

Edinburgh Infectious Diseases

Summary of activities 2021/22

Professor Ross Fitzgerald and Dr Hilary Snaith
November 2022

Edinburgh
Infectious
Diseases



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Table of Contents

Table of Contents	1
Summary	2
Director's message	3
About Edinburgh Infectious Diseases	4
New strategy for Edinburgh Infectious Diseases	4
Academic outputs	6
Funding awards	6
Publications	8
REF2021	9
Results of REF2021 for Edinburgh Infectious Diseases	10
REF Impact Case studies	10
Key network activities in 2021/22	12
Fleming Fund Fellowship Schemes in Uganda, Malawi and Kenya	12
Host Institution University of Edinburgh	12
Edinburgh Antimicrobial Resistance Forum	13
External and industrial links	13
One Health – Una Europa	14
Postgraduate training	14
Wellcome Trust PhD programme in Hosts, Pathogens and Global Health	15
Wellcome Trust PhD programme in One Health Models of Disease – Science, Ethics and Society	15
Communications and engagement	17
Connecting across the University	17
Events for our members	17
Annual Symposia	17
Disease Transmission workshop	18
Early Career Researcher Symposium	19
Winter lectures	19
Appendix	21
Grants of >£500K awarded to Edinburgh Infectious Diseases members at University of Edinburgh in 2021/22	21
Programmes at Annual Symposia in 2021 and 2022	25
Keeping Connected – 10th Edinburgh Infectious Diseases Symposium	25
Together Again – 11 th Edinburgh Infectious Diseases Symposium	26
Publications from Edinburgh Infectious Diseases members in 2021	28

Summary

- ◇ New strategy for Edinburgh Infectious Diseases implemented in July 2022
- ◇ Establishment of working groups to develop funding bids around key areas of strength to EID– AMR, Disease Transmission, One Health, Environment and Health
- ◇ Award of £50.2M grant funding to Edinburgh Infectious Diseases members at the University of Edinburgh in FY2020/21 and £37.4 in FY 2021/22
- ◇ Over 540 papers published by EID members in 2021
- ◇ Excellent power ranking results for key Units of Assessment in REF2021 – Agriculture Food and Veterinary Sciences 2nd; Clinical Medicine 4th; Biological Sciences 5th
- ◇ Capacity building in Low-and-Middle-Income Countries for surveillance of Antimicrobial Resistance through role as Host institution for Fleming Fund Fellowship schemes in Uganda, Malawi and Kenya
- ◇ Renewal of grant to EID for phase II of Fleming Fund Fellowship scheme (3 years est. £2M)
- ◇ Leading industrial engagement through BBSRC-Impact Accelerator Account award for Analysis of Market Opportunities for Industry-Academia partnering in Antimicrobial Resistance Diagnostics
- ◇ Continued delivery of postgraduate training programmes including the Wellcome Trust-funded PhD Programme in Hosts, Pathogens & Global Health and WT PhD Programme with Integrated Study in One Health Models of Disease – Sciences, Ethics and Society; and the UoE-Leiden University Medical School PhD partnership in One Health Solutions to Infectious Diseases
- ◇ Ker Memorial Lectures by Professor Stewart Cole (Institut Pasteur) and Professor Sarah Gilbert (University of Oxford)
- ◇ Public Winter Lectures by Professor Sir Jeremy Farrar (Wellcome Trust) and Professor Frank Møller Aarestrup (Technical University of Denmark)

Director's message

The last 12 months have seen a gradual relaxing of restrictions related to the pandemic and a cautious move towards more face-to-face academic interactions. In June, we were able to hold our first in-person annual symposium in 3 years and it was a most welcome occasion. As a successful network we appreciate the importance of in-person meetings for making new contacts, developing ideas and formulating plans. In the last year, we have been moving towards the restructuring of EID in order to implement our revised strategy (more information in the report). We believe this will provide us with the resource and flexibility to support funding bids of strategic importance to our community.

At the same time, we have continued to deliver on our ongoing commitments such as leadership and delivery of UoE PhD programmes, capacity building projects in Anti-Microbial Resistance (AMR) in LMIC countries through the Fleming Fund, and fostering the community represented by our large network of 800 infectious disease researchers across the University of Edinburgh and partner organisations via workshops, symposia, and engagement activities. As detailed in the report, the EID membership has continued to be successful in winning significant research funding (representing 14% of the total UoE research income) and in publishing a large number of papers, many of which are in high profile journals.

Looking ahead, EID-led grant successes (in particular the Fleming Fund renewal) place us on a strong footing for our strategy to place greater emphasis on supporting the development of inter-disciplinary funding bids. I am stepping down from my role as EID Director after 7 years at the end of 2022, in what has been a hugely rewarding experience. However, I look forward to continuing to engage with EID as a member and supporting its activities in the years ahead.



Ross Fitzgerald
Director, EID

About Edinburgh Infectious Diseases

The Edinburgh Infectious Diseases community has over 230 research groups and 800 members across the University of Edinburgh, and other institutions across the city including Edinburgh Napier and Heriot Watt Universities, the Moredun Research Institute, Scotland's Rural College and clinical colleagues in NHS Lothian. It is led by the academic director Prof Ross Fitzgerald, Chair of Molecular Bacteriology at the Roslin Institute, supported by an executive committee of senior leaders from across our network, alongside the (newly created) Development Manager Dr Hilary Snaith, the Fleming Fund Project Officer Romana Gorjanc and the Postgraduate Taught Projects Officer, Jennifer Hurst. We have also just appointed a new Communications and Engagement Officer.

The past 16 months have been ones of continued adaptation to the restrictions enforced by the Covid-19 pandemic and the gradual resumption of more normal activities as we finally emerge into the new normal. They have been full of new challenges for Edinburgh Infectious Diseases as we started bringing our community together again, to continue strengthening and developing the essential networks needed to carry out world class interdisciplinary research.

