

# **Edinburgh Infectious Diseases**

Leading infectious disease research and training



Annual Report 2015

## Edinburgh Infectious Diseases Annual Report 2015

Prof. Ross Fitzgerald (Director) and Dr. Hilary Snaith (Executive Manager)

<b>EXECUTIVE SUMMARY</b> .....	<b>3</b>
<b>DIRECTOR'S STATEMENT</b> .....	<b>4</b>
<b>ORGANISATION OF <i>EDINBURGH INFECTIOUS DISEASES</i></b> .....	<b>6</b>
<b>EVALUATING OUR POSITION AND DEFINING OUR FUTURE</b> .....	<b>7</b>
<b>BUILDING STRONG AND EFFECTIVE NETWORKS</b> .....	<b>8</b>
DEVELOPING MULTIDISCIPLINARY COLLABORATIONS .....	8
DEFINING A STRATEGY ON ANTIMICROBIAL RESISTANCE .....	8
SUPPORTING SPECIFIC SUBJECT AREAS .....	9
BRINGING THE NETWORK TOGETHER AT OUR ANNUAL SYMPOSIUM .....	10
<b>RESEARCH OUTPUT FROM <i>EDINBURGH INFECTIOUS DISEASES</i> IN 2015</b> .....	<b>11</b>
<b>RESEARCH FUNDING AWARDS</b> .....	<b>13</b>
<b>EXCELLENCE WITH IMPACT: PUBLIC ENGAGEMENT, KNOWLEDGE EXCHANGE AND POLICY</b> .....	<b>15</b>
ENGAGING WITH KNOWLEDGE EXCHANGE .....	15
ENGAGING WITH POLICYMAKERS .....	16
ENGAGING WITH THE PUBLIC .....	16
ONLINE VISIBILITY .....	18
<b>STUDENT FOCUSED ACTIVITY / TEACHING AND TRAINING</b> .....	<b>19</b>
WELLCOME TRUST FOUR YEAR PHD PROGRAMME IN HOSTS, PATHOGENS AND GLOBAL HEALTH .....	19
MASTERS LEVEL PROVISION IN INFECTIOUS DISEASES .....	20
UNDERGRADUATE OPPORTUNITIES .....	20
LEIDEN UNIVERSITY MEDICAL CENTRE UNDERGRADUATE SUMMER PLACEMENTS .....	21
SUPPORTING IMMUNOLOGY AND INFECTIOUS DISEASES STUDENT SOCIETIES AND CAREERS .....	22
<b>APPENDIX 1</b> .....	<b>23</b>
SUMMARY OF <i>EDINBURGH INFECTIOUS DISEASES</i> ACCOUNTS FOR FY 2014/15 .....	23
<b>APPENDIX 2</b> .....	<b>24</b>
PUBLICATIONS BY <i>EDINBURGH INFECTIOUS DISEASES</i> MEMBERS IN 2015 .....	24
<b>APPENDIX 3</b> .....	<b>49</b>
EDINBURGH INFECTIOUS DISEASES PRESS COVERAGE IN 2015 .....	49
<b>APPENDIX 4</b> .....	<b>52</b>
NEWS FROM THE <i>EDINBURGH INFECTIOUS DISEASES</i> WEBSITE IN 2015 .....	52
<b>APPENDIX 5</b> .....	<b>55</b>
SCIENCE HAS IMPACT: COMBATting NEGLECTED TROPICAL DISEASES IN AFRICA .....	55
SCIENCE HAS IMPACT: GM CHICKENS AND DISEASE PREVENTION .....	56
SCIENCE HAS IMPACT: A NEW TEST FOR MALARIA IN BLOOD DONATIONS .....	57
SCIENCE HAS IMPACT: BREEDING DISEASE-RESISTANT SALMON .....	58

## Executive Summary

- The mission of *Edinburgh Infectious Diseases* is to **build a world leading consortium in infectious disease sciences** across the University of Edinburgh and neighbouring Institutions with the following specific aims:
  - Represent the strengths and promise of infectious disease science in Edinburgh through our symposia, workshops, outreach activity and digital profile;
  - Maintain strategic oversight of infectious disease research in Edinburgh, to maximise synergy between established groups and promote new avenues for investigation;
  - Foster infectious disease teaching and training at all levels within the University, including the development of new postgraduate initiatives.
- *Edinburgh Infectious Diseases* now comprises **over 160 academics** from the 3 Colleges of the University of Edinburgh, as well as Heriot Watt University, Edinburgh Napier University, NHS Lothian and associated Institutes including the Moredun Research Institute and Scotland's Rural College).
- In the academic year 2014 / 2015, our annual audit of external income and outputs revealed that **a total of £41m in research funding was secured within the University of Edinburgh alone**. This is over 10% of the total University income of £304m, and a marked increase on our funding from 2013 / 14.
- In conjunction with the Centre for Immunity, Infection and Evolution based in the School of Biological Science, we were successful in our bid for a Wellcome Trust Four Year PhD programme in Hosts, Pathogens and Global Health. The first students will arrive in Edinburgh in October 2016. We also support the undergraduate programme in infectious diseases, and provide a portal for Master's and PhD student applicants to the University.
- We organised a series of successful events including our **Annual Symposium** at the Royal College of Physicians addressed by an internationally renowned keynote speaker Professor Helen McShane; several Edinburgh wide workshops and a public **Winter Lecture** on The State of the World's Antibiotics, delivered by Prof Ramanan Laxminarayan, Director of the Center for Disease Dynamics Economics and Policy in Washington DC, and Vice-President at the Public Health Foundation of India.

## Director's statement

We exist in a rapidly changing world and perhaps more than many academic disciplines, infectious disease (ID) research is a highly dynamic field characterized by the capacity of new pathogens to emerge, and the ability of existing ones to rapidly adapt to antimicrobial strategies. Accordingly we are required to be proactive in identifying key areas of development in ID research and policy, and to anticipate future funding opportunities.

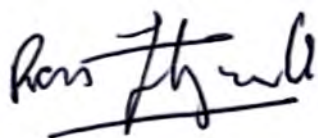
With the change in Director, *Edinburgh Infectious Diseases* is taking the opportunity to carry out an evaluation of its role by both critically examining our activities and successes, and consulting our membership on how they feel *Edinburgh Infectious Diseases* can best support their work in the coming years. In particular, we are identifying the strategic areas of focus for *Edinburgh Infectious Diseases* to support the Edinburgh ID community and to maximize our competitiveness for funding in key research and training areas.

One area of critical importance in the current global climate is antimicrobial resistance (AMR). We are currently carrying out an analysis of our current research strengths in this area so we can position ourselves appropriately for future funding opportunities. We will also identify areas of the AMR research portfolio in Edinburgh that could benefit from strengthening by strategic new appointments. An overlapping area is the broad concept of 'One Health' referring to science carried out in either a human or veterinary context that informs our understanding of both human and veterinary health. The *Edinburgh Infectious Diseases* committee believes that this is an area of potential strength particularly for University of Edinburgh and the Moredun Research Institute which offers opportunities for both human and veterinary clinician involvement. We plan to examine our strengths in this area to highlight potential topics for major funding initiatives such as doctoral training programmes to be led by *Edinburgh Infectious Diseases*. Related to this, we have also identified enhanced interactions between clinicians (of human and veterinary medicine) and basic scientists including greater opportunities for clinicians to carry out basic research in infectious diseases as an important priority area.

Furthermore, in addition to continuing to provide an essential network to enhance ID-related activities across the city, we will aim to better synergise our activities and strategic objectives with other bodies in Edinburgh with related or overlapping interests including the newly formed Centre for livestock Genetics and Health and the Global Academies. Related to this, based on existing research expertise and structures, we believe we are well positioned to deliver research for Overseas Development Assistance (ODA) against Grand Challenges identified as part of the last spending review including improved food security and mitigating the impact of diseases and AMR.

Finally, we will continue to increase our visibility through public engagement activities, a MOOC in AMR, and a re-developed website, and increased social media activities.

Overall, this is a tremendously exciting time to be involved with ID research and training. *Edinburgh Infectious Diseases* has an important responsibility to facilitate interactions between investigators with complementary interests, identify opportunities and establish strategic goals towards major funding awards to enable Edinburgh to become a world-leading community for infectious disease research.

A handwritten signature in black ink, appearing to read 'Ross Fitzgerald', with a horizontal line drawn underneath the name.

Prof Ross Fitzgerald, Director of *Edinburgh Infectious Diseases*

The Roslin Institute, University of Edinburgh

April 2016

## Organisation of *Edinburgh Infectious Diseases*

*Edinburgh Infectious Diseases* is the Network of researchers working in Edinburgh on infectious diseases. We bring together over **160 research groups**, and a total of over **860 staff and students** actively working in infectious diseases. The Network is run from the University of Edinburgh, and has considerable input from other research organisations in our city including Moredun Research Institute, NHS Lothian, and also Heriot Watt, Edinburgh Napier and Queen Margaret Universities. Our members come from all perspectives on infectious disease: from basic, clinical and veterinary scientists, to hospital consultants and social scientists. Through developing the Network we seek to better integrate these researchers and provide a rich environment to promote interdisciplinary collaboration.

*Edinburgh Infectious Diseases* is administered by the Director (Prof. Ross Fitzgerald) and Executive Manager (Dr. Hilary Snaith) with monthly input from an active Executive Committee (below) and annual oversight by a Strategic Board. Our funding is provided centrally by the University of Edinburgh, and a summary of our accounts for FY 2014/15 is given in Appendix 1.

