

# **Edinburgh** *Infectious* **Diseases**

Leading infectious disease research and training

## **7<sup>th</sup> Annual Symposium**

**Wednesday 23 May 2018**

**Informatics Forum, University of Edinburgh**



## Seventh Annual Symposium

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### Programme

9.00 – 9.30	Coffee and poster set up	
9.30 – 9.40	<b>Ross Fitzgerald</b> (Director <i>Edinburgh Infectious Diseases</i> )	<i>Welcome and introduction</i>
	SESSION 1: Chaired by Amy Buck	
9.40 – 10.00	<b>Eleanor Riley</b> , The Roslin Institute	<i>Malaria-salmonella coinfection in Africa</i>
10.00 – 10.20	<b>Darren Obbard</b> , School of Biological Sciences	<i>New viruses from flies and other animals</i>
10.20 – 10.40	<b>Mark Stevens</b> , The Roslin Institute	<i>Salmonella</i> pathogenesis in cattle
10.40 – 11.00	<b>Thamarai Schneiders</b> , Division of Infection and Pathway Medicine	<i>Dissecting antimicrobial resistance in Klebsiella</i>
11.00 – 11.30	Tea and coffee / posters	

	SESSION 2: Chaired by Keith Matthews	
11.30 – 11.50	<b>Rose Zamoyaska</b> , School of Biological Sciences	<i>Regulation of T cell activation: the good and the bad</i>
11.50 – 12.10	<b>Alasdair Nisbet</b> , Moredun Research Institute	<i>Simplifying a recombinant cocktail vaccine which protects against parasitic nematodes in sheep</i>
12.10 – 12.25	<b>Nisha Philip</b> , School of Biological Sciences	Post-transcriptional mechanisms in malaria parasite development and transmission
12.25 – 12.40	<b>Finn Grey</b> , The Roslin Institute	<i>Dissecting the interferon response to human cytomegalovirus</i>
12.40 – 12.55	<b>Nadejda Lupolova</b> , The Roslin Institute	<i>Machine learning for bacterial genomics</i>
	<b>Greg Albery</b> , School of Biological Sciences	<i>Life History-Immune Tradeoffs in Wild Red Deer</i>
12.55 – 14.15	Lunch / posters	

	SESSION 3: Chaired by Gary Entrican	
14.15 – 14.35	<b>Rowland Kao</b> , Royal (Dick) School of Veterinary Studies	Big models for big data - a process-driven model characterising the national epidemic of bovine Tuberculosis in cattle and badger
14.35 – 14.55	<b>Peter Barlow</b> , Edinburgh Napier University	<i>Host defence peptides in rhinovirus infection</i>
14.55 – 15:15	<b>Meghan Perry</b> , Regional Infectious Diseases Unit, WGH; CIE	<i>Secrets of the hospital underbelly - AMR in hospital sewage</i>
15:15 – 15.35	<b>Bryan Wee</b> , The Roslin Institute <b>Amy Sweeny</b> , School of Biological Sciences <b>Ting Shi</b> , Usher Institute	<i>An Evolutionary Genomic History of Legionnaires' Disease</i> <i>Role of nutrition in determining fitness and resistance to parasites</i> <i>RSV associated acute respiratory infection in older adults</i>
15.35 – 15.50	<b>KER MEMORIAL PRIZE WINNER – Rodrigo Bacigalupe</b> , VIB-KU Leuven Center for Microbiology	Population genomic analysis of the niche adaptation of bacterial pathogens
15.50 – 16.15	Tea and coffee / posters	
16.15 – 16.20	Presentation of poster prize	
16.20 – 17.15	<b>KER MEMORIAL LECTURER – Mike Ferguson</b> , University of Dundee	<i>Drugs for neglected diseases: a very collective endeavour</i>
17.15 – 18.30	Drinks reception – ALL WELCOME	

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## Ker Memorial Prize and Lecture 2018

The Ker Prizes are very generously supported by Miss Aileen Ker, in memory of two outstanding Edinburgh physicians, her grandfather Dr. Claude Buchanan Ker, and his son (her father), Dr. Frank Leighton Ker.