New strategy for Edinburgh Infectious Diseases

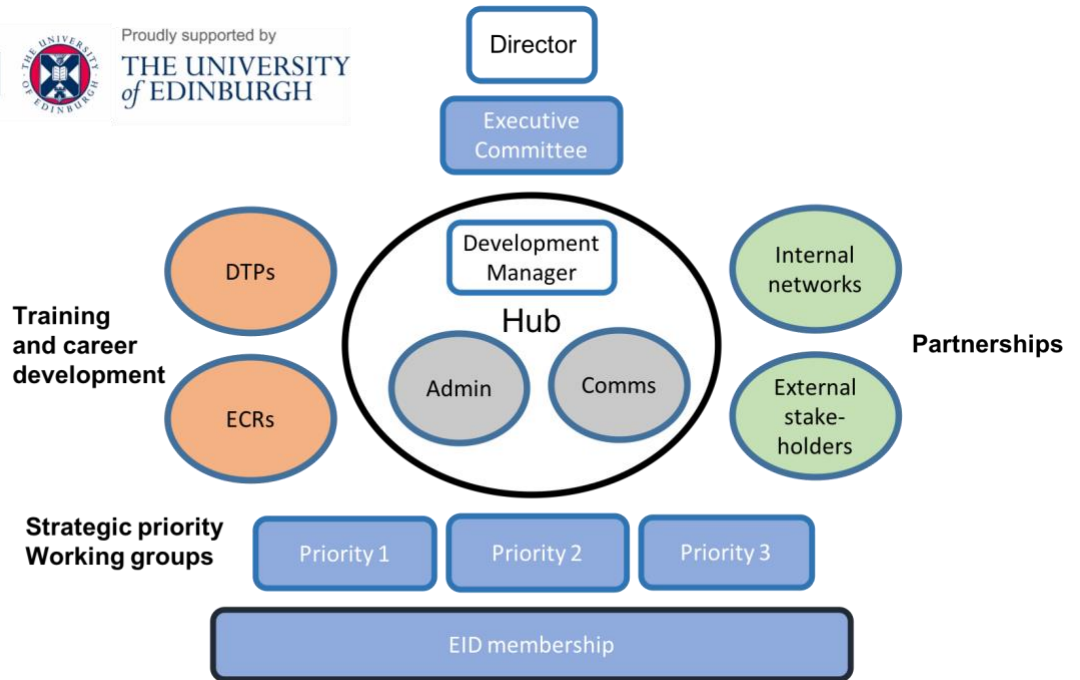
At the last meeting of the Edinburgh Infectious Diseases Strategy Board in June 2021, a revised strategy for the network was discussed, which saw the subsequent adoption of the following revised aims:, which included the revised aims

AIM 1 Represent the strengths of infectious disease science in Edinburgh through engagement with our internal **and external stakeholders**.

AIM 2 Support and develop infectious disease research in Edinburgh, to maximise synergy between established activities and **promote new avenues for investigation**.

AIM 3 Foster infectious disease teaching and training at all levels within the University, including the **development of new postgraduate initiatives and support for Early Career Researchers**.

It was further agreed that the Director will continue to provide academic oversight with input from the executive committee to identify key strategic priorities for EID focus, and that the Executive Manager role should be expanded into a Development Manager post, with responsibility for establishment of cross-disciplinary research collaborations and development of key external partnerships. To fully maximise benefits from this expansion of activities within Edinburgh Infectious Diseases, it was recognised that there needed to be increased resource for Communications and Engagement. The new structure is diagrammed below.

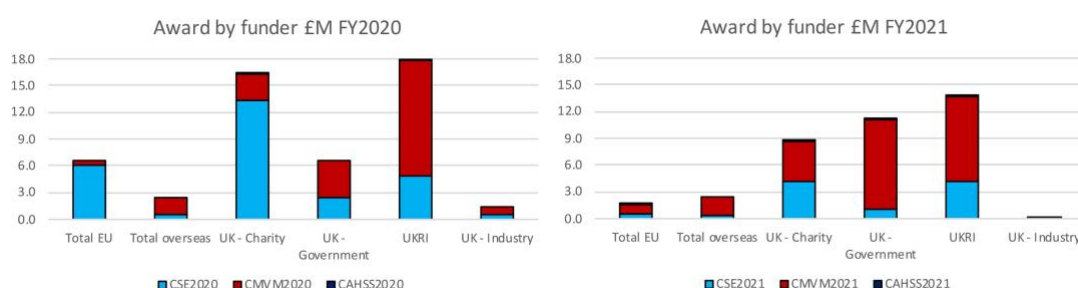


Over the past ~12 months we have been working through the necessary approvals to make the appointments required for this new structure. The necessary new posts have now been filled and we look forward to developing our activities to fully maximise our outputs.

Academic outputs

Funding awards

A key metric of the recent success of Edinburgh Infectious Diseases members is in the level of external research funding awarded. In FY 2020/21 University of Edinburgh members of EID were awarded £51.4M, and £37.2 in FY 2021/22. Over the past two years, infectious disease researchers have contributed almost 14% of total University research funding awards.



Awards by funder to Edinburgh Infectious Diseases members at the University of Edinburgh in FY 2020/21 and 2021/22.

As in previous years the most substantial funding was received from UKRI (in particular the Biotechnology and Biological Sciences Research Council and Medical Research Council), UK charities (including the Wellcome Trust) and the UK Government (including the NIHR and the Royal Society). A break-down of these numbers is shown in the charts above.

The decrease in funding in FY2021 is reflected in the overall University awards. Several sector-wide factors are likely to have impacted the funding, including cuts to the GCRF budget, uncertainty over the UK's relationship with the European Union, and drops in charitable funding resulting from financial pressures due to the pandemic.

A selection of awards >£500K are given below. A list of all awards >£500K is presented in the Appendix.

PI Name	PI Dept	Project Title	Funder	Award Total
Robin Allshire	School of Biological Sciences	Epigenetic mechanisms mediating antifungal resistance	Wellcome Trust	3500000
Kenneth Baillie	Centre for Inflammation Res.	Post-hospitalisation COVID-19 study: a national consortium to understand and improve long-term health outcomes (PHOSP-COVID)	MRC	1101992

Cecile Benezech	Centre for Cardiovascular Sci.	Does impaired adipose tissue B cell function lead to loss of natural antibody secretion and increase susceptibility to infection in obesity?	MRC	605419
Amy Buck	School of Biological Sciences	RNACOM: RNA functions in parasite-host communication in the gut	European Commission	1595017
Harry Campbell	Centre for Global Health Res.	NIHR Global Health Research Unit on Respiratory Health (RESPIRE-2)	NIHR	4558103
Dominic Campopiano	Chemistry	Bacterial sphingolipids - revealing hidden biosynthetic pathways of key players in host-microbe interactions.	BBSRC	509680
Emma Cunningham	School of Biological Sciences	A direct test of the impact of infection on animal migration and subsequent consequences for parasite and host populations	NERC	673029
Paul Digard	Roslin Institute	Identification of host factors underpinning resistance against Newcastle Disease Virus	Cobb-Vantress inc	515000
David Dockrell	Centre for Inflammation Res.	Mitochondrial dysfunction in macrophages and impaired bacterial clearance in chronic obstructive pulmonary disease (COPD)	MRC	1982688
Ross Fitzgerald	Roslin Institute	Dairy niche adaptation by bovine mastitis pathogens: novel targets for control	BBSRC	523312
Jim Kaufman	School of Biological Sciences	The drivers of MHC evolution during a viral pandemic	BBSRC	555937
Keith Matthews	School of Biological Sciences	Quorum sensing in African trypanosomes	Wellcome Trust	2488909
Sara Macias Ribela	School of Biological Sciences	Contribution of the miRNA-interferon interaction to human disease	Wellcome Trust	1827981
Beth Mills	Centre for Inflammation Res.	Pathways to reducing the burden of corneal ulcer in India and beyond	UKRI	1721615
Teuta Pilizota	School of Biological Sciences	Infections in complex physical environments: Life and death in the sinuses	EPSRC	804672
Andrew Rambaut	School of Biological Sciences	Covid-19 Genomics UK (COG-UK) Consortium Severe Acute Respiratory Syndrome Virus (SARS-Cov-2)	MRC	522600
Diego Robledo	Roslin Institute	Harnessing cross- species variation in sea lice resistance	FHF	805238
Steven Spoel	School of Biological Sciences	UbRegulate: Dynamic ubiquitin signalling coordinates transcriptional reprogramming in plant immunity	European Commission	1600000