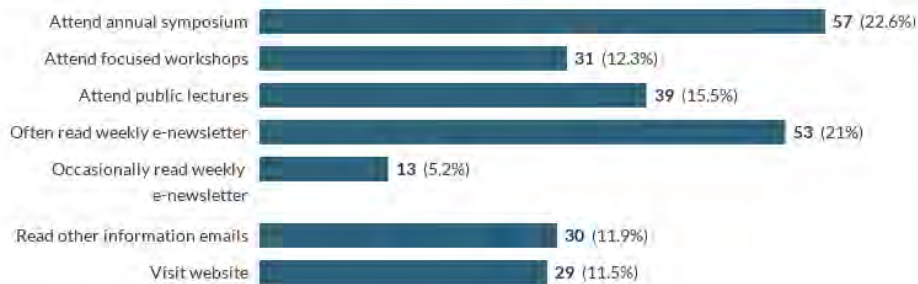
Committee Member	Location
Dr Till Bachmann	Division of Infection and Pathway Medicine, Little France
Dr Amy Buck	Centre for Immunity Infection and Evolution, Kings Buildings
Prof Harry Campbell	Usher Institute of Population Health Sciences and Informatics
Dr Bernadette Dutia	The Roslin Institute, Easter Bush
Prof Gary Entrican	The Moredun Research Institute
Prof Ross Fitzgerald	The Roslin Institute Easter Bush (Director)
Prof Clifford Leen	Department of Infectious Diseases, Western General Hospital
Prof Keith Matthews	Centre for Immunity, Infection and Evolution, Kings Buildings
Dr Harish Nair	Usher Institute of Population Health Sciences and Informatics
Prof Jürgen Schwarze	Centre for Inflammation Research, Queen's Medical Research Institute
Dr Hilary Snaith	<i>Edinburgh Infectious Diseases</i> , Kings Buildings (Executive Manager)
Prof Mark Stevens	The Roslin Institute, Easter Bush
Dr Alice Street	School of Social and Political Science George Square
Dr Kate Templeton	Division of Laboratory Medicine, Royal Infirmary of Edinburgh
Prof Sue Welburn	Division of Infection and Pathway Medicine, Little France

The beginning of 2016 has seen some significant changes for *Edinburgh Infectious Diseases*. Professor Rick Maizels stood down as Director after four and half years, and we are indebted to him for his leadership and guidance during that time. Professor Ross Fitzgerald who holds a Chair in Molecular Bacteriology, and is based at The Roslin Institute has now taken over at the helm. We are very grateful to outgoing executive committee members Prof José Vazquez Boland and Prof Judi Allen for their invaluable contributions, and are very pleased to welcome two new members, Dr. Amy Buck from the Center for Immunity, Infection and Evolution at Kings Buildings, and Dr. Kate Templeton from the Division of Laboratory Medicine at the Royal Infirmary of Edinburgh.

## Evaluating our position and defining our future

We have taken the opportunity provided by the change in Director to both critically evaluate our activities and successes in delivering our mission, and also to consult our membership on how they would like the network to support their work in future (below).

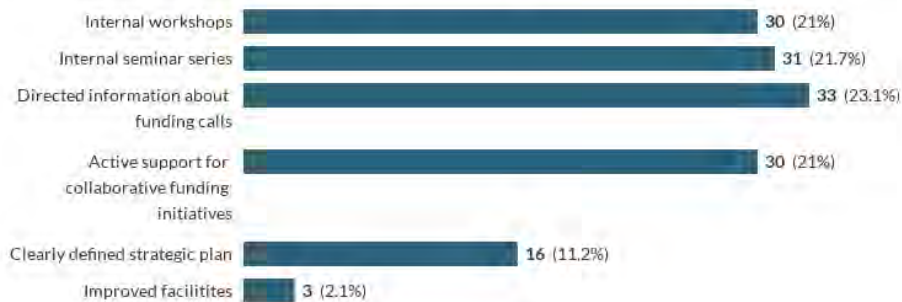
How do you interact with *Edinburgh Infectious Diseases*? Please select all that apply.



Which of these activities do you value most? Please select a single answer.



What activities do you think would best support you in your infectious disease research? .



We asked respondents about the ways in which they interact with the Network, and about which of our current activities they find the most useful. It is clear the weekly e-newsletter summarising news, seminars and events from the across the network, and our Annual Symposium are the most valuable to our members. Both these activities are key to ensuring information flow between our members, helping them to keep informed, and providing an opportunity to meet with one another. In addition, we note that focused support for internal seminar series and workshops is strongly welcomed by the *Edinburgh Infectious Diseases* community. Members also would like to see more directed information about funding calls and active support for developing collaborative funding initiatives. These inputs will now serve to help guide our future activities to ensure that we best meet the needs of our members.

## Building strong and effective networks

One of the main aims of *Edinburgh Infectious Diseases* is to build strong and effective networks of researchers through the University of Edinburgh and our partner organisations. Over 2015 we have made considerable progress in these aims, in particular helping to engage basic and clinical scientists with researchers in social sciences.

### Developing multidisciplinary collaborations

A major strength in Edinburgh is having considerable expertise in infectious diseases research not only in basic, clinical and veterinary sciences, but also in the social sciences and humanities. During 2015 we have benefitted from the recruitment of Dr Alice Street onto the *Edinburgh Infectious Diseases* Executive Committee. Alice is a Chancellor's Fellow in the School of Social and Political Science, and her research focuses healthcare delivery in resource-poor settings. In conjunction with the Institute for Advanced Studies in the Humanities, *Edinburgh Infectious Diseases* has organised an ongoing series of "Common Ground" workshops.



These events are designed to bring together researchers from a broad range of backgrounds and disciplines, to explore topics where greater integration of basic and social science



research can deliver novel outcomes. These smaller discussion forums have provided researchers much needed space to meet and discuss possible collaborative projects. We are working with the new Edinburgh Centre for Medical Anthropology, directed by Prof Ian

Harper, to further bolster these connections, with the intention of developing concrete future projects.

We are also continuing to work closely with the Global Health Academy. In September of 2015 we co-hosted Dr John Reeder, Director of the World Health Organisation Tropical Diseases Research (TDR). He met with a number of researchers from across Edinburgh during his visit, gaining a full flavour of the work we do here. He also participated in a careers event for students, giving his considerable insight into what makes a successful researcher, and gave a very well received lecture on the work that the TDR has



THE UNIVERSITY of EDINBURGH  
Global Health Academy

done over the past 40 years, and where he sees its work in the future. Alongside the Global Health Academy, we are currently working together to develop further resources to help both undergraduate and postgraduate students in making career choices.

### Defining a strategy on antimicrobial resistance

A key topic in the field of infectious diseases research is the threat of antimicrobial resistance and how this can be addressed. Edinburgh has a large number of researchers



across many disciplines who engaged in work that is relevant to this challenge. In April 2015 *Edinburgh Infectious Diseases* organised a large workshop that brought together basic scientists, clinicians, vets and social scientists to hear about the different research approaches being brought to bear on this problem.

After the event there was clear consensus about the need for an Edinburgh AMR Forum allowing researchers to connect, explore potential future collaborations and disseminate AMR related activities in Edinburgh. The Forum has now been set up by Dr. Till Bachmann (Division of Infection and Pathway Medicine), with initial supporting funds from *Edinburgh Infectious Diseases* and now from the Academic Networking Fund. The Edinburgh AMR Forum has over 100 members and through its networking seminars and other events is providing much needed opportunities for researchers to meet, discuss and develop funding proposals.

We are currently engaged in a strategic review of our strengths in the general area of AMR research. Encouragingly, we have noted significant activity from EID members in applying for grant funding for AMR-related research from the MRC, BBSRC, JPIAMR, China-UK Newton fund, Wellcome Trust. This has culminated in notable recent successes: Dockrell et al, MRC- Tackling AMR Theme 2: Accelerating therapeutic and diagnostics development. £4 M- SHIELD *Optimising Innate Host Defence to Combat Antimicrobial Resistance*; Fitzgerald et al, Wellcome Trust Collaborative Award- £1.3 M *Understanding Bacterial Host-adaptation to Combat Infectious Diseases*. Holmes, Stevens et al MRC Tackling AMR Theme 1 *Determination of the dynamics of AMR genes in the human and animal gut microbiome* 1.6M (145k to UoE). Dunn et al, BBSRC LINK award- £831,297 *Optimising ovodefensins* (alternative to antibiotics for growth promotion) (Also see section on Research Funding Awards below). We are confident that we will build on this success in the future.