- Dr. Claude Buchanan Ker (1867-1925) spent his professional medical career in Edinburgh, working ceaselessly to improving the treatment of infectious diseases. He is best remembered for his tireless efforts to build the City Fever Hospital which opened in Colinton in 1903, and of which he was medical superintendent for 21 years.
- Dr. Frank Leighton Ker (1907-1966), began his medical career in Edinburgh and went on to carry out his main work at the East Birmingham Hospital, where he became medical superintendent in 1950.

The glowing and heartfelt obituaries written for both these men show the enormous regard and affection in which they were held, and to which the Ker Memorial Prize and Lecture now provide fitting testimony.

### 2018 awardees

#### Ker Memorial Prize

The winner of the 2018 Ker Memorial Prize for the most outstanding thesis in Infectious Disease research presented to the University of Edinburgh in 2017, is awarded to **Dr Rodrigo Bacigalupe**, for the work he carried out at the Roslin Institute under the supervision of Prof Ross Fitzgerald.

- *Population genomic analysis of the niche adaptation of bacterial pathogens*

#### Ker Memorial Lecture

The presenter of the Ker Memorial Lecture for 2018 is **Professor Mike Ferguson** FRS from the University of Dundee.

- *Drugs for neglected diseases: a very collective endeavour*

## Speaker biographies

<b>Eleanor Riley</b>
The Roslin Institute
Eleanor Riley became the Director of the Roslin Institute and Dean of Research at the Royal (Dick) School of Veterinary Studies of the University of Edinburgh in September 2017. Prior to taking up this role she was Professor of Immunology and Head of the Department of Immunology and Infection at the London School of Hygiene and Tropical Medicine, University of London. With a background in veterinary medicine, human infectious diseases and global health, she has more than 30 years' experience of research in the UK and Africa. Her research interests include immunity to malaria and related infections, genetic susceptibility to infection, the biology of natural killer cells and immunological evaluation of vaccines.
<b>Darren Obbard</b>
School of Biological Sciences
Darren is a University lecturer in the School of Biological Sciences. He did his PhD with Prof. John Pannell and Dr. Stephen Harris at the department of Plant Sciences at the University of Oxford. Darren has been in Edinburgh since 2004, first of all as a postdoc with Prof. Tom Little in the Institute of Evolutionary Biology, and latterly as Wellcome Trust Research Career Development Fellow and a University Chancellor's Fellow.
<b>Mark Stevens</b>
The Roslin Institute
Mark Stevens obtained a first class honours degree in Microbiology & Virology at the University of Warwick in 1992 before undertaking doctoral studies with Prof. Ian Roberts at the University of Leicester. He obtained his Ph. D in 1996 on transcriptional control of capsule expression in <i>E. coli</i> associated with neonatal meningitis. His initial postdoctoral research with Prof. Wendy Barclay at the University of Reading focused on transcription and replication of the influenza B virus genome and nucleoprotein trafficking. He joined the Institute for Animal Health in 1999 to analyse the role of enterohaemorrhagic <i>E. coli</i> genes in intestinal colonisation of cattle with Dr Tim Wallis. From 2005, Mark led the Enteric Bacterial Pathogens Laboratory at Compton and joined The Roslin Institute and Royal (Dick) School of Veterinary Studies in January 2011 as a Reader. He was awarded a Personal Chair in Microbial Pathogenesis in 2011 and became Research Director of the Institute in 2015.
<b>Thamarai Schneiders</b>
Division of Infection and Pathway Medicine
Following her PhD studies at the University of Edinburgh, she moved to Boston, USA to work with Professor Stuart Levy at Tufts University. In Professor Levy's laboratory her research focussed on the characterising the role of the MarA protein as a transcriptional repressor at different <i>E. coli</i> promoters. Upon her return to the UK, she was awarded a New Investigator Research Award (NIRG) from the Medical Research Council to support research into the intrinsic drug resistance regulator, RamA in <i>K. pneumoniae</i> . She was appointed to a lectureship in molecular bacteriology in Queen's University Belfast and in 2014 took up a position of Senior Lecturer in the Division of Infection and Pathway Medicine in the University of Edinburgh.
<b>Rose Zamoyska</b>
School of Biological Sciences
Rose Zamoyska has been Professor of Immune Cell Biology at the University of Edinburgh since 2007. She obtained her PhD from the University of Cambridge and undertook postdoctoral training in Stanford, USA before moving to