6. Oliu-Barton M, Pradelski BSR, Aghion P, Artus P, Kickbusch I, Lazarus JV, Sridhar D, Vanderslott S (2021) SARS-CoV-2 elimination, not mitigation, creates best outcomes for health, the economy, and civil liberties. *Lancet* 397: 2234-2236
7. Pardal AJ, Piquerez SJM, Dominguez-Ferreras A, Frungillo L, Mastorakis E, Reilly E, Latrasse D, Concia L, Gimenez-Ibanez S, Spoel SH *et al* (2021) Immunity onset alters plant chromatin and utilizes EDA16 to regulate oxidative homeostasis. *PLoS Pathog* 17: e1009572
8. du Plessis L, McCrone JT, Zarebski AE, Hill V, Ruis C, Gutierrez B, Raghwan J, Ashworth J, Colquhoun R, Connor TR *et al* (2021) Establishment and lineage dynamics of the SARS-CoV-2 epidemic in the UK. *Science* 371: 708-712
9. Rojas F, Cayla M, Matthews KR (2021a) Basement membrane proteins as a substrate for efficient *Trypanosoma brucei* differentiation in vitro. *PLoS Negl Trop Dis* 15: e0009284
10. Simonet C, McNally L (2021) Kin selection explains the evolution of cooperation in the gut microbiota. *Proc Natl Acad Sci U S A* 118
11. Siva-Jothy JA, Vale PF (2021) Dissecting genetic and sex-specific sources of host heterogeneity in pathogen shedding and spread. *PLoS Pathog* 17: e1009196
12. Steketee PC, Giordani F, Vincent IM, Crouch K, Achcar F, Dickens NJ, Morrison LJ, MacLeod A, Barrett MP (2021b) Transcriptional differentiation of *Trypanosoma brucei* during in vitro acquisition of resistance to acoziborole. *PLoS Negl Trop Dis* 15: e0009939
13. Willson JA, Arienti S, Sadiku P, Reyes L, Coelho P, Morrison T, Rinaldi G, Dockrell DH, Whyte MKB, Walmsley SR (2021) Neutrophil HIF-1 α stabilisation is augmented by mitochondrial ROS produced via the glycerol 3-phosphate shuttle. *Blood* 139
14. Yebra G, Haag AF, Neamah MM, Wee BA, Richardson EJ, Horcajo P, Granneman S, Tormo-Más M, de la Fuente R, Fitzgerald JR *et al* (2021) Radical genome remodelling accompanied the emergence of a novel host-restricted bacterial pathogen. *PLoS Pathog* 17: e1009606
15. Zhang F, Karamagi H, Nsenga N, Nanyunja M, Karinja M, Amanfo S, Chase-Topping M, Calder-Gerver G, McGibbon M, Huber A *et al* (2021a) Predictors of COVID-19 epidemics in countries of the World Health Organization African Region. *Nature medicine* 27: 2041-2047

REF2021

Many members of Edinburgh Infectious Diseases contributed to the data submitted to the Research Excellence Framework 2021, with significant contributions made to the Units of Assessment in Agriculture, Food and Veterinary Sciences (UoA06; jointly submitted with SRUC), Clinical Medicine (UoA01) and Biological Sciences (UoA05), as well as inputs to a number of other UoAs (in table below).

Results of REF2021 for Edinburgh Infectious Diseases

The results of the University submission to the REF2021 were published in May 2022 and underline the contribution made to the University's success by infection-related research. Overall the University of Edinburgh was ranked 4th in Research Power: submissions in Agriculture, Food and Veterinary Sciences ranked 2nd in research power; Clinical Medicine was ranked 4th, and Biological Sciences ranked 5th.

Description	UoA	Power Rank (THE)	FTE of submitted staff	4* or 3* %	4* or 3* x FTE
Anthropology and Development Studies	22	1	63.5	81.00%	51.435
Agriculture, Food and Veterinary Sciences	6	2	151.84	87.00%	132.1008
Earth Systems and Environmental Sciences	7	2	123.3	94.00%	115.902
Psychology, Psychiatry and Neuroscience	4	3	189.21	94.00%	177.8574
Clinical Medicine	1	4	357.12	94.00%	335.6928
Physics	9	4	118.04	98.00%	115.6792
Biological Sciences	5	5	138.6	94.00%	130.284
Law	18	5	74.1	86.00%	63.726
Mathematical Sciences	10	6	90.55	96.00%	86.928
Chemistry	8	8	48	99.00%	47.52
Engineering	12	18	146.25	96.00%	140.4

REF Impact Case studies

Overall the University of Edinburgh submitted 191 Impact Case Studies to REF2021, with work from Edinburgh Infectious Diseases researchers underpinning twelve of these submissions.

UoA number	Unit of assessment	Title
1	Clinical Medicine	Accurate estimates of pneumonia disease burden guide child immunisation policy, practice and global investment to reduce child pneumonia mortality
4	Psychology, Psychiatry and Neuroscience	Change in UK blood donation policy around plasma and platelets following accurate definition of vCJD transmission risks leads to simpler logistics and cost savings
5	Biological Sciences	Fundamental research on exhausted T-cells leads to creation of a spinout that is now part of a multinational pharmaceutical support company
5	Biological Sciences	Mutations in the HIV genome are used to combat drug resistance, for tracking infection, and in litigation.

5	Biological Sciences	Real time genetic epidemiology and the BEAST phylogenetics software inform public health responses to minimise damage from Ebola and SARS-CoV-2 outbreaks
5	Biological Sciences	Reduction in infection and morbidity from neglected tropical disease in Zimbabwe and across Africa
6	Agriculture, Food and Veterinary Sciences	Improving disease management practice in barley leads to increased yields and safeguards against pathogen resistance
6	Agriculture, Food and Veterinary Sciences	Foot and mouth disease in Scotland: Improving preparedness and outbreak responses
6	Agriculture, Food and Veterinary Sciences	Implementation of large-scale vaccination programmes to control rabies in dogs and protect human health
6	Agriculture, Food and Veterinary Sciences	Genomics-enabled breeding for disease resistance prevents mortality and improves welfare in aquaculture
6	Agriculture, Food and Veterinary Sciences	Sustained long-term control of Human African Trypanosomiasis infections in Uganda through economically viable strategies
8	Chemistry	Direct detection of microRNA enables business growth through commercialisation of fast, accurate and quantitative detection of disease biomarkers

Key network activities in 2021/22

Edinburgh Infectious Diseases is responsible for the delivery of a number of key programmes focusing on teaching and training, and activities focused on communications and engagement.

Fleming Fund Fellowship Schemes in Uganda, Malawi and Kenya

The Fleming Fund is a £265M UK Government fund started in 2018 to provide support for capacity building in the surveillance of antimicrobial resistance in low and middle income countries. The Fund is channelled through the Department for Health and Social Care, and managed by Mott MacDonald. The Fleming Fund has three main funding streams – Regional Grants, Country Grant and the Fellowship Scheme – and operates in four geographical regions – Western Africa, Southern and Eastern Africa, South-East Asia and South Asia.