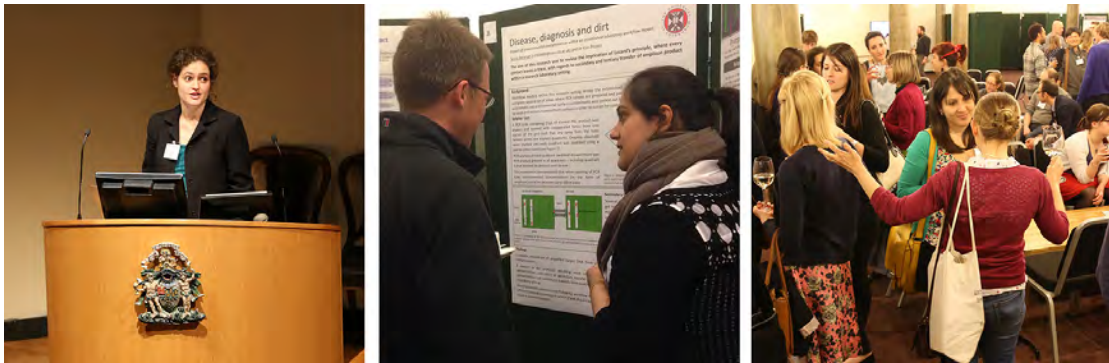
### Supporting specific subject areas

Along with the Roslin Institute *Edinburgh Infectious Diseases* is also supporting both the Edinburgh Virology Group and the re-launched Edinburgh Microbiology Forum. This latter grouping has a wide remit and attracts researchers from many disciplines with an interest in microbiology. Currently their main activity is a city-wide programme of seminars covering a wide variety of topics. Lectures in the past year have included Prof. Ian Henderson (University of Birmingham) on resolution of *Pseudomonas aeruginosa* infection in patients through antibody modulation, Prof. Jose Penades, (University of Glasgow) on the bacteriophage - *Staph. aureus* pathogenicity islands war, and Prof. Carmen Buchreiser (Institut Pasteur) speaking about the pathogenesis of Legionnaires' disease.

One Health is another topic of growing relevance to researchers in *Edinburgh Infectious Diseases*. Working with the Global Health Academy we are initiating a mapping exercise to identify where strengths lie across the University of Edinburgh and our sister organisations in the city, with a view to positioning ourselves to take advantage of new funding opportunities in this area. The new Centre for Livestock Genetics and Health at the Roslin Institute, which received £10m funding from the Gates Foundation in December 2015, offers further opportunities to our members to develop new projects and productive collaborations.

## Bringing the network together at our annual symposium

The Annual Symposium is a highlight in our year. It is one of most visible activities and an event that our members always enjoy and return to. IN 2015 we were hosted again by the Royal College of Physicians, and over 200 people listened to a fascinating day of presentations, both as talks and posters. The Symposium provided us with further opportunity to feature work from across the whole spectrum of research in infectious diseases in Edinburgh, from public health approaches to vector borne diseases, to genetic variation in Trypanosomes and the implications for infectious diseases from the resolution of inflammation.



This year we were privileged to have Prof Helen McShane from the University of Oxford as the Ker Memorial lecturer, discussing her work in the development of vaccines against Tuberculosis (*below left*). The lectureship is 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.



The symposium also allowed us to recognise the winner of this year's Ker Memorial Prize for the most outstanding PhD student in infectious diseases. Wei Yuan Hsieh (*above right*) worked with Peter Ghazal in the Division of Infection and Pathway Medicine for his PhD thesis on *Functional Characterisation of the Host Sterol Metabolic Network in the Interferon Antiviral Response*.

## Research output from *Edinburgh Infectious Diseases* in 2015

Our publication output has been high again in 2015, with members contributing over **480 papers**.

There have been several highlights including two in the Lancet, Cell and Science, three in PLoS Pathogens, five in Nature and the Proceedings of the National Academy of Sciences and 10 in PLoS Neglected tropical Diseases. A few of the major publications are listed below and a complete list is given in Appendix 2.

- Bedford, T., et al., *Global circulation patterns of seasonal influenza viruses vary with antigenic drift*. Nature, 2015. **523**(7559): p. 217-20.
  - The observed patterns of epidemic spread of influenza viruses suggest that differences in ages of infection could explain patterns of global circulation for variety of human viruses.
- D'Arc, M., et al., *Origin of the HIV-1 group O epidemic in western lowland gorillas*. Proc Natl Acad Sci U S A, 2015. **112**(11): p. E1343-52.
  - The data indicate that HIV-1 group O, which spreads epidemically in west central Africa and is estimated to have infected around 100,000 people, originated by cross-species transmission from western lowland gorillas, and not from chimpanzees as has been shown for other phylogenetic lineages of HIV-1.
- De Majumdar, S., et al., *Elucidation of the RamA Regulon in Klebsiella pneumoniae Reveals a Role in LPS Regulation*. PLoS pathogens, 2015. **11**(1): p. e1004627.
  - This paper highlights the RamA as a global regulator that confers pathoadaptive phenotypes with implications for our understanding of the pathogenesis of *Enterobacter*, *Salmonella* and *Citrobacter* spp. that express orthologous RamA proteins.
- Gadsby, N.J., et al., *Development of two real-time multiplex PCR assays for the detection and quantification of eight key bacterial pathogens in lower respiratory tract infection*. Clin Microbiol Infect, 2015. **21**(8): p. 788 e1-788 e13.
  - The assay described in this report should facilitate de-escalation from broad-spectrum to narrow-spectrum antibiotics, substantially improving the management of patients with lower respiratory tract infections and supporting efforts to curtail inappropriate antibiotic use.
- Kay, G.L., et al., *Differences in the Faecal Microbiome in Schistosoma haematobium Infected Children vs. Uninfected Children*. PLoS Negl Trop Dis, 2015. **9**(6): p. e0003861.
  - There are significant differences in the gut microbiome structure of schistosome-infected children vs. uninfected children and these differences are refractory to treatment with the anti-helminthic drug praziquantel.

- Kropp, K.A., et al., *A Temporal Gate for Viral Enhancers to Co-opt Toll-Like-Receptor Transcriptional Activation Pathways upon Acute Infection*. PLoS Pathog, 2015. **11**(4): p. e1004737.
  - This study shows that innate-immune transcription factors can drive viral expression and replication in the face of on-going pro-inflammatory antiviral responses, and demonstrates important future implications for regulating viral latency.
- McNeilly, T.N., et al., *Optimizing the Protection of Cattle against Escherichia coli O157:H7 Colonization through Immunization with Different Combinations of H7 Flagellin, Tir, Intimin-531 or EspA*. PLoS One, 2015. **10**(5): p. e0128391.
  - This study identifies vaccine antigen combinations that generate protection against enterohemorrhagic *E. coli* O157 (EHEC) in calves, and informs future studies that can formally test the cross-protective potential of the vaccines against other non-O157 EHEC infections.
- Park, D.J., et al., *Ebola Virus Epidemiology, Transmission, and Evolution during Seven Months in Sierra Leone*. Cell, 2015. **161**(7): p. 1516-26.
  - The findings clarify the movement of EBOV within Sierra Leone during the recent epidemic and describe viral evolution during prolonged human-to-human transmission.
- Spence, P.J., T. Brugat, and J. Langhorne, *Mosquitoes Reset Malaria Parasites*. PLoS Pathog, 2015. **11**(7): p. e1004987.
  - This study provides direct evidence for the first time that mosquito transmission resets *Plasmodium* virulence via epigenetic reprogramming.
- Viana, D., et al., *A single natural nucleotide mutation alters bacterial pathogen host tropism*. Nat Genet, 2015. **47**(4): p. 361-6.
  - This is the first report of a single mutation that is sufficient to alter the host tropism of a microorganism during its evolution, and highlights the capacity of some pathogens to readily expand into new host species populations.



## Research funding awards

It has been another successful year for *Edinburgh Infectious Diseases* for research funding awards. **Between August 2014 and July 2015** our members were awarded a total of **£41.4m**, with £24.8m to members in the College of Medicine and Veterinary Medicine, and £16.5m to members in the College of Science and Engineering. The University of Edinburgh as a whole awarded was £304.5m. Grants over £500,000 are shown in table 1.

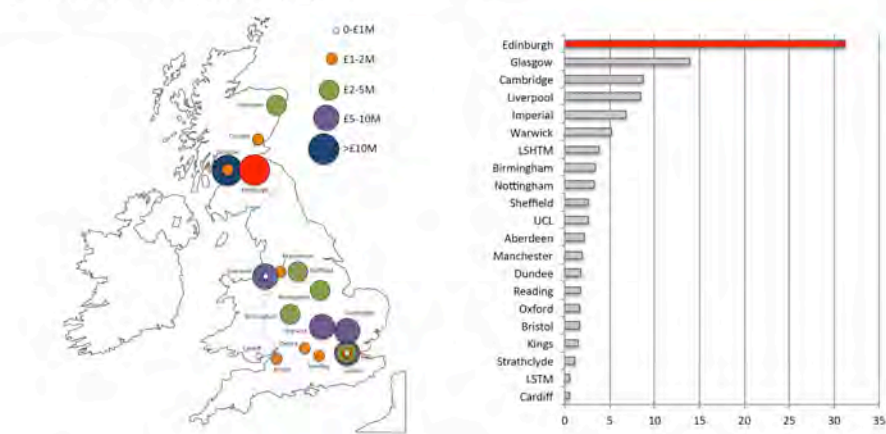
Researcher	Funding body	Amount
Devi Sridhar	Wellcome Trust	£501,906
Liam J Morrison	Biotechnology and Biological Sciences Research Council	£506,989
Peter Kaiser	Biotechnology and Biological Sciences Research Council	£521,488
Mark E Woolhouse	Pirbright Institute, The BBSRC	£522,988
Peter Kaiser	Biotechnology and Biological Sciences Research Council	£535,862
Mark E Woolhouse	European Commission	£536,353
Andrea Wilson	European Commission	£562,577
Karl J Oparka	Biotechnology and Biological Sciences Research Council	£568,365
Neil D Sargison	University of Glasgow/BBSRC	£642,605
Dietmar Zaiss	Medical Research Council	£658,045
Dominic J Campopiano	Biotechnology and Biological Sciences Research Council	£704,003
Stephen C Bishop	Biotechnology and Biological Sciences Research Council	£844,979
Cecile M Benezech	Medical Research Council	£871,799
Sara Macias Ribela	Wellcome Trust Sir Henry Dale Fellowship	£935,172
David Hume	Biotechnology and Biological Sciences Research Council	£951,944
Michael Watson	Biotechnology and Biological Sciences Research Council	£1,000,000
David Hume	Medical Research Council	£1,023,894
Peter Simmonds	Wellcome Trust	£1,100,513
Sarah Walmsley	Wellcome Trust	£1,149,414
Philip J Spence	Wellcome Trust Sir Henry Dale Fellowship	£1,163,281
Andrew W Horne	National Institute for Health Research	£1,448,916
Judith E Allen	Wellcome Trust	£1,949,179
Richard M Maizels	Wellcome Trust	£2,039,266
Keith R Matthews	Wellcome Trust	£2,365,413
Jean C Manson	Department of Health	£3,107,733