London where she established her research group first at University College and then as a tenured scientist at the National Institute for Medical Research in Mill Hill.

## Alasdair Nisbet

Moredun Research Institute

Alasdair Nisbet is Head of the Vaccines Pillar at Moredun. He graduated from Glasgow University with a BSc in Agricultural Zoology, followed by a PhD in Biochemistry. After postdoctoral periods at Aberdeen University and the University of Melbourne, he joined Moredun in 2004. Throughout his scientific career his research focus has been on novel methods of controlling invertebrate pests and parasites with an emphasis on understanding and exploiting the unique physiology of parasites of veterinary significance, in particular by understanding their interactions with the host.

## Nisha Philip

School of Biological Sciences

Nisha did her PhD in the Dept. of Pharmacology and Cancer Biology at Duke University, Durham, NC. She was an EMBO Fellow with Andy Waters at the University of Glasgow before moving to Edinburgh in September 2017 where she is now a lecturer at the Institute of Immunology and Infection Research in the School of Biological Sciences.

## Finn Grey

The Roslin Institute

Finn Grey received his PhD from the University of Cambridge in 2002 following his studies on acyclovir resistance in HSV-1. Following his PhD he took up a postdoctoral position in Jay Nelson's group at the Vaccine and Gene Therapy Institute, Portland, Oregon. It was here he developed a research program on the role of microRNAs in virus infection, focusing on human cytomegalovirus. This work led to a Wellcome Trust Career Fellowship and in 2010 he returned to the UK to start his own group at the Roslin Institute, where he is currently a group leader. His current research uses systems approaches to identify and characterize novel host-virus interactions, with particular focus on the role of microRNAs, high throughput siRNA and small molecule screens and genome wide CRISPR/Cas9 screens.

## Rowland Kao

Royal (Dick) School of Veterinary Studies

Rowland graduated from Engineering Physics at the University of Toronto, followed by graduate work at the University of Guelph ending in 1995. When he realized that his PhD thesis was unlikely to change the world, he moved to work in infectious disease epidemiology, first of all at AgResearch in New Zealand, and then at the Institute for Animal Health and the University of Oxford. Before moving to Edinburgh in 2017, Rowland was Director of the Boyd Orr Centre for Population and Ecosystem Health at the University of Glasgow. His research has centred on TSEs in sheep, bovine Tuberculosis and foot-and-mouth disease, but he has also been involved in the study of many other infectious diseases of humans and animals.

## Peter Barlow

Edinburgh Napier University

Peter is Associate Professor of Immunology and Infection, and Director of Research of the School of Applied Sciences at Edinburgh Napier University, Scotland, UK. Peter graduated with a PhD from Edinburgh Napier in 2004 with a thesis that examined the effects of nanoparticles on macrophage mediated clearance mechanisms in the lungs, under the direction of Prof. Vicki Stone. In 2005, he took up a post in the MRC Centre for Inflammation Research at the University of Edinburgh working with Donald Davidson on the immunomodulatory activities of Cationic Host Defence Peptides (CHDP). In 2009 Peter moved to the United States, where he worked within the Influenza Division of the US Centers for Disease Control & Prevention (CDC) in Atlanta, Georgia. In June 2011, Peter returned to

Edinburgh to take up the post of Lecturer and Principal Investigator in Immunotoxicology at Edinburgh Napier University. In October 2013, Peter was awarded a University Readership and in January 2015 was appointed Director of Research for the School of Applied Sciences. In August 2017 he was made Associate Professor.

