: Meeting Room 8

ORAL POSTER SESSION: ANIMAL PRODUCTION AND FOOD SECURITY

11:00-12:30

- Room 1: Riverside Theatre
- Room 2: Meeting Room 1
- Room 3: Meeting Room 2
- Room 4: Meeting Room 3
- Room 5: Meeting Room 4
- Room 6: Meeting Room 5
- Room 7: Meeting Room 6
- Room 8: Meeting Room 8

ORAL POSTER SESSION: ANIMAL PRODUCTION AND FOOD SECURITY

12:30-14:00

- Room 1: Riverside Theatre
- Room 2: Meeting Room 1
- Room 3: Meeting Room 2
- Room 4: Meeting Room 3
- Room 5: Meeting Room 4
- Room 6: Meeting Room 5
- Room 7: Meeting Room 6
- Room 8: Meeting Room 8

ORAL POSTER SESSION: ANIMAL PRODUCTION AND FOOD SECURITY

14:00-15:30

- Room 1: Riverside Theatre
- Room 2: Meeting Room 1
- Room 3: Meeting Room 2
- Room 4: Meeting Room 3
- Room 5: Meeting Room 4
- Room 6: Meeting Room 5
- Room 7: Meeting Room 6
- Room 8: Meeting Room 8

ORAL POSTER SESSION: ANIMAL PRODUCTION AND FOOD SECURITY

15:30-17:00

- Room 1: Riverside Theatre
- Room 2: Meeting Room 1
- Room 3: Meeting Room 2
- Room 4: Meeting Room 3
- Room 5: Meeting Room 4
- Room 6: Meeting Room 5
- Room 7: Meeting Room 6
- Room 8: Meeting Room 8

ORAL POSTER SESSION: ANIMAL PRODUCTION AND FOOD SECURITY

17:00-18:30

- Room 1: Riverside Theatre
- Room 2: Meeting Room 1
- Room 3: Meeting Room 2
- Room 4: Meeting Room 3
- Room 5: Meeting Room 4
- Room 6: Meeting Room 5
- Room 7: Meeting Room 6
- Room 8: Meeting Room 8
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Room</th>
<th>Chair</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.45-13.30</td>
<td>Lunch (WAPF AGM) Sponsored by Ziwelds</td>
<td>Room: Riverside Theatre</td>
<td>Griff Siagianh</td>
</tr>
<tr>
<td>13.30-14.45</td>
<td>MSD (GOLD SPONSOR) VACCINES - FLUKES CONSERVATION AND WILDLIFE TAXONOMY DIAGNOSTICS - MOLECULAR HOST PARASITE INTERACTIONS DRUG RESISTANCE - MOLECULAR DRUG EFFICACY - SHEEP ONE HEALTH - ANIMAL PRODUCTION</td>
<td>Room: Meeting Room 7 Chair: David Piedrafita</td>
<td>Room: Meeting Room 1 Chair: Ian Beveridge</td>
</tr>
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<td>13.30-13.45</td>
<td>Biochemical characterisation of serine protease inhibitors from Schistosoma japonicum Addasoye Nielles Queensland Institute of Medical Research</td>
<td>Room: Meeting Room 5 Chair: Mal Jones</td>
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<td>Morphological features and molecular characteristics of proximolins interfering the Platynosoma (Diphyllobothriidae) andurocystis Andrea Paparini Murdoch University</td>
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<td>A high-throughput diagnostic platform for gastrointestinal nematode infections in small ruminants Florian Roobor AusDiagnostix Pty Ltd</td>
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- **Morphological features and molecular characteristics of proximolins interfering the Platynosoma (Diphyllobothriidae) andurocystis**
  - Andrea Paparini, Murdoch University
- **A high-throughput diagnostic platform for gastrointestinal nematode infections in small ruminants**
  - Florian Roobor, AusDiagnostix Pty Ltd
- **Effect of repeated antigen administration on hyposensitization and faecal worm content in sheep following infection with Trichostrongylus axei**
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**COMMERCIAL LIVESTOCK**

**DRUG EFFICACY - ECOTOPARASITES**

**FUNCTIONAL GENOMICS 3**

**DRUG RESISTANCE - SMALL RUBERNANTS 3**

**APICOMPLEXAN BIOLOGY 2**

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