In addition in the first six months of the new financial year several other major awards have been received, including **£10M in funding from the Gates Foundation** for projects in the new Centre for Livestock Genetics and Health at The Roslin Institute, and significant awards from both the MRC, BBSRC and Wellcome Trust for AMR-related research as highlighted on p.8.

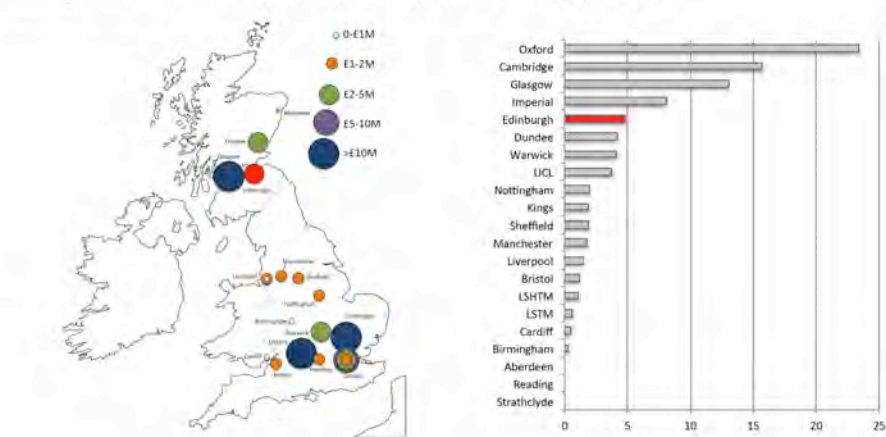
An analysis of funds awarded by the BBSRC, MRC and Wellcome Trust to ourselves and comparator institutions for infectious disease related research during the past year, shows that we are competing well, as illustrated in the maps and graphs below. Analysis of total active grants from the BBSRC in January 2016 shows that Edinburgh is doing exceptionally well, both receiving the most overall funding, and also specific funding for infectious

diseases. This reflects the strength of infectious diseases research at the Roslin Institute, and the strides the University of Edinburgh is making in synthetic biology. Although the data show that our members were awarded relatively few grants by the Medical Research Council, Edinburgh is performing strongly on infectious diseases funding from the Wellcome Trust with several multi-million pound awards made during the last year. Although it should be noted that three Wellcome Trust senior Investigators have since moved on from UoE highlighting the importance of maintaining the appeal of UoE as an excellent environment for top level ID research.

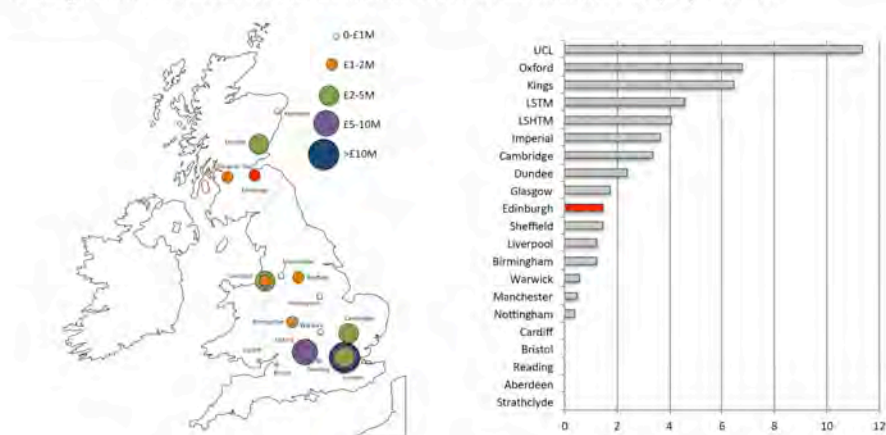
Current (Jan 2016) funding from the Biotechnology and Biosciences Research Council for infectious diseases research (£M)



Funding from the Wellcome Trust for infectious diseases research (£M) in 2013/14



Funding from the Medical Research Council for infectious diseases research (£M) in 2014/5



## Excellence with Impact: Public Engagement, Knowledge Exchange and Policy

*Edinburgh Infectious Diseases* was actively engaged with promoting our research, both internally and externally throughout 2015. In particular we have participated in the University of Edinburgh's Excellence with Impact project.



Over the past three years (2013-2015) the BBSRC has been running the Excellence with Impact competition for organisations across the UK to whom they provide major funding, including the University of Edinburgh. Within our University, BBSRC funded activities are

focused within the School of Biological Sciences and the Roslin Institute, both of which also have many members of *Edinburgh Infectious Diseases*. The aim of the competition was to encourage actions that would lead to culture change within the organisations involved, leading to greater research impact. We are delighted that our submission to the BBSRC in December 2015 was selected as one of the top 10 finalists from over 30 competitors.

## Engaging with Knowledge Exchange

The Activating Impact Technology Scouts programme was jointly run by *Edinburgh Infectious Diseases* and Edinburgh Research and Innovation, to identify areas of research within our portfolio where increased collaboration with industrial partners might prove fruitful. The project was kick-started by a £50,000 prize from the BBSRC under their "Activating Impact" scheme, which funded a one-year pilot project to assess the current commercialisation landscape within *Edinburgh Infectious Diseases* and connect academic researchers with potential industrial collaborators.



Three research scientists (two postdoctoral researchers and a PhD student) were seconded to work as part-time technology scouts for *Edinburgh Infectious Diseases* focusing on Antimicrobials; Inflammation, Allergy and Tropical Diseases; and Vaccinology. The project demonstrated that technology scouts embedded in the research environment can play a valuable role in promoting knowledge exchange. They increase awareness of commercial opportunities, break down perceived barriers between academia and industry and provide an additional point of contact for business development managers looking for technical input on a new technology or collaborative opportunity. The project has also played an important role in encouraging the University to commit further resource to this area, embedding the approach in the University's KEC strategy.

*Edinburgh Infectious Diseases* is also working with Edinburgh Research and Innovation to run

an AIM Day on Infection. Edinburgh is the first University in the UK to be licensed to run Academic Industry Meeting Days (<http://www.aimday.se>). These events were devised by the University of Uppsala, and have been very successful in promoting effective collaborations between Universities and potential commercial partners. Companies are asked for questions on a particular topic with which they would like input from universities. These questions are then addressed in facilitated discussions with groups of academics with mutual interests. The Infection AIM Day will be run later in 2016.



### Engaging with Policymakers

Another major area of activity has been to highlight the need for researchers to contribute to policymaking at all levels, through provision of reasoned and measured advice to local and national government, learned bodies, charities and other non-governmental organisations.

To help build capacity to support the engagement of researchers with policy makers, the Excellence with Impact team organised a one-day workshop. The event was supported by the senior Vice-Principal Prof Charlie Jeffrey and Associate Principal Prof Susan Deacon, who both affirmed the University's strong support of policy engagement and encouraged participants to identify ways in which they can continue to develop this work.



The workshop brought together senior policy advisors from the Wellcome Trust, the Scottish Parliament Information Centre, UN Environment Programme World Conservation Monitoring Centre, the Royal Society of Biology and the Scottish Universities' Insight Institute, with researchers from many researchers from *Edinburgh Infectious Diseases* and other UoE staff involved in public engagement and stakeholder

relations. The event provided momentum to develop improved support for researchers, so that we can be more effective at ensuring that the excellent research in Edinburgh has impacts on relevant policy issues in the future.

### Engaging with the Public

*Edinburgh Infectious Diseases* continues to develop its public engagement activities with the "Bugs and Bones" treasure chest. The samples of bones and parasites in the chest are taken from the Ashworth Natural History Collection in the Ashworth Labs at Kings Buildings. They have allowed us to effectively develop dialogues with a range of audiences about how





different infections are spread, and what measures can be undertaken to reduce transmission. Members of the network took part in several sciences festivals including those in Dunbar, Edinburgh and Midlothian. We also contributed to the explosion of events that happened at Edinburgh zoo and across the city for the EU Researchers Night Explorathon in September 2015.