## **Meghan Perry**

Regional Infectious Diseases Unit, WGH; Centre for Immunity, Infection and Evolution, Kings Buildings

Meghan studied Medicine at the University of Edinburgh and continued to specialise in infectious diseases. In 2014 she completed her PhD with Alan Fairlamb at the University of Dundee, studying pathogen resistance in Leishmania, before returning to Edinburgh. She is now a Clinical Lecturer at the University of Edinburgh and honorary Specialist Registrar in Infectious Diseases, now a clinician scientist based in the Regional Infectious Diseases Unit at the Western General Hospital in Edinburgh, and is also a member of Mark Woolhouse's EpiGroup research team in the Ashworth Labs at King Buildings.

## **KER MEMORIAL PRIZE WINNER – Rodrigo Bacigalupe**

The Roslin Institute

Rodrigo Bacigalupe graduated in Biology from the University of Salamanca and completed an MSc in Bioinformatics from the University of Edinburgh. In 2013, he joined Ross Fitzgerald's lab at The Roslin Institute where he did his PhD in Population Genomics of Bacterial Pathogens Niche Adaptation. After completing his PhD in 2017, Rodrigo went to work on translational bioinformatics at Navarrabiomed, and has recently moved to the VIB-KU Leuven Center for Microbiology as a postdoctoral scientist, where he is pursuing research on microbiome transmission dynamics.

## **KER MEMORIAL LECTURER – Mike Ferguson**

University of Dundee

Mike obtained a BSc in Biochemistry at The University of Manchester Institute of Science and Technology (1979) and a PhD in Biochemistry (1982) at London University. He was a Postdoctoral Fellow at the Rockefeller University, New York, with George Cross, FRS (1982-1985) and at Oxford University with Raymond Dwek, FRS (1985-1988). He took up a lectureship at The University of Dundee in 1988 and was promoted to a personal chair in Molecular Parasitology in 1994. He became Dean of Research for the School of Life Sciences at The University of Dundee in 2007. Mike has published over 200 peer reviewed research papers and given numerous invited lectures at Scientific Meetings around the world. He is known for solving the first structures of glycosylphosphatidylinositol (GPI) membrane anchors, which play important roles throughout eukaryotic biology. His research takes a multidisciplinary approach to understanding the biochemistry of protozoan parasites that cause tropical diseases, particularly the trypanosomatids that cause human African Sleeping Sickness, Chagas' disease and leishmaniasis. He believes in the fundamental importance of working across the Biology / Chemistry interface and he has published extensively in this area. He is particularly interested in Translational Research and, together with his colleagues, was instrumental in establishing the new Drug Discovery Unit at the University of Dundee. He is also co-Director of the successful Dundee Proteomics Facility. Mike was Dean of Research for Life Sciences from 2007-2014 and continues to play a role in Research Strategy. He led the construction of, and directs, the Discovery Centre for Translational and Interdisciplinary Research, which opened in 2014. He is also a member of the Board of Governors for The Wellcome Trust and the Board of Directors of the Medicines for Malaria Venture (MMV).