Host Institution University of Edinburgh

In 2018 EID led an application for the University of Edinburgh to become a host institution for Fleming Fund fellows in the Southern and Eastern Africa region. The programme is directed by Prof Ross Fitzgerald, supported by Dr Adrian Muwonge (Roslin Institute) as deputy director. The grants awarded for this work in total have brought £1.2M to the University.

Edinburgh infectious Diseases began working with the first cohort of fellows from Uganda in January 2019, to collaboratively develop one health approaches for tackling the surveillance of AMR and antibiotic use. We subsequently started working with professional fellows in Malawi in summer 2020, and summer 2021 two further cohorts of professional and policy fellows in Uganda, and two policy fellows in Kenya commenced their work.

In all cases, the fellows are paired with University of Edinburgh mentors to acquire skills receive the support and guidance experience needed to successfully make an impact in their countries. Necessarily during the pandemic all interactions were online. However the fellowships highlighted the importance of in person interactions in developing effective relationships, and we were delighted to finally bring 13 of the fellows from Uganda Malawi and Kenya to Edinburgh for an extensive visit in March 2022 (above, top). The University of Edinburgh also facilitated



a Fleming Fund Fellowship colloquium in Jinja, Uganda in Jinja 2022, attended by current fellows and alumni, and representatives from the beneficiary organisations in Kenya, Malawi and Uganda, including the Director General of Health Services in the Ugandan Ministry of Health, Dr Henry Mwebesa (above, bottom).

Although each fellowship only lasts for approximately 18 months, they have laid the foundations for long term collaboration and partnership. Projects carried out by the fellowship teams in Uganda and Malawi to investigate patterns of AMR have yielded data sets that are providing the foundations of several ongoing research projects in Edinburgh. Phase 1 of the Fleming Fund is now drawing to a close, but Phase 2 is due to start in early 2023 and the University of Edinburgh has been successful in having their Host Institute status renewed. This will mean approx £2M in funding over the next 3 years. Particular thanks should go to Romana Gorjanc, the Fleming Fund Project Officer for her enthusiastic contributions to ensuring the smooth running of these fellowships, in often challenging conditions.

Edinburgh Antimicrobial Resistance Forum

The work with the Fleming Fund fellowship scheme is built on the wide base of research that is addressing Antimicrobial Resistance across Edinburgh. Over the past year the wide range of activities across the network that address this key global challenge have been drawn together in the Edinburgh AMR Forum. This is a subgrouping of researchers from across Edinburgh Infectious Diseases, led by the Prof Till Bachmann (Infection Medicine).

Following a series of scoping workshops in May 2021, the Forum has developed a number of activities over the past year that have strengthened the community, and brought together researchers from across all three colleges. A continuing biweekly webinar series started in November 2021, and in April 2022 the Forum ran a very well attended in-person poster day and seminar in Teviot Place. Many thanks to Dr Bryan Wee and Hannah Lepper for their help and enthusiasm in the organization of this event.



External and industrial links

In late 2020 Edinburgh Infectious Disease was awarded £10K from the BBSRC Impact Accelerator Account to support an **Analysis of Market Opportunities for Industry-Academia partnering in Antimicrobial Resistance Diagnostics**. This work was carried out by the consultancy company IP Pragmatics who delivered their report in December 2021.

Significantly, the analysis confirmed the leading position Edinburgh has in the UK for output addressing antimicrobial resistance, particularly in diagnostics. The study identified potential

partners for industrial collaboration, and further work has been undertaken with colleagues in Edinburgh Innovations to maximise these linkages. The study also highlighted a need to develop a more effective communication strategy to ensure that relevant partners are kept informed about the work that we are undertaking. The Edinburgh AMR Forum has set up a communications group, led by Dr Katie Atkins and Dr Helen Alexander, which is now increasing social media traffic, developing public engagement activities, and producing podcasts, which should bear fruit in in the coming year.

In World Antibiotic Awareness Week in November 2022, the Forum will host the Edinburgh AMR Showcase in the Playfair library, bringing together academic researchers and industrial collaborators. The event will conclude with the Edinburgh Infectious Diseases Winter Lecture, this year given by Prof Frank Møller Aarestrup from the Technical University of Denmark on “Beating the Silent Pandemic – Surveillance of Antimicrobial Resistance”.

One Health – Una Europa

EID Director Ross Fitzgerald along with Executive committee member Lisa Boden and Rebecca Marsland (School of Social and Political Science) are **members of the Una Europa Self Steering Committee for One Health**.

[Una Europa](#) is a partnership of 11 research-intensive European Universities that is aiming to reimagine the future of third level research and education. A recent success was the [Una Europa One Health Summer school](#) held in UoE, which welcomed 50 undergraduate and post-graduate students to Edinburgh to develop their skills and thinking around the One Health concept and its potential for impact.

Postgraduate training

In addition to the ongoing UoE-Leiden University Medical School PhD partnership in One Health Solutions to Infectious Disease, Edinburgh Infectious Diseases continue to lead or support two Wellcome Trust PhD programmes: Hosts, Pathogens and Global Health, directed by Prof Keith Matthews (Biological Sciences) and Prof Mark Woolhouse (Usher Institute), and One Health Models of Disease, directed by Prof Ross Fitzgerald (Roslin Institute) and Prof Martyn Pickersgill (Usher Institute).

Both programmes attract students from across the world, and we recognise the University’s commitment to waiving international student fees in making the programme accessible to students from lower income countries. In the 2022 recruitment round we received almost 400 applications for the 12 places available across both PhD programmes, and are able to appoint students with excellent potential to excel in their studies.

Crucially these programmes embed multidisciplinary approaches to research, enabling students, and their supervisors, to build robust and effective linkages across the University. Edinburgh Infectious Diseases has also engaged with colleagues across the University and beyond to develop applications for further centres of doctoral training that draw together expertise at the intersection of health and the environment (eg application to the UKRI/NERC CDT in Environmental solutions to zoonoses).

Wellcome Trust PhD programme in Hosts, Pathogens and Global Health

The **Hosts, Pathogens and Global Health** PhD programme welcomed its 7th cohort of students in October 2022. With the programme now able to cover fees for all students, we have been able to recruit a very diverse cohort and have students from Malaysia, Indonesia, Kenya, France, Ireland, and Luxembourg this year. The sixth cohort of students who joined in 2021 are from Nigeria, Bahrain, Australia, and the UK.

The easing of the Covid-19 restrictions meant that we were finally able to hold an in-person retreat for all the students and supervisors in September 2022. The event again highlighted the importance of in person meetings to build connectedness and coherence within the programme. Summer 2022 also saw our first cohort of students, who started in 2016, finally able to graduate. They have now moved into a variety of roles, including postdoctoral fellows in Edinburgh, Oxford, and Stanford CA, and as a veterinary officer in Inverness.



Wellcome Trust PhD programme in One Health Models of Disease – Science, Ethics and Society

The first cohort of students on the **One Health Models of Disease** PhD programme joined the University in the middle of pandemic in October 2020. Our second cohort brought together students from Thailand, Singapore, Pakistan and the UK. In October 2022 we welcomed our third intake of students from Kenya, the Gambia, the Philippines, South Africa, and Pakistan, were delighted that they have been able to have a near normal start to their experiences in Edinburgh.