These activities outwith the University of Edinburgh continue to allow us to have very positive interactions with a wide range of public audiences that would not normally be able to access our research. We have also invited the our local community to come and meet us here at the University at Doors Open Days – labs at both at Kings Buildings and the Roslin Institute had 100s of visitors eager to see the work we do here.

In November we hosted a public lecture in the Playfair Library addressing the pressing issue of antimicrobial resistance. Prof Ramanan Laxminarayan, Director of the Center for Disease Dynamics Economics and Policy in Washington DC, and Vice-President at the Public Health Foundation of India, gave an extremely insightful lecture to over 150 guests on “The State of the World’s Antibiotics”. This lecture was videoed and has been extensively viewed on YouTube, again helping to raise our profile.

**Edinburgh Infectious Diseases**  
Leading infectious disease research and training

**ROSLIN**  
Research Institute

**Moredun**  
Research Institute

**NHS**  
Lothian

**SRUC**

**Edinburgh Napier**  
University

**PUBLIC LECTURE**

**Professor Ramanan Laxminarayan**  
**The state of the world's antibiotics**

**5.30 – 6.30 pm · Thursday 19 November 2015**

Playfair Library, University of Edinburgh, South Bridge

Please register at: <http://winter-lecture-2015.eventbrite.co.uk>

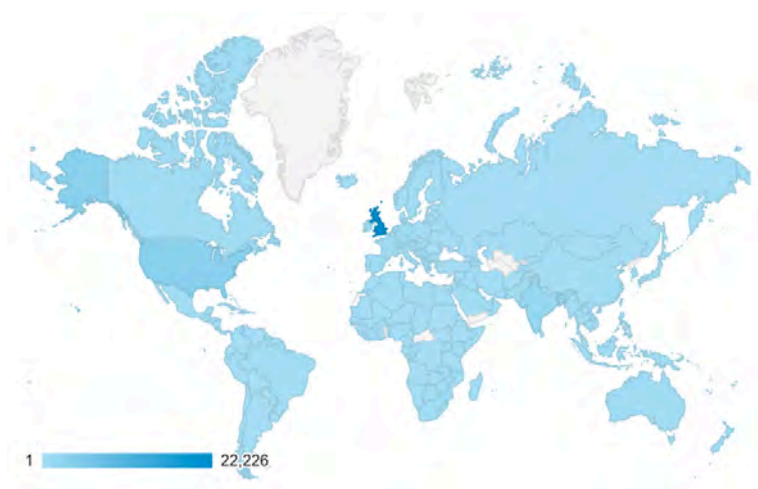
The BBSRC Excellence with Impact competition has also strengthened our links with other University of Edinburgh public engagement practitioners and will work to continue more collaboratively in future. In conjunction with colleagues at the Roslin Institute we produced a number of pop-up banners describing the impact research in infectious diseases has made,

and which we have used at different events to engage both scientific and public audiences. The banners are reproduced in appendix 5.

Finally, in December 2015 provided input to the recent British Science Association event on antimicrobial resistance at the National Museum of Scotland, again helping to raise the profile of *Edinburgh Infectious Diseases* with a wide audience.

## Online visibility

One of the important ways in which we share information about our activities both internally and to the wider public is through our website and social media presence. In 2015 our website have visitors from every country in the world apart from five – a total of over 42000 visits.



The most popular pages concern the taught and research degrees available to students coming to Edinburgh and future work will be done over the coming year to further improve the information we are providing to potential students.

We continue to promote the work of our members through the news items on

our home page – a summary of stories is presented in appendix 3. Our news feed runs alongside the work of the University of Edinburgh press office, whose press releases on the work of our members have been picked up by news outlets across the world, including the BBC online, The Herald, The Scotsman, BBC Radio 4, The New York Times, National Geographic, Science Daily and Medical Xpress. In particular contributions by Prof Andrew Rambaut to the recent Ebola epidemic, Prof David Gally's work on E. coli O157 and Prof Mark Woolhouse's comments on the current fight against antimicrobial resistance gains extensive coverage. More details are given in appendix 4.

We also disseminate news about our activities using Twitter and have increased our followers nearly 60% to 1450. Twitter is proving to be an effective means of reaching our target audience - several applicants to the Hosts Pathogens and Global Health PhD Programme said that they were made aware of the new Programme via our tweets. In the week prior to the preparation of this report, tracking software estimated that over 44,000 people read one of our tweets, again helping to raise the profile of our work and that of the University of Edinburgh.

## Student focused activity / Teaching and Training

*Edinburgh Infectious Diseases* continues to enhance the teaching and training of students at both undergraduate and postgraduate level.

### Wellcome Trust Four year PhD programme in Hosts, Pathogens and Global Health

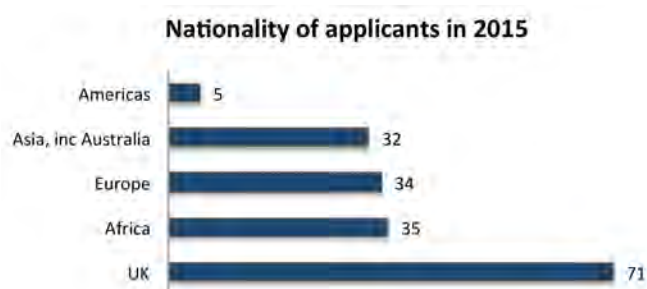
This year we were delighted to be successful in our application to the Wellcome Trust to deliver a Four Year PhD Programme entitled Hosts, Pathogens and Global Health.

The Wellcome Trust will fully fund 5 students each year, with the School of Biological Sciences providing a scholarship for a 6<sup>th</sup> outstanding student from a low or middle income country. This Programme will currently fund three cohorts of students, with the first students arriving in Edinburgh in October 2016. Professors Keith Matthews and Mark Woolhouse will be co-directors of the new Programme, and administrative support will be provided from *Edinburgh Infectious Diseases* by Dr. Hilary Snaith.

**wellcome**trust

During the first year of their study in Edinburgh, the new students will undertake formal teaching and research rotation projects in the three themes of the Programme: Molecular Phylogeny and Epidemiology, Evolutionary Biology and Ecology, and Molecular Biology and Immunology. Students will have the opportunity to select from a wide pool of potential supervisors based at the Kings Buildings, Little France and the Roslin Institute, for the remaining three years of their PhD.

**HP** Hosts, Pathogens  
**GH** & Global Health  
**Four year PhD Programme**



The students will be able to choose to work with supervisors who have collaborators in disease-endemic countries. It is hoped that students will have the opportunity to travel to these countries as part of their studies to gain first hand experience of how and where their research can

make an impact in future. The Programme has already proved to be extremely popular and we received over 175 applications from across the world for the 6 available places – 60% of the applicants were from outwith the UK (see graph left). We are confident that we have attracted outstanding candidates and look forward to working with them as their scientific careers develop.

## Masters level provision in infectious diseases

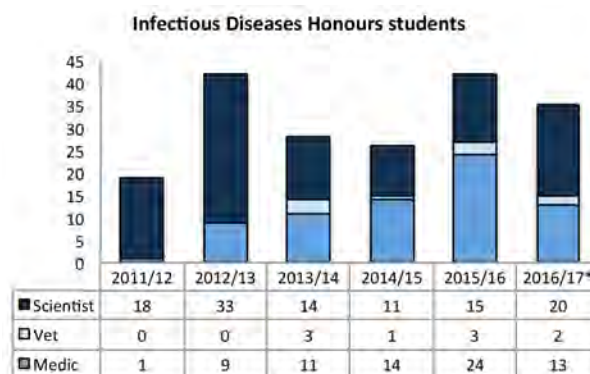
There are a large number of Master level courses teaching aspects of infectious diseases. On-campus courses including MSc by Research in Infectious Diseases, Biomedical Sciences and Animal Bioscience, stand along side on-line distance learning courses such as Global Health and Infectious Diseases Clinical Microbiology and Infectious Diseases, One Health, and International Animal Health. The numbers on these courses are continuing to grow, reflecting the strength and growing reputation of the University of Edinburgh as a leader in this field. The numbers of students on the different Masters courses for the past two years are given in the table below.

Title	Mode of delivery	2014 / 15	2015 / 16
Animal Bioscience	On Campus	10	9
Biomedical Sciences	On Campus	19	20
Infectious Diseases	On campus	8	6
Quantitative Genetics and Genomics	On campus	11	23
Veterinary Studies	On campus	3	2
Biodiversity, Wildlife and Ecosystem Health	Distance learning	30	26
Clinical Microbiology and Infectious Diseases	Distance learning	n/a	8
Global Health and Infectious Diseases	Distance learning	62	64
International Animal Health	Distance learning	35	35
Next Generation Drug Discovery	Distance learning	3	13
One Health	Distance learning	12	19

## Undergraduate opportunities

The number of undergraduates entering the Infectious Diseases Honours programme continues to grow. There are 42 students on the 2015/16 course, split fairly evenly between basic scientists, and medical and veterinary students taking an intercalated degree (see table on right). It is already projected that there will be 35 students on the 2016/17 course, 20 scientists and 15 medics and vets. From 2016 the MBChB programme at the University of Edinburgh will take six years, with all students undertaking an intercalated BSc degree. This will present further opportunities and challenges for increasing student numbers on the Infectious Diseases Honours programme.

*Edinburgh Infectious Diseases* continues to provide support and encouragement to the Infectious Diseases Honours students: at the start of the academic year they are introduced to the *Edinburgh Infectious Diseases* as part of their initial orientation presentations and all the students receive our weekly e-newsletter with details of relevant events and seminars to which they are invited.