## Poster presentations

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1	<b>East Coast Fever and vaccination at the livestock / wildlife interface.</b>	S
	Fiona K Allan (1), Geoffrey Mbata (2), Jeremy Salt (3), Ian Handel (1), Edith Paxton (1), Furaha Mramba (4), Ivan Morrison (1), Liam Morrison (1), Harriet Auty (5).	
	(1) Division of Infection & Immunity, Roslin Institute, Easterbush, University of Edinburgh; (2) Vector and Vector-borne Disease Research Institute, Tanga, Tanzania; (3) GALVmed, Doherty Building, Pentlands Science Park Bush Loan, Penicuik, Edinburgh; (4) Tanzanian Veterinary Laboratory Agency, Dar es Salaam, Tanzania; (5) SRUC, Beechwood Campus, An Lochran, Inverness	
2	<b>The effect of pre-disposed local skin inflammatory response on African trypanosome infection.</b>	S
	Omar A. Alfituri- Liam Morrison- Neil A. Mabbott	
	The Roslin Institute, University of Edinburgh	
3	<b>Population metagenomics of the porcine pathogen <i>Lawsonia intracellularis</i>.</b>	S
	Rebecca J. Bengtsson (1), Bryan A. Wee (1), Rodrigo Bacigalupe (1), Eleanor Watson (2), Zen Lu (1), Alan L. Archibald (1), J. Ross Fitzgerald (1), Tahar Ait-Ali (1)	
	(1) The Roslin Institute, University of Edinburgh, UK, (2) Moredun Research institute, Penicuik, UK, Edinburgh, UK.	
4	<b>Studies towards a vaccine against <i>Histomonas meleagridis</i>.</b>	P
	Cosmin Chintoan-Uta	
	The Roslin Institute and the Royal (Dick) School of Veterinary Science, University of Edinburgh	
5	<b>A Trypanosome Expressed Small non-coding RNA as a Diagnostic Marker.</b>	P
	Stephen Chiweshe (1), Pieter Steketee (1), Edith Paxton (1), Siddharth Jayaraman (1), Heidi Erasmus (2), Michel Labuschagne (2), Finn Grey (1), Liam Morrison (1)	
	(1) The Roslin Institute, The University of Edinburgh, UK. (2) Clinvet Research Innovation, Uitzich Road, Bainsvlei, Bloemfontein, 9300, South Africa.	
6	<b>A parasitic nematode harnesses novel repeats and an Argonaute protein for sRNA secretion in EV : Scope for communication with the mouse host.</b>	P
	Franklin Wang-Ngai Chow (1) , Georgios Koutsovoulos (1) ,Cesare Ovando-Vazquez (2), Dominik R Laetsch (1), José Roberto Bermúdez Barrientos (2), Julie Claycomb (3), Mark Blaxter (1), Ceil Abreu-Goodger (2), Amy Buck (1)	
	(1) Institute of Immunology and Infection Research, The University of Edinburgh, United Kingdom; (2) Laboratorio Nacional de Genómica Para la Biodiversidad, Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional, Mexico; (3) Department of Molecular Genetics, University of Toronto, Canada	
7	<b>Systematic literature review of Rift Valley fever virus seroprevalence in livestock- wildlife and humans in Africa from 1968 to 2016.</b>	S
	Madeleine Clark	
	The Pirbright Institute	
8	<b>Equine piroplasmiasis: Assessing the threat to the UK and Ireland.</b>	S
	Robert Coultous, Willie Weir, David Sutton, Brian Shiels	
	University of Glasgow School of Veterinary Medicine	
9	<b>Mitochondrial Acetate Production in <i>Trypanosoma congolense</i></b>	S
	Iremonger, J, Steketee, P, Schnauffer, A, Morrison, L	