Students from all three cohorts on the programme were able to get to know each other during a visit to the Firbush outdoors centre on Loch Tay in October 2022, building relationships that will sustain them throughout their studies. Given the wide breadth of topics covered in the One Health Models of Disease

programme, and the geographical spread of the students for their main PhD project, opportunities to come together are crucial for learning from each others experiences.

The programme is set up as a PhD with Integrated Study and the year has taken advantage of this structure to introduce Student Led individually Create Courses (SLICCs) into the curriculum. These highly flexible courses allow students to receive credits for pieces of reflective learning based on their PhD studies. The students who have chosen these courses are finding the process of defining their own learning outcomes and activities to be highly beneficial to both their personal and career development. Special thanks go to Jennifer Hurst, the Postgraduate Taught Programme Administrator, for the smooth and effective delivery of this programme.

Communications and engagement

Our members have previously told us about the importance of Edinburgh Infectious Diseases in providing a common connection for researchers across all three colleges. Our weekly newsletter goes out to over 1000 readers, with details of infection related seminars from across the University, relevant events, and information about job vacancies. Twitter feeds for both Edinburgh Infectious Diseases and the Edinburgh AMR Forum (see above) continue to help us engage with a wide global audience. The need to engage effectively with both our internal and external audiences has been recognised by the creation of a Communications and Engagement officer role within Edinburgh Infectious Diseases, and the new appointee will be taking up her post in December 2022. This added resource will support researchers to keep abreast of activities across the network, and to engage with partners, collaborators, funders and the general public.

Connecting across the University

One of the key aims of Edinburgh Infectious Diseases is to facilitate research connections in infection-related topics across the University. Over the past year members have contributed to development of other activities with a University-wide remit, including the new Edinburgh Earth Initiative, and the Centre for Adapting to the Changing Environment, and to discussions that to better coordinate Global Health research. We look forward to continuing to work with these synergistic groupings in the coming months.

Events for our members

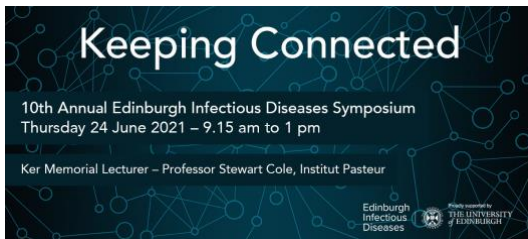
Throughout the pandemic links between our members were maintained through weekly newsletters and other online activity that provide a common point of connection – the enormous increase in webinars from colleagues across the world has facilitated a truly global perspective, and can be seen as one of the silver linings to fall from the pandemic.

All community events in 2021 were held online as the world continued to proceed cautiously during the Covid-19 pandemic. However, we were able to start in person events during the spring of 2022.

Annual Symposia

Our 10th Annual Symposium on 24 June 2021 nevertheless provided an important opportunity to gather together to hear world class presentations from researchers across Edinburgh. The theme of the event was “Keeping Connected” and provided an excellent forum to hear from

researchers at all career stages - the lightning talk sessions presented by early career researchers were particularly lively.



We were very pleased that **Professor Stewart Cole**, President of the Institut Pasteur, joined us to give the Ker Memorial Lecture on “Accelerating tuberculosis drug development”. The Ker Memorial Prize winner was **Dr Derick Osakunor** (Mutapi lab, School of Biological Sciences) for this thesis on “Paediatric Schistosomiasis – Dynamics and Consequences”

In 2022 we held our first in-person annual symposium for three years at the Roslin Institute. The theme for this, our 11th annual event was Together Again. Ker Memorial Lecturer was **Professor Sarah Gilbert**, from the University of Oxford who spoke on “ChAdOx1-vectored vaccines against different viral targets”. The Ker Memorial Prize winner was **Dr Mabel Tetley** (Matthews lab, School of Biological Sciences) for her thesis on “Analysis of released peptidases and their role in the transmission biology of African trypanosomes”.



[Disease Transmission workshop](#)

One of the key activities of Edinburgh Infectious Diseases is to encourage interaction between members, focussing on specific areas of interest. The Disease Transmission workshop was organised by Professor Keith Matthews in April 2021, and once again drew inputs from across the University, further encouraging open discourse between researchers with different perspectives and insights.



Among others, participants heard from Sarah Reece (School of Biological Sciences) on “The private life of parasites: Sophisticated strategies for survival & reproduction”, Samantha Lycett (Roslin Institute) on Revealing viral transmission patterns in evolving situations using phylodynamics, Mark Woolhouse (Usher Institute) on “The epidemiology and evolution of pandemic potential”, and Pedro Vale (School of Biological Sciences) on “Linking individual host heterogeneity to population disease dynamics”.

Early Career Researcher Symposium

In October 2021 we held the Early Career Researcher Symposium. This was specifically aimed at students and postdocs, and gave a platform for over 30 presenters to give lightning talks about their work. Again the topics discussed covered all areas of infectious disease research from “Hypervirulent *Klebsiella pneumoniae* specifically destroy tight junctions of gut and liver cells” (Martin Vandeputte, Infection Medicine); “The visibility of melioidosis, a ‘neglected’ neglected tropical disease” (Aphaluck Bhatiasevi, School of Social and Political Science), “Genome-scale identification of *Staphylococcus aureus* determinants of avian disease pathogenesis: (Fiona Sargison, Roslin Institute) and “Exploring the Interplay of Sex, Immunity and Ageing” (Mary-Kate Corbally, School of Biological Sciences).



Winter lectures

The 2021 Winter Lecture on 16 November 2021 was presented by **Professor Sir Jeremy Farrar**, former director of the Wellcome Trust. Given the significant uncertainties around risks from Covid-19, this event was hosted online, and through Zoom we reached a global audience over 500, who heard a message discussion of the critical importance of science and innovation, underpinned by justice and equity, that is essential to successfully address the pandemic, and prepare for the next one.



The 2022 Winter Lecture will take place on Monday 21 November, and is presented by **Professor Frank Møller Aarestrup**. Frank’s lecture is timed to coincide with World Antibiotic Awareness Week, and will discuss “Beating the Silent Pandemic – Surveillance of Antimicrobial Resistance”.

A summary of events is shown below.