## Leiden University Medical Centre undergraduate summer placements



THE UNIVERSITY  
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LU Leiden University  
MC Medical Center

In the summer of 2014 we initiated the first summer student placements in collaboration with Prof Maria Yazdanbakhsh and Leiden University Medical Center. It is clear that students intending to move into research careers after their undergraduate degree benefit greatly from having opportunities to turn class-learning into real hands-on experience. We felt that it was important that we support our own students to gain this experience, and as a result we have established what has been a very productive partnership with Leiden University Medical Center. Starting in the summer of 2014 we have provided scholarships for

two third year Edinburgh students who are intending to move into the Infectious Diseases Honours class the following September. These funds allow the selected students to undertake 8-week projects in Molecular Parasitology or Medical Microbiology in Leiden. Four students have now travelled to Leiden on this scheme and all have thoroughly enjoyed and benefitted from their experiences (see below). We are now in the process of recruiting students who will travel to Leiden in summer 2016.



*It was a fantastic experience. It gave me a great impression of what it could be like to do further study in the field of infectious disease, and has helped me decide that I definitely want to do further study. (Jack Law, 2014)*

*I absolutely loved working in the Department of Parasitology... Having hands on experience has reinforced how interesting and satisfying parasitology is... It has strengthened my desire to continue into a research masters or exploring other aspect Infectious Diseases in the future. (Rachel Halkerston, 2015)*

The flow of students is not all from Edinburgh to Leiden. As part of this partnership eight medical students from Leiden University Medical Center travelled to Edinburgh during semester one of 2015/16 to take honours courses run by the Biomedical Teaching Organisation. This has been a very fruitful collaboration between our two institutions and we hope that we will be able to continue working together in the future.

## Supporting Immunology and Infectious Diseases student societies and careers

A recent development supported by *Edinburgh Infectious Diseases* has been the formation of a student-led societies for both Immunology and Infectious Diseases & Tropical Medicine. Both these organisations have organised seminars for bioscience and medical students, and held social events. We have provided some funds to support events and help and advice to promote these seminars.

*Edinburgh Infectious Diseases* also supported the Infectious Diseases Honours students in hosting their choice of seminar speaker. The class chose to invite Professor David Denning from the University of Manchester in March 2015 who gave two very illuminating lectures on the burden and treatment of fungal infections during his day in Edinburgh, and also made time to speak with the students about their own studies and future aspirations.

### **Edinburgh Infectious Diseases**

Leading infectious disease research and training

#### **Special Seminars**

**Professor David Denning**  
University of Manchester

Tuesday 3 March 2015

#### ***Learning from Aspergillus – from asthma to TB and transplant***

1 – 2 pm, Wellcome Lecture Theatre, Queens Medical Research Institute, Little France

#### ***150 deaths an hour – the neglected fungal disease ‘epidemic’***

5 -6 pm Lecture theatre 3, Ashworth Laboratories, Kings Buildings

More information: [contact.eid@ed.ac.uk](mailto:contact.eid@ed.ac.uk)

In conjunction with the Global Health Academy, during 2015 we ran a careers workshop for both undergraduate and postgraduate students considering careers in infectious disease and global health. The students heard from four panelists at different stages in their own careers, reflecting on their experiences and choices, and benefitted from their advice on how to approach planning a career. It is intended that this will be an annual event.

## Appendix 1

### Summary of *Edinburgh Infectious Diseases* accounts for FY 2014/15

Details	Income (£)	Expenditure (£)
Event organisation		7657.22
Meeting support		1184.15
Organisational support		1415.88
Printing		585.00
Prizes		200.00
Support staff		32878.69
Symposium 2015		6064.17
Symposium sponsorship	-1500	
University income	-55,000	
Vacation study grants		3532.08
<b>Subtotal</b>	-56500	53340.35
<b>TOTAL</b>		<b>-3159.65</b>

## Appendix 2

### Publications by *Edinburgh Infectious Diseases* members in 2015

1. Abkhallo, H.M., et al., *Within-host competition does not select for virulence in malaria parasites; studies with Plasmodium yoelii*. PLoS Pathog, 2015. **11**(2): p. e1004628.
2. Adams, M.J., et al., *Ratification vote on taxonomic proposals to the International Committee on Taxonomy of Viruses (2015)*. Arch Virol, 2015. **160**(7): p. 1837-50.
3. Adeloye, D., et al., *An estimate of the prevalence of COPD in Africa: a systematic analysis*. Copd, 2015. **12**(1): p. 71-81.
4. Adeloye, D., et al., *Global and regional estimates of COPD prevalence: Systematic review and meta-analysis*. J Glob Health, 2015. **5**(2): p. 020415.
5. Agarwal, S., et al., *Complex folding and misfolding effects of deer-specific amino acid substitutions in the beta2-alpha2 loop of murine prion protein*. Sci Rep, 2015. **5**: p. 15528.
6. Aguilar-Calvo, P., et al., *Effect of Q211 and K222 PRNP Polymorphic Variants in the Susceptibility of Goats to Oral Infection With Goat Bovine Spongiform Encephalopathy*. J Infect Dis, 2015. **212**(4): p. 664-72.
7. Ahlstrom, C., et al., *Limitations of variable number of tandem repeat typing identified through whole genome sequencing of Mycobacterium avium subsp. paratuberculosis on a national and herd level*. BMC Genomics, 2015. **16**: p. 161.
8. Ahmad, S.F., A. Akoum, and A.W. Horne, *Selective modulation of the prostaglandin F2alpha pathway markedly impacts on endometriosis progression in a xenograft mouse model*. Mol Hum Reprod, 2015. **21**(12): p. 905-16.
9. Ahmed, H.A., et al., *Development of Real Time PCR to Study Experimental Mixed Infections of T. congolense Savannah and T. b. brucei in Glossina morsitans morsitans*. PLoS One, 2015. **10**(3): p. e0117147.
10. Al-Rubaye, D.S., et al., *Genotypic assessment of Drug Resistant Tuberculosis in Baghdad and other Iraqi provinces using low-cost and density (LCD) DNA microarrays*. J Med Microbiol, 2015.
11. Al-Sultan, A.A., et al., *Dissemination of multiple carbapenem-resistant clones of Acinetobacter baumannii in the Eastern District of Saudi Arabia*. Front Microbiol, 2015. **6**: p. 634.
12. Al-Tassan, N.A., et al., *A new GWAS and meta-analysis with 1000Genomes imputation identifies novel risk variants for colorectal cancer*. Sci Rep, 2015. **5**: p. 10442.
13. Albert, M., et al., *Tsetse fly (G. f. fuscipes) distribution in the Lake Victoria basin of Uganda*. PLoS Negl Trop Dis, 2015. **9**(4): p. e0003705.
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16. Baumert, J., et al., *No evidence for genome-wide interactions on plasma fibrinogen by smoking, alcohol consumption and body mass index: results from meta-analyses of 80,607 subjects*. PLoS One, 2014. **9**(12): p. e111156.
17. Allen, R.C., et al., *Quorum sensing protects bacterial co-operation from exploitation by cheats*. Isme j, 2016.



18. Ambriz-Vilchis, V., et al., *Comparison of rumination activity measured using rumination collars against direct visual observations and analysis of video recordings of dairy cows in commercial farm environments*. J Dairy Sci, 2015. **98**(3): p. 1750-8.
19. Anastasi, E., et al., *Novel transferable erm(46) determinant responsible for emerging macrolide resistance in Rhodococcus equi*. J Antimicrob Chemother, 2015. **70**(12): p. 3184-90.
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31. Ballingall, K.T., et al., *An ancient interlocus recombination increases class II MHC DQA diversity in sheep and other Bovidae*. Anim Genet, 2015. **46**(3): p. 333-6.
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## Appendix 3