	The Roslin Institute, University of Edinburgh	
10	<b>Development of predictive phage therapy as a treatment option for multidrug resistant <i>E. coli</i> infections in dogs.</b>	P
	Alison Low , Nadedja Lupolova, David Gally	
	The Roslin Institute, University of Edinburgh, Edinburgh,	
11	<b>Genetic diversity of co-circulating viral pathogens identified in hospitalized respiratory tract infections (RTIs) in Vietnam, 2012-2016.</b>	P
	Lu Lu (1), Gail Robertson (1), Alasdair Ivens (1), Stephen Baker (2,3,4), Mark Woolhouse (1) on behalf of the VIZIONS Consortium	
	(1) Centre for Immunity, Infection and Evolution, University of Edinburgh, Ashworth Laboratories, Kings Buildings, Charlotte Auerbach Road, Edinburgh EH9 3FL, UK; (2) Centre for Tropical Medicine, University of Oxford, Oxford, United Kingdom; (3) The Hospital for Tropical Diseases, Wellcome Trust Major Overseas Programme, Oxford University Clinical Research Unit, Ho Chi Minh City, Vietnam; (4) The Department of Medicine, University of Cambridge, Cambridge, United Kingdom	
12	<b>The Outer Membrane Stability of <i>K.pneumoniae</i> is Controlled by the Transcriptional Regulator RamA.</b>	S
	Charles Metcalf and Thamarai Schneiders	
	Division of Infection and Pathway Medicine, University of Edinburgh	
13	<b>Hemolysis and heme oxygenase-1 induction during persistent "asymptomatic" malaria infection in Burkinabé children.</b>	P
	Mooney, Jason P (1,2), Barry, Aissata (3), Gonçalves, Bronner P (1), Tiono, Alfred (3), Drakeley, Chris J (1), Bottomley, Christian (4), Bousema, Teun (5), Riley, Eleanor M (1,2)	
	(1) Department of Immunology and Infection, London School of Hygiene and Tropical Medicine, London, United Kingdom; (2) The Roslin Institute and Royal (Dick) School of Veterinary Studies, University of Edinburgh, Easter Bush, Midlothian, United Kingdom; (3) Centre National de Recherche et de Formation sur le Paludisme, Université de Ouagadougou, Ouagadougou, Burkina Faso; (4) Department of Infectious Disease Epidemiology, London School of Hygiene and Tropical Medicine, London, United Kingdom; (5) Radboud Institute for Health Sciences, Radboud University Medical Center, Nijmegen, The Netherlands.	
14	<b>Towards new drugs for trypanosomatid diseases based on inhibitors for <i>Trypanosoma brucei</i> RNA editing ligase 1.</b>	S
	Zandile Nare (1), <u>Marios Sardis (1)</u> , Stephan Zimmermann (1), Michael Speake (2), Stuart McElroy (2), Chris Smith (3), Mike Greaney (3), Victoria Feher (4), Rommie E. Amaro (4) & Achim Schnauffer (1)	
	(1) Institute for Immunology and Infection Research, University of Edinburgh, UK, (2) European Screening Centre Newhouse, UK, (3) School of Chemistry, University of Manchester, UK, (4) Department of Chemistry and Biochemistry, University of California San Diego, USA	
15	<b>Bats as a source of zoonotic spillover: Investigating virus in enteric bat samples from Viet Nam.</b>	S
	Áine O'Toole (1), Mark Woolhouse (2), VIZIONS Consortium	
	(1) Hosts, Pathogens and Global Health PhD Programme, (2) Centre for Immunity, Infection and Evolution, University of Edinburgh	
16	<b>"The Mould that Changed the World" a primary school musical about antimicrobial resistance.</b>	P
	Meghan Perry (1) and Robin Hiley (2)	
	(1) University of Edinburgh; (2) Charades Musical Theatre	
17	<b>Profiling Lineage Specific Epigenetic Landscapes Across Immune Cell Types of European and African Cattle Breeds.</b>	S
	Jessica Powell (1), Edith Paxton (1), Carly Hamilton (1), Ruben Barroso Rodriguez (1), Tim Connelley (1), James Prendergast (2) and Liam Morrison (1)	