Date	Event	Where
29 April 2021	Disease Transmission Workshop	Online
24 June 2021	Keeping Connected – 10 th Edinburgh Infectious Diseases Annual Symposium	Online
28 October 2021	Early Career researchers Symposium	Online

Appendix

Grants of >£500K awarded to Edinburgh Infectious Diseases members at University of Edinburgh in 2021/22

PI Name	PI Dept	Project Title	Funder	Award Total	Start	End
Keith Matthews	Sch. Biological Sciences	Hosts, Pathogens and Global Health	Wellcome Trust	5509212	01/10/20	30/09/28
Harry Campbell	Centre for Global Health Res.	NIHR Global Health Research Unit on Respiratory Health (RESPIRE-2)	NIHR	4558103	01/06/22	31/05/26
Robin Allshire	Sch. Biological sciences	Epigenetic mechanisms mediating antifungal resistance	Wellcome Trust	3500000	01/04/22	31/03/27
Harry Campbell	Centre for Global Health Res.	NIHR Global Health Research Unit on Respiratory Health (RESPIRE-2)	NIHR	3038735	01/06/22	31/05/26
Keith Matthews	Sch. Biological sciences	Quorum sensing in African trypanosomes	Wellcome Trust	2488909	01/02/22	31/01/27
David Dockrell	Centre for Inflammation Res.	Mitochondrial dysfunction in macrophages and impaired bacterial clearance in chronic obstructive pulmonary disease (COPD)	MRC	1982688	01/06/22	31/05/27
Teuta Pilizota	Sch. Biological sciences	A novel biohybrid electronic device architecture for environmental and physiological sensing	EPSRC	1892649	01/12/21	30/11/26
Sara Macias Ribela	Sch. Biological sciences	Contribution of the miRNA-interferon interaction to human disease	Wellcome Trust	1827981	01/01/22	31/12/26
Robin Allshire	Sch. Biological sciences	Integrative Cell Mechanisms	Wellcome Trust	1811847	01/10/20	30/09/28
Beth Mills	Centre for Inflammation Res.	Pathways to reducing the burden of corneal ulcer in India and beyond	UKRI	1721615	01/03/22	28/02/26
Kenneth Baillie	Centre for Inflammation Res.	Translational genomics in critical care medicine	Wellcome Trust	1659251	01/12/21	30/11/26
Joanna Young	Sch. Biological sciences	Deciphering the role of secreted proteins at the host-parasite interface during chronic <i>Toxoplasma gondii</i> infection	MRC	1645048	06/09/21	05/09/26

Steven Spoel	Sch. Biological sciences	UbRegulate: Dynamic ubiquitin signalling coordinates transcriptional reprogramming in plant immunity	European Commission	1600000	01/09/21	31/08/26
Amy Buck	Sch. Biological sciences	RNACOM: RNA functions in parasite-host communication in the gut	European Commission	1595017	01/02/21	31/01/26
Loeske Kruuk	Sch. Biological sciences	EVOWILD: Evolution in wild populations	European Commission	1454734	01/12/21	30/11/26
Clare Blackburn	Sch. Biological sciences	EuroGCT: European consortium for communicating gene- and cell-based therapy information.	European Commission	1368387	01/02/21	31/01/26
Moira Whyte	Centre for Inflammation Res.	The Edinburgh Clinical Academic Track (ECAT)-Plus Programme	Wellcome Trust	1279500	01/08/17	31/07/25
Loeske Kruuk	Sch. Biological sciences	Evolution in changing environments	Royal Society	1216349	01/12/21	30/11/26
Kenneth Baillie	Centre for Inflammation Res.	Post-hospitalisation COVID-19 study: a national consortium to understand and improve long-term health outcomes (PHOSP-COVID)	MRC	1101992	30/07/20	29/08/22
Kevin Dhaliwal	Centre for Inflammation Res.	U-care: Deep ultraviolet light therapies	EPSRC	1019591	01/01/21	31/12/24
Jim Kaufman	Sch. Biological sciences	Comparative studies to understand the role of class II molecules expressed in epithelial cells	Wellcome Trust	915075	01/01/20	30/06/22
Andrea Wilson	Roslin Institute	Combined influence of imperfect vaccines, host genetics, and non-genetic drivers on virus transmission and virulence evolution	BBSRC	827093	01/01/21	31/12/23
Diego Robledo	Roslin Institute	Harnessing cross-species variation in sea lice resistance	FHF	805238	01/01/21	31/12/24
Teuta Pilizota	Sch. Biological sciences	Infections in complex physical environments: Life and death in the sinuses	EPSRC	804672	01/04/22	31/03/25
Kevin Dhaliwal	Centre for Inflammation Res.	BT032 Project	Bacainn Therapeutics inc.	796442	01/08/21	31/07/22
Manu Shankar-Hari	Centre for Inflammation Res.	Time critical precision medicine for acute critical illness using treatable trait principles: Data enabled adaptive platform trial with embedded biological characterisation [TRAITS Program]	Chief Scientist Office	780417	01/04/22	31/03/26

Neil Mabbott	Roslin Institute	Role of IFNGR1 in reactive astrocyte activation	BBSRC	700902	04/10/21	03/10/24
Emma Cunningham	Sch. Biological sciences	A direct test of the impact of infection on animal migration and subsequent consequences for parasite and host populations	NERC	673029	01/11/21	30/04/24
Kenneth Baillie	Centre for Inflammation Res.	A UK underpinning platform to study immunology and immunopathology of COVID-19: The UK Coronavirus Immunology Consortium (UK-CIC)	MRC	633154	20/08/20	19/08/21
Niki Gray	Centre for Reproductive Health	Challenging the dogma: is PABP-mediated post-transcriptional control essential in mammals?	BBSRC	608118	01/07/21	30/06/24
Cecile Benezech	Centre for Cardiovascular Sci.	Does impaired adipose tissue B cell function lead to loss of natural antibody secretion and increase susceptibility to infection in obesity?	MRC	605419	01/01/22	31/12/24
Musa Hassan	Roslin Institute	Identification of interferon stimulated genes that control Toxoplasma in pig macrophages	BBSRC	588626	01/07/22	30/06/25
Jim Kaufman	Sch. Biological sciences	The drivers of MHC evolution during a viral pandemic	BBSRC	555937	01/04/21	31/03/24
Ross Houston	Roslin Institute	Towards lice-resistant salmon: functional genetics and genome editing to enhance disease resistance in aquaculture	BBSRC	540470	01/10/21	30/09/25
Ross Fitzgerald	Roslin Institute	Dairy niche adaptation by bovine mastitis pathogens: novel targets for control	BBSRC	523312	01/06/22	31/05/25
Andrew Rambaut	Sch. Biological sciences	Covid-19 Genomics UK (COG-UK) Consortium Severe Acute Respiratory Syndrome Virus (SARS-Cov-2)	MRC	522600	01/04/20	30/09/21
Paul Digard	Roslin Institute	Identification of host factors underpinning resistance against Newcastle Disease Virus	Cobb-Vantress inc	515000	01/04/22	31/12/24
Dominic Campopiano	Chemistry	Bacterial sphingolipids - revealing hidden biosynthetic pathways of key players in host-microbe interactions.	BBSRC	509680	01/12/20	30/11/23
Amanda Warr	Roslin Institute	The impact of gut microbiome on the innate immune response against enteric coronaviruses	BBSRC	508144	01/07/22	30/06/25