### Edinburgh Infectious Diseases press coverage in 2015

News Story	Coverage
African cows could hold key to combating Malaria, finds study led by <b>Prof Mark Woolhouse</b>	SUN, DAILY MAIL ONLINE (UK)
Andrew Rambaut (Biological Sciences) considers methods of tackling Ebola in Africa	THE NEW YORK TIMES (USA) THE TIMES (S Africa), MEDICAL XPRESS, PHYSORG.COM, SCIENCENEWS.ORG (USA)
Bacteria jump between species with relative ease, says Roslin's <b>Prof Ross Fitzgerald</b>	THE HERALD, THE COURIER, THE NATIONAL, EDINBURGH EVENING NEWS, EVENING TIMES (GLASGOW), EVENING EXPRESS (ABERDEEN), EASTERN DAILY PRESS, PRESS TRUST OF INDIA (India), DIARIO MEDICO (Spain), SCIENCE DAILY (USA), EUROPA PRESS (Spain), HERENCIA GENETICA YENFERMEDAD (Argentina)
Cattle drug trial by <b>Prof Sue Welburn</b> curbs sleeping sickness spread among people	THE INDEPENDENT, INTERNATIONAL BUSINESS TIMES, METRO, THE HERALD, THE SCOTSMAN, THE NATIONAL, PRESS & JOURNAL, COURIER & ADVERTISER, BBC ONLINE, BBC WORLD SERVICE, BBC RADIO 4, SCOTTISH TELEVISION
Deadly killer turn E.coli into killer virus, <b>Prof David Gally</b> finds	THE INDEPENDENT, INTERNATIONAL BUSINESS TIMES, METRO, THE HERALD, THE SCOTSMAN, THE NATIONAL, PRESS & JOURNAL, COURIER & ADVERTISER, BBC ONLINE, BBC WORLD SERVICE, BBC RADIO 4, SCOTTISH TELEVISION
<b>Dr Devi Sridhar</b> voices concern isolated Ebola cases returning to UK will stop volunteers to affected countries	EVENING EXPRESS, THE DAILY MAIL, THE SUNDAY HERALD
<b>Dr Laura Pollitt</b> finds repeat infection with malaria parasites might make mosquitoes more dangerous	MEDICALXPRESS.COM (USA)
Edinburgh research on Ebola in Africa is praised by UN Secretary General	FOREIGNAFFAIRS.CO.NZ (N Zealand) US FED NEWS (USA)
<b>Evelyn Rynkiewicz</b> (Biological Sciences) says southern Indiana will be free of Lyme Disease	TERRA DAILY, U-WIRE (USA), NEWS MEDICAL NET (Australia) INDIANA UNIVERSITY, NEWSWISE, SCIENCE DAILY, INFECTION CONTROL TODAY, US FED NEWS, DRUG DISCOVERY AND DEVELOPMENT, SCIENCE 2.0, MEDICAL DAILY (USA)
Garlic extract could help cystic fibrosis patients fight infection <b>Prof John Govan &amp; Dr Dominic Campopiano</b> find	THE HERALD, THE SCOTTISH DAILY EXPRESS, EUREKALERT, MEDICAL XPRESS (USA), DECCAN HERALD, PRESS TRUST OF INDIA, INDO-ASIAN NEWS SERVICE, ECONOMIC TIMES, NDTV, JAGRAN POST, ZEE NEWS (India), KHALEEJ TIMES (UAE), NUTRAINGREDIENTS.COM (France), C2W

	(Netherlands)
<b>Harish Nair</b> (Population Health Sciences) leads study into the treatment of babies with clinically suspected serious infections outside hospital	PHYS ORG (USA)
HIV-positive children are more likely to die from pneumonia, <b>finds Dr Harish Nair</b>	VOICE OF AMERICA, SCIENCE NEWSLINE, SCIENCE DAILY, EUREKALERT, MEDICAL EXPRESS, JERSEY TRIBUNE, UNIVERSITY HERALD, SCIENCE DAILY, SCIENCE NEWSLINE (USA)
Inoculating cattle with a less harmful but related parasite could protect against East Coast fever	FINANCIAL TIMES
Livestock scientists at University of Edinburgh and the Moredun Institute share in £3m award to tackle helminthic resistance	PRESS AND JOURNAL
<b>Prof Helen Sang</b> (Roslin) says using gene manipulation is as effective as vaccines against Bird Flu	EPOCH TIMES.DE (Germany)
<b>Prof Mark Stevens</b> (Roslin) comments on food poisoning bug found in most shop-bought chickens	THE SCOTSMAN, SOUTH WALES ECHO, FOOD QUALITY NEWS.COM, FOOD AND DRINK EUROPE (France)
<b>Prof Mark Woolhouse</b> (Biological Sciences) says Ebola crisis has highlighted need to bolster global surveillance	EVENING NEWS, THE EDINBURGH PAPER, XINHUA NEWSWIRE, GUANGXI NEWS NETWORK, JIANGSU NEWS NETWORK (China)
<b>Prof Mark Woolhouse</b> (Biological Sciences) comments on growing concerns about antimicrobial resistance	FOREIGNAFFAIRS.CO.NZ (New Zealand), CHINA CHEMICAL INSTRUMENT NETWORK, CHINA BIOTECHNOLOGY INFORMATION NETWORK (China), SUNDAY TIMES, BBC NEWS, THE SCOTSMAN, DAILY RECORD, THE NATIONAL
<b>Prof Neil Mabbott</b> (Roslin) claims that diseases can move from the gut to the brain	THE TIMES, EDINBURGH EVENING NEWS, EUREKALERT, UPI, TECH TIMES (USA), WEB INDIA 123 (India) Prof Neil Mabbott finds vCJD infection begins in small intestine before spreading to brain
<b>Prof Paul Digard</b> comments on bird flu outbreak	THE SCOTSMAN
<b>Prof Rick Maizels</b> (Biological Science) tells Live Science show how hosts fend off parasitic infections	BBC RADIO 5
<b>Prof Robert Will</b> comments on possibilities of an outbreak of BSE in UK	NATIONAL GEOGRAPHIC (USA)
<b>Professor Daniëlle Gunn-Moore</b> (Roslin) develops improved diagnostic test to help diagnosis of mycobacterial disease in cats	MEDICAL DESIGN TECHNOLOGY (USA)
Roslin Institute developing pigs that are resistant to African swine fever	TAKE PART (USA)
Roslin researchers insert gene into chickens as part of experiment to assess resistance to Avian Flu	DAILY MAIL, GLOBAL TIMES, XINHUA (China) CHINA TIMES, TAIWAN.CN, COMMERCIAL TIMES (Taiwan) BUSINESS LINE, YAHOO! INDIA (India) ZAMYA (UAE) SABC NEWS (S Africa) CHANNEL

	NEWS ASIA, YAHOO! SINGAPORE (Singapore) THE CYPRUS WEEKLY (Cyprus) YAHOO! CANADA (Canada) BANGOR DAILY NEWS, FOX <a href="#">NEWS.COM</a> , NEW YORK POST, THE DAILY CALLER, CBS, TECH TIMES, BIOSPACE (USA) <a href="#">LIPUTAN6.COM</a> (Indonesia) DOMAIN B (India), SHANGHAI DAILY, PHOTOELECTRIC NEWS NETWORK (China)
Roslin researchers sign letter opposing Scottish Government's plan to ban cultivation of GM crops	THE SCOTSMAN, THE PRESS AND JOURNAL, THE COURIER, THE NATIONAL, THE TIMES, THE HERALD, DAILY TELEGRAPH, SUNDAY HERALD, GENETIC LITERACY PROJECT (USA)
Roslin scientists work with colleagues in Chile to improve resistance of salmon to Rickettsial Syndrome	MERCO PRESS (Uruguay)
Shetland pony midge study by <b>Dietmar Zaiss</b> (Biological Sciences) offers clues to curbing allergies	THE HERALD, RED ORBIT (USA)
<b>Seshasailam Venkateswaran</b> says hospital infections could be cut by coating medical tools	PLASTEMART.COM (India)

## Appendix 4

### News from the *Edinburgh Infectious Diseases* website in 2015

1. Researchers at Roslin Institute receive BBSRC sLoLa grant to develop novel vaccines for poultry
2. Prof Ross Fitzgerald to be new Director of Edinburgh Infectious Diseases
3. Recognising Excellence in the School of Biological Sciences
4. £10m award from Bill and Melinda Gates Foundation boosts efforts to aid plight of tropical livestock farmers
5. Cattle drug trial led by University of Edinburgh curbs the spread of sleeping sickness among people
6. A great summer for two Edinburgh Infectious Diseases Honours students exploring science in Leiden
7. Keith Matthews given Sanofi - Institut Pasteur Award for 2015 - many congratulations!
8. School of Biological Sciences and Roslin Institute workshop: Making an Impact on Policy
9. Latest technology could curb repeat Ebola crisis, say experts from University of Edinburgh and Wellcome Trust
10. Announcing a new Wellcome Trust funded 4yr PhD programme in Edinburgh "Hosts, Pathogens & Global Health"
11. Sue Welburn's work on sleeping sickness features in list of top 20 impact stories in REF2014
12. Superbug study reveals how E. coli strain acquired deadly powers
13. Scottish wildcats threatened by feline form of HIV, Edinburgh University study finds
14. Edinburgh University helps boost writing and publication skills of African researchers
15. The Onchocerciasis Vaccine for Africa (TOVA) - A global initiative to advance river blindness vaccine
16. New brain infection study from the Roslin Institute reveals how prion disease spreads from gut
17. Edinburgh PhD student writes about his passion for malaria

18. Moredun researchers awarded ~€9M grant to develop new parasite vaccines
19. Antimicrobial Resistance Diagnostics Competition AMR-DxC is launched by the Division of Infection and Pathway Medicine
20. Animals' infections can impact most on relatives, study finds
21. Recent University of Edinburgh study helps predictions of ecosystem change in response to multiple environmental drivers
22. Ocean algae will cope well in varying climates, study shows
23. Edinburgh Infectious Diseases researchers to take part in the Cabaret of Dangerous Ideas
24. Edinburgh researchers receive funding to improve animal health and welfare
25. New Edinburgh study shows smoking ban cuts child hospital intake for respiratory infections
26. Another successful Edinburgh Infectious Diseases symposium held on 20 May 2015
27. Salmon breeding to benefit from gene study of disease resistance at the Roslin Institute
28. Many congratulations to Prof Peter Ghazal on election as Fellow of the Academy of Medical Sciences
29. Edinburgh Infectious Diseases announces Wei Yuan Hsieh as winner of the 2015 Ker Memorial Prize - congratulations!
30. Report of Edinburgh Infectious Diseases workshop on Antimicrobial Resistance, Diagnostics and Drug Discovery
31. Bacterial raincoat discovery paves way to improve crop protection from infection
32. Moredun Scientists awarded new grants to help improve the health and welfare of livestock
33. Francisca Mutapi selected as inaugural fellow of the African Science Leadership Programme
34. Shetland pony midge study at the University of Edinburgh offers clues to curbing allergies