	(1) Division of Infection and Immunity, The Roslin Institute, University of Edinburgh; (2) Division of Genetics and Genomics, The Roslin Institute, University of Edinburgh	
18	<b>Tackling antimicrobial resistance through innate host defence manipulation.</b> Tim Regan (1), Sara M Clohisey (1), David H. Dockrell (2)*, J. Kenneth Baillie (1)* (1) The Roslin Institute, University of Edinburgh, Edinburgh, UK; (2) Queens Medical Research Institute, University of Edinburgh, Edinburgh, UK; * These authors contributed equally to this work.	P
19	<b>Towards rapid electrochemical detection of New Delhi Metallo-beta-lactamase producing multi-drug resistant bacteria at point of care.</b> Jimmy Ming-Yuan Huang (1,3), Grace Henihan (1), Kate Templeton (1,2), Alan P. Gibb (2), Holger Schulze(1), Till T. Bachmann (1) (1) Division of Infection and Pathway Medicine, The University of Edinburgh; (2) Royal Infirmary of Edinburgh, Little France, (3) Emergency Department, Mackay Memorial Hospital, Taipei, Taiwan	P
20	<b>The transcriptional regulator RamA controls <i>ompK36</i> expression in <i>Klebsiella pneumoniae</i></b> Aishwarya Saxena, Manasa Bharathwaj, James Haycocks, Charles Metcalf, David Grainger, Arianna Mayorga Ramos, Thamarai Schneiders The University of Edinburgh, The University of Birmingham	S
21	<b>Anti-tuberculosis drug-induced liver injury.</b> Sarah Stedman (1), Till Bachmann (1), James Dear (2) (1) Division of Infection and Pathway Medicine, (2) Centre for Cardiovascular Science, University of Edinburgh	S
22	<b>Comparative metabolomics analysis of the livestock trypanosomes.</b> Steketee PC (1), Achcar F (2), Jayaraman S (1), Crouch K (2), Iremonger J (1), Giordani F (2), Paxton E (1), Donachie AM (2), Witty M (3), Peter R (3), de Koning H (2), Barrett MP (2) & Morrison LJ (1) (1) Roslin Institute, Royal (Dick) School of Veterinary Studies, University of Edinburgh, (2) Wellcome Centre for Molecular Parasitology, College of Medical, Veterinary & Life Sciences, University of Glasgow, (3) GALVmed	P
23	<b>F1-ATPase as a drug target in parasitic trypanosomatids.</b> K. Subrtova (1), N. D. MacKenzie Anderson (1), A. Porter (2), S. McElroy (2), A. Schnauffer (1) (1) Institute for Immunology and Infection Research, University of Edinburgh, UK, (2) European Screening Centre Newhouse, UK, (3) School of Chemistry, University of Manchester, UK, (4) Department of Chemistry and Biochemistry, University of California San Diego, USA	P
24	<b>Development of a Genome Wide CRISPR Knockout Library to Study Host Pathogen Interactions in Cattle.</b> Wenfang Spring Tan (1), Inga Dry (1), Simon Lillico (2), Andy Law (3), Bruce Whitelaw(2), Bob Dalziel (1) (1) Division of Infection and Immunity, (2) Division of Developmental Biology, (3) Division of Genetics and Genomics; the Roslin Institute, University of Edinburgh, Scotland, United Kingdom, EH25 9RG	P
25	<b>Characterising the Dynamics of the Wild Drosophila Virosphere.</b> Megan Wallace and Darren Obbard Institute of Evolutionary Biology, University of Edinburgh	S
26	<b>Genomic evolutionary history of Legionnaires' disease in Scotland</b> Bryan Wee (1), Joana Alves (1), Diane Lindsay (3), Ross Cameron (2), Andrew Smith (3,4), Ross Fitzgerald (1) (1) The Roslin Institute, University of Edinburgh; (2) NHS National Services Scotland, Health Protection Scotland; (3) Scottish Haemophilus, Legionella, Meningococcus and Pneumococcus Reference Laboratory, NHS Greater Glasgow & Clyde, Glasgow Royal Infirmary; (4) School of Medicine, Dentistry & Nursing, University of Glasgow	P

S – student presenter

P – postdoc presenter