Programmes at Annual Symposia in 2021 and 2022

Keeping Connected – 10th Edinburgh Infectious Diseases Symposium

24 June 2021, Online via Blackboard Collaborate

SESSION 1		
09.30 – 09.35	Ross Fitzgerald , Director Edinburgh Infectious Diseases	Welcome and introduction
09.20 – 10;15	Ker Lecture: Stewart Cole (President of the Institut Pasteur, Paris) –	Accelerating tuberculosis drug development
SESSION 2		
09.55 – 10.15	Aaron Trent Irving (Zhejiang University-University of Edinburgh Institute, Zhejiang)	Bats as reservoirs of zoonotic coronaviruses
10.15 – 10.35	Katie Atkins (Usher Institute)	Combining mathematical models and phylogenetics to understand SARS-CoV-2 and HIV
10.35 – 10.50	Adam Hayward (Moredun Research Institute)	Quantifying the impact of liver fluke on performance in beef cattle
10.50 – 11.05	Enock Mararo (Roslin Institute)	Comparative metabolomics of Trypanosoma brucei and Trypanosoma congolense and their impact on macrophage function and host immune responses
	Sara Clohisey (Roslin Institute)	Genetic mechanisms of critical illness in COVID-19
	Wiebke Nahrendorf (School of Biological Sciences)	Adaptive T cells regulate disease tolerance in human malaria
	Lois King (Usher Institute)	Addressing childhood pneumonia in a post-COVID world: power, political priorities and progress
11.05 - 11.35	Comfort break	
SESSION 3		
11.35 – 11:50	Ker Prize Winner: Derick Osakunor (School of Biological Sciences) –	Paediatric Schistosomiasis – Dynamics and Consequences
11.50 – 12.05	Christine Tait-Burkard (Roslin Institute)	IFN alpha variants as a treatment and immune-stimulant against SARS-CoV-2 infection
12.05 – 12.20	Maddie Moule (School of Biological Sciences)	Dissecting the host-pathogen interactions of Mycobacterium tuberculosis dissemination and extrapulmonary spread
12.20 – 12.35	Dominic Moran (Global Academy of Agriculture and Food Security)	Antimicrobial resistance: an economic primer

Together Again – 11th Edinburgh Infectious Diseases Symposium

23 June 2022, Roslin Institute, University of Edinburgh

09.00 – 09.30	Coffee and poster set up	
09.30 – 09.35	Ross Fitzgerald , Director Edinburgh Infectious Diseases	Welcome and introduction
SESSION 1: Chair – Katie Atkins		
09.35 – 09.55	Kate Cuschieri , Royal Infirmary of Edinburgh	Impact of HPV vaccination in Scotland
09.55 – 10.15	Liam Morrison , Roslin Institute	Drug resistance in livestock trypanosomes: a neglected problem in neglected pathogens
10.15 – 10.35	Richard Sloan , Infection Medicine	How does the cellular protein RPRD2 inhibit HIV-1 infection?
10.35 – 10.50	Beth Mills , Centre for Inflammation Research	Routes to reducing the burden of microbial keratitis
10.50 – 11.05	Freya Bull , School of Physics and Astronomy	A model for the infection dynamics of a urinary catheter
	Jamie Gorzynski , Roslin Institute	Genomic epidemiological analysis of Legionnaires' Disease in Scotland uncovers long-term endemic L. pneumophila clones of public health importance
	Rose Doyle , School of Biological Sciences	Characterisation of novel dissemination genes in Burkholderia pseudomallei
11.05 - 11.35	Coffee and posters	
SESSION 2: Chair – Till Bachmann		
11.35 – 11:50	Vasso Makrantonis , Infection Medicine	Genome plasticity: A survival strategy for human fungal pathogens
11.50 – 12.05	Joanna Young , School of Biological Sciences	Toxoplasma gondii: dissecting chronic infection of a ubiquitous parasite
12.05 – 12.20	David Smith , Moredun Research Institute	Bradyzoite biology: from invasion to persistence
12.20 – 12.35	Farren Yero , Inst. for Advanced Studies in the Humanities	Where Science Meets Slavery: Reimagining Vaccine History through Anti-Colonial Art
12.40 – 12.55	Will Harvey , Roslin Institute	Predicting the direction of influenza evolution
	Piotr Janas , Centre for Inflammation Research	Respiratory syncytial virus infection causes long-term changes in the expression of major histocompatibility complexes in murine airway epithelial cells
	Richa Sharma , School of Chemistry,	Fluorescent smart probes – a "tag-and-kill" approach for infectious microbial pathogens

	Nelly Mak , Infection Medicine	Does Allelic Variation in the IFITM Amphipathic Helix Influence Its Antiviral Activity?
12.55 – 14.10	Lunch and posters	
	SESSION 3: Chair – Elly Gaunt	
14.10 – 14.25	Prerna Vohra , School of Biological Sciences	Sequencing approaches to understand and control zoonotic pathogens
14.25 – 14.45	Ian Laurenson , Royal Infirmary of Edinburgh	Diagnosing mycobacterial infection – where are we and where are we going?
14.45 – 15:05	Lonneke Vervelde , Roslin Institute	Mucosal tissue models: from egg to enteroid
15:05 – 15.25	Katerina Guschanski , School of Biological Sciences	AMR in ancient DNA
15.25 – 15.40	KER MEMORIAL PRIZE WINNER: Mabel Tettey , School of Biological Sciences	Analysis of released peptidases and their role in the transmission biology of African trypanosomes
15.40 – 16.10	Tea and coffee / posters	
	SESSION 4: Chair – Ross Fitzgerald	
16.10 – 16.15	Presentation of poster prize	
16.15 – 17.15	KER MEMORIAL LECTURER: Sarah Gilbert , University of Oxford	ChAdOx1-vectored vaccines against different viral targets
17.15 – 18.30	Drinks reception – ALL WELCOME	