35. Gene study helps explain complications in tracing the source of the 2012 Legionnaires' disease outbreak in Edinburgh
36. Researchers at the Roslin and Moredun Research Institutes have received £2.7M boost to improve the health of livestock around the world
37. Biological scientists at the University of Edinburgh secure £25.7m to create powerhouse of research
38. On World Tuberculosis Day: Why you need to know your enemy when it comes to eradicating TB
39. Infectious Diseases Honours students recently invited David Denning, prominent expert in fungal infections, to visit them in Edinburgh
40. Cattle parasite study from Centre for Immunity, Infection and Evolution, suggests new ways to combat infectious diseases
41. Children under five living in sub-Saharan Africa are at greater risk than older children of developing a long-term parasitic disease
42. Soil study led by Edinburgh researchers helps unearth vital clues in search for infection treatments
43. Three members of Edinburgh Infectious Diseases elected to the Royal Society of Edinburgh
44. Edinburgh study shows that garlic extract could help cystic fibrosis patients fight infection
45. New study from the Roslin Institute shows how easy it can be for bacteria to jump species
46. Edinburgh Infectious Diseases members at Edinburgh Napier University win grant to investigate novel drugs to treat Rhinovirus infection
47. Recent study shows that co-infected plants cause more severe epidemics
48. Crohn's study at University of Edinburgh seeks to find causes of the disease
49. New micro-residency teaming artists and researchers in infectious diseases starts at the University of Edinburgh
50. Research at University of Edinburgh shows that infection risk could be cut with new coatings for surgical devices



## SCIENCE HAS IMPACT: COMBATting NEGLECTED TROPICAL DISEASES IN AFRICA

Bilharzia (or Urogenital schistosomiasis to give its proper name) is a disease of poverty that affects more than 100 million people across Africa.

The disease is caused by infection with tiny *Schistosoma haematobium* worms. The larval worms live in the fresh water that many people have to use for washing, drinking and cooking, and the worms can easily infect unwary visitors through the skin.

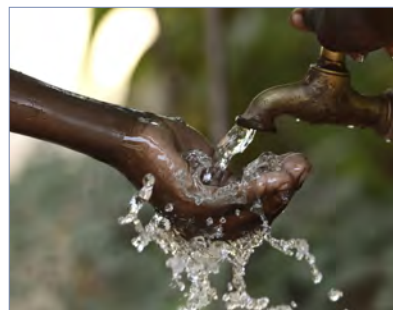
Once they have entered the bloodstream the worms mature into adults which live in the urinary tract and intestines. Some of the eggs laid by the worms become trapped in the tissues and it is the body's immune reaction to these eggs that can cause severe illness.

Children are the most severely affected by Bilharzia, often suffering from malnutritional, low growth and poor achievement at school.



If schistosome infections in children are not treated, this can lead to kidney and bladder disease, reduced fertility and increased susceptibility to HIV infection in adulthood.

Francisca Mutapi at the University of Edinburgh has studied how our immune system responds to urogenital schistosomiasis infection. Her research has shown that the drug Praziquantel (PZQ) speeds up the development of immunity to Schistosome infection, and helps protect against re-infection with the parasites.



### NEW SCHISTOSOMIASIS TREATMENTS FOR INFANTS

Further work from Francisca and her collaborators allowed the World Health Organisation to start an ongoing Mass Drug Administration programme using PZQ in 2012, which includes pre-school children for the first time.

This new programme has already treated almost 350,000 children, and has been extremely successful in reducing *S. haematobium* infection, significantly reducing the risk of long-term illness.

The Chair of the 2010 WHO workshop on schistosomiasis said:

"This programme and evaluation study in Zimbabwe will help many thousands of children in the short term and several million in the long term."



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## SCIENCE HAS IMPACT: GM CHICKENS AND DISEASE PREVENTION

### Chicken is the UK's most consumed meat and more chickens are eaten worldwide than any other animal.

Eggs are produced by around 4.93 billion egg-laying hens worldwide.

Sales of chicken meat and eggs are worth over £7.2 billion per year in the UK alone.

Demand for chicken meat and eggs is growing fast due to an increasing world population.

Researchers at The Roslin Institute are working to tackle the global challenge of food security by improving the health of chickens.



### The threat from Bird Flu

Avian influenza or "bird flu" is a harmless viral infection in wild birds that can cause deadly disease in chickens.

The virus spreads rapidly through chicken flocks and birds are culled to prevent the spread of disease.

In 2015, 42 million chickens were culled in the US due to an outbreak of bird flu, costing the poultry industry and its suppliers \$3.3 billion.

Disease in chickens also increases the risk of spread to humans and the potential for a worldwide influenza outbreak.

Scientists at Roslin are helping to minimise farming losses due to livestock diseases, such as bird flu, and to prevent potential transmission to humans.



### HOW CAN GM HELP US COMBAT DISEASE?

Scientists at The Roslin Institute, working with the University of Cambridge, have developed genetically modified (GM) chickens that can catch bird flu but do not pass it on to other chickens.

The chickens are engineered to make a 'decoy' molecule, identical to part of the influenza virus. This prevents new viruses being made, so the disease cannot spread.

The 'decoy' matches a part of the flu virus that is present in all types of influenza, so the GM chickens should stop the spread of all types of avian influenza virus.

GM technology in chickens has also led to the production of therapeutic proteins in eggs. Drugs to treat many serious diseases, including cancer, could be mass produced cheaply in this way.



### What next?

Currently GM animals are not permitted on UK farms and further work needs to be done to licence the technology and ensure its safety.

We want to ensure that the public are aware of the opportunities that GM technologies could offer and can have their say.

Please contact us and tell us what you think.

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## SCIENCE HAS IMPACT: A NEW TEST FOR MALARIA IN BLOOD DONATIONS

Malaria is one of the most common diseases in the world. It affects more than 200 million people and is a major cause of illness and death.

Across the globe, it is estimated that 3.4 billion people are at risk of malaria: in 2012 alone there were 207 million cases of the disease and 627,000 deaths. Three quarters of these deaths were children under 5 years of age.

Malaria is caused by Plasmodium parasites. The parasites are transferred from person to person through the bite of an infected mosquito.



### MALARIA TEST HAS WORLD-WIDE IMPACT

Work carried out at the University of Edinburgh led to the development of a new and highly sensitive test for the malaria-causing Plasmodium parasites in blood donations. This new assay allows reliable identification of all malaria-positive blood donations.

Since 2004 the new test has been used to accurately detect these antibodies in all blood donations, allowing blood transfusion services to identify infected samples.

The assay is in use across the world. Between 2008-13 in the UK alone, more than 345,000 blood donations which would previously have been thrown away, were retained – approximately 3% of all donations made – and 250,000 donations have been kept in Australia and New Zealand.

Since July 2013 Trinity Biotech has marketed the Malaria EIA worldwide, with ongoing sales of over 2.5 million assays since 2008.

Every year thousands of people return to the UK infected with malaria. This causes several problems, including a risk that blood donations are made by donors who are infected with malaria.

Because of this, until recently all blood donations from people returning from countries where malaria is common was not used. In 2002 this meant that over 3% of all donations in England and Wales were lost, and it became very challenging to hold enough blood for essential treatments and operations.



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## SCIENCE HAS IMPACT: BREEDING DISEASE-RESISTANT SALMON

The salmon farming industry plays a key role in the Scottish economy with an estimated value of £600 million. Outbreaks of the viral disease Infectious Pancreatic Necrosis (IPN) affect salmon farms worldwide.

Outbreaks typically kill 25% of farmed fish and in severe outbreaks this can increase to 90%, causing large costs and losses.

There is no effective vaccine for very young fish, but some fish are naturally resistant to the disease.

Researchers at The Roslin Institute have demonstrated the genetic basis of IPN resistance and are using their findings to improve the sustainable production of fish through aquaculture.



### IPN resistance

IPN resistance is almost entirely due to variation in a single area of the salmon genome.

Fish inheriting two copies of the resistant version of the gene have almost no mortality during IPN outbreaks, whereas those inheriting the susceptible version from both parents have mortality levels of over 50%.

This genetic information can be obtained from a fin clip sample taken before breeding.



### Fish n' (SNP) Chips

Scientists at Roslin have contributed to the development of a high-density salmon SNP chip, containing thousands of genetic markers.

These chips can be used to select for salmon with increased resistance to a range of diseases and will be a key tool for improving the competitiveness and sustainability of the UK salmon farming industry.

### BENEFITS TO THE SALMON FARMING INDUSTRY

The salmon breeding company Landcatch Natural Selection is using the DNA markers identified at Roslin that are closely associated with IPN resistance to select for disease-resistant fish.

Selection for IPN resistance can lower IPN mortality to virtually zero and has had an estimated economic impact of £26.4 million Gross Value Added (GVA).

Furthermore, it has generated over 400 jobs across the UK, many of which are based in the Scottish Highlands and Islands.

Thanks to a licence agreement between The Roslin Institute and Landcatch Natural Selection, a genetic test for IPN resistance has been sold to aquaculture companies worldwide.

Similar technology is being developed to identify genes that are associated with resistance to other diseases that threaten the aquaculture industry.



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