Publications from Edinburgh Infectious Diseases members in 2021

1. Adam KE, Bruce A, Corbishley A (2021) Veterinary Interventions to Improve Neonatal Survival on British Beef and Sheep Farms: A Qualitative Study. *Frontiers in veterinary science* 8: 619889
2. Adedeji AJ, Ijoma SI, Atai RB, Dogonyaro BB, Adole JA, Maurice NA, Osemeke OH, Waziri IA, Atuman YJ, Lyons NA *et al* (2021) Household and animal factors associated with sheeppox and goatpox sero-prevalence and identification of high-risk areas in selected States of northern Nigeria. *Preventive veterinary medicine* 196: 105473
3. Adeloye D, Agarwal D, Barnes PJ, Bonay M, van Boven JF, Bryant J, Caramori G, Dockrell D, D'Urzo A, Ekström M *et al* (2021a) Research priorities to address the global burden of chronic obstructive pulmonary disease (COPD) in the next decade. *J Glob Health* 11: 15003
4. Adeloye D, Elneima O, Daines L, Poinasamy K, Quint JK, Walker S, Brightling CE, Siddiqui S, Hurst JR, Chalmers JD *et al* (2021b) The long-term sequelae of COVID-19: an international consensus on research priorities for patients with pre-existing and new-onset airways disease. *The Lancet Respiratory medicine* 9: 1467-1478
5. Affar S, Morrison DS, Campbell C (2021) Cervical cancer incidence by ethnic group in Scotland from 2008 to 2017: A population-based study. *European journal of cancer care* 30: e13441
6. Agache I, Akdis C, Akdis M, Brockow K, Chivato T, Del Giacco S, Eiwegger T, Eyerich K, Giménez-Arnau A, Gutermuth J *et al* (2021a) EAACI Biologicals Guidelines - Omalizumab for the treatment of chronic spontaneous urticaria in adults and in the paediatric population 12-17 years old. *Allergy* 77: 17-38
7. Agache I, Akdis CA, Akdis M, Brockow K, Chivato T, Del Giacco S, Eiwegger T, Eyerich K, Giménez-Arnau A, Gutermuth J *et al* (2021b) EAACI Biologicals Guidelines-dupilumab for children and adults with moderate-to-severe atopic dermatitis. *Allergy* 76: 988-1009
8. Agache I, Akdis CA, Akdis M, Canonica GW, Casale T, Chivato T, Corren J, Chu DK, Del Giacco S, Eiwegger T *et al* (2021c) EAACI Biologicals Guidelines-Recommendations for severe asthma. *Allergy* 76: 14-44
9. Agache I, Rocha C, Pereira A, Song Y, Alonso-Coello P, Solà I, Beltran J, Posso M, Akdis CA, Akdis M *et al* (2021d) Efficacy and safety of treatment with omalizumab for chronic spontaneous urticaria: A systematic review for the EAACI Biologicals Guidelines. *Allergy* 76: 59-70
10. Agache I, Song Y, Alonso-Coello P, Vogel Y, Rocha C, Solà I, Santero M, Akdis CA, Akdis M, Canonica GW *et al* (2021e) Efficacy and safety of treatment with biologicals for severe chronic rhinosinusitis with nasal polyps: A systematic review for the EAACI guidelines. *Allergy* 76: 2337-2353
11. Al-Kuraishy HM, Al-Gareeb AI, Mostafa-Hedeab G, Kasozi KI, Zirintunda G, Aslam A, Allahyani M, Welburn SC, Batiha GE (2021) Effects of β -Blockers on the Sympathetic and Cytokines Storms in Covid-19. *Front Immunol* 12: 749291
12. Al-Omari B, McMeekin P, Allen AJ, Akram AR, Graziadio S, Suklan J, Jones WS, Lendrem BC, Winter A, Cullinan M *et al* (2021) Systematic review of studies investigating ventilator associated pneumonia diagnostics in intensive care. *BMC Pulm Med* 21: 196
13. Alber A, Stevens MP, Vervelde L (2021) The bird's immune response to avian pathogenic Escherichia coli. *Avian pathology : journal of the WVPA* 50: 382-391
14. Albery GF, Morris A, Morris S, Kenyon F, Nussey DH, Pemberton JM (2021a) Fitness Costs of Parasites Explain Multiple Life-History Trade-Offs in a Wild Mammal. *The American naturalist* 197: 324-335
15. Albery GF, Morris A, Morris S, Pemberton JM, Clutton-Brock TH, Nussey DH, Firth JA (2021b) Multiple spatial behaviours govern social network positions in a wild ungulate. *Ecology letters* 24: 676-686
16. Albuquerque CS, Černá P, Gunn-Moore DA (2021) Repeated bouts of pulmonary tuberculosis in a hunting cat: reinfection or recrudescence? *JFMS open reports* 7: 2055116921990292
17. Alfituri OA, Mararo EM, Steketee PC, Morrison LJ, Mabbott NA (2021a) Dermal bacterial LPS-stimulation reduces susceptibility to intradermal *Trypanosoma brucei* infection. *Sci Rep* 11: 9856
18. Alfituri OA, Quintana JF, MacLeod A, Garside P, Benson RA, Brewer JM, Mabbott NA, Morrison LJ, Capewell P (2021b) Corrigendum: To the Skin and Beyond: The Immune Response to African Trypanosomes as They Enter and Exit the Vertebrate Host. *Front Immunol* 12: 780758

19. Allan FK, Jayaraman S, Paxton E, Sindoya E, Kibona T, Fyumagwa R, Mramba F, Torr SJ, Hemmink JD, Toye P *et al* (2021a) Antigenic Diversity in *Theileria parva* Populations From Sympatric Cattle and African Buffalo Analyzed Using Long Read Sequencing. *Frontiers in genetics* 12: 684127
20. Allan FK, Sindoya E, Adam KE, Byamungu M, Lea RS, Lord JS, Mbata G, Paxton E, Mramba F, Torr SJ *et al* (2021b) A cross-sectional survey to establish *Theileria parva* prevalence and vector control at the wildlife-livestock interface, Northern Tanzania. *Preventive veterinary medicine* 196: 105491
21. Alsallakh MA, Sivakumaran S, Kennedy S, Vasileiou E, Lyons RA, Robertson C, Sheikh A, Davies GA (2021) Impact of COVID-19 lockdown on the incidence and mortality of acute exacerbations of chronic obstructive pulmonary disease: national interrupted time series analyses for Scotland and Wales. *BMC medicine* 19: 124
22. Álvarez de Haro N, Van AP, Robb CT, Rossi AG, Desbois AP (2021) Release of chromatin extracellular traps by phagocytes of Atlantic salmon, *Salmo salar* (Linnaeus, 1758). *Fish Shellfish Immunol* 119: 209-219
23. Álvarez-Narváez S, Giguère S, Cohen N, Slovis N, Vázquez-Boland JA (2021) Spread of Multidrug-Resistant *Rhodococcus equi*, United States. *Emerg Infect Dis* 27: 529-537
24. Angelova AG, Berx B, Bresnan E, Joye SB, Free A, Gutierrez T (2021) Inter- and Intra-Annual Bacterioplankton Community Patterns in a Deepwater Sub-Arctic Region: Persistent High Background Abundance of Putative Oil Degraders. *mBio* 12: e03701-03720
25. Arbyn M, Simon M, Peeters E, Xu L, Meijer C, Berkhof J, Cuschieri K, Bonde J, Ostrbenk Vanlencak A, Zhao FH *et al* (2021) 2020 list of human papillomavirus assays suitable for primary cervical cancer screening. *Clin Microbiol Infect* 27: 1083-1095
26. Archibong V, Usman IM, Kasozi KI, Aigbogun EO, Jr., Josiah I, Monima AL, Ssebuufu R, Chekwech G, Terkimbi SD, Owoisinke O *et al* (2021) Anxiety, Anger and Depression Amongst Low-Income Earners in Southwestern Uganda During the COVID-19 Total Lockdown. *Front Public Health* 9: 590458
27. Assil Z, Esegbue O, Mašek O, Gutierrez T, Free A (2021a) Corrigendum to "Specific enrichment of hydrocarbonclastic bacteria from diesel-amended soil on biochar particles" [Sci. Total Environ. (2021) 762:143084]. *The Science of the total environment* 776: 146796
28. Assil Z, Esegbue O, Mašek O, Gutierrez T, Free A (2021b) Specific enrichment of hydrocarbonclastic bacteria from diesel-amended soil on biochar particles. *The Science of the total environment* 762: 143084
29. Awasthi S, Campbell H, Dela Cruz CS, Graham HR, Greenslade L, Jehan F, Zar HJ (2021) What Does Severe Acute Respiratory Syndrome Coronavirus 2 Mean for Global Pneumonia Prevention, Diagnosis, and Treatment? *Chest* 159: 486-488
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33. Bacon H, Vigors B, Shaw DJ, Waran N, Dwyer CM, Bell C (2021b) Zookeepers - The most important animal in the zoo? *J Appl Anim Welf Sci*: 1-13
34. Bagulo H, Majekodunmi AO, Welburn SC (2021) Hepatitis E in Sub Saharan Africa - A significant emerging disease. *One health (Amsterdam, Netherlands)* 11: 100186
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