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Cambridge Academy of Therapeutic Sciences

Cambridge Zero Research Symposium 4

Climate & disease: drivers, impacts and solutions

Wednesday 7th December, Pavillion Room, Hughes Hall

1.00pm **Lunch**

1.45pm **Welcome and Introduction**

Simon Buckle, Director of Research, Cambridge Zero

1.50pm **Keynote: Environmental drivers of Hendra virus spillover from Australian bats**

Olivier Restif, Alborada Associate Professor in Epidemiology, Department of Veterinary Medicine

Zoonotic diseases of wildlife origin are a constant threat to global health, livestock welfare and food security. While there is growing recognition that human encroachment into and destruction of natural habitats have created opportunities for pathogen spillover, the role of climate in the spread of non-vector-borne zoonotic diseases remains poorly understood. Hendra virus (family Paramyxoviridae), first discovered in Australia 25 years ago following the sudden death of racing horses, is a zoonotic pathogen harboured by Australian Pteropus bats (known as flying foxes). In recent years, it has become apparent that spillover events follow a seasonal pattern, with peaks of horse cases coinciding with increased virus shedding in bat urine. In this talk, I will present an overview of the interdisciplinary research carried out by the Bat One Health consortium to identify the drivers of Hendra virus spillover, at the interface of ecology, immunology and epidemiology. I will be focusing on the use of mathematical models of bat-virus population dynamics to infer the mechanisms of seasonal cycles from field data. We have now identified climatic and environmental risk factors of virus spillover which will help direct control measures in the short term and develop longer-time strategies to reduce zoonotic risk.

2.05pm **Climate and Ageing Populations: Impacts and opportunities for health, equity and sustainability.**

Dr Angélique Mavrodaris, Clinical Research Fellow, Cambridge Public Health

In both scale and impact, population ageing has far-reaching implications for our planet - as a driver of population growth and increasing human demands on ecosystems and as communities vulnerable to the effects of climate change. The connections between global ageing, the environment and sustainability are clear, yet

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our responses to-date have been largely disconnected. We will share our work reviewing the impacts of environmental and climate change on older populations; analysis of current strategies addressing healthy ageing and alignment with sustainability policy; and framework for sustainable solutions underpinned by evidence-based actions delivering co-benefits for climate, health and equity.

2.15pm Tools to monitor and combat the spread of insect-borne viruses in the wake of climate change

Monique Merchant, Research Associate, Department of Pathology

After Dengue fever, Oropouche fever is the second-most prevalent insect-borne viral disease in Brazil. Over 500,000 infections have been documented as the result of numerous regional epidemics in South America since its discovery in 1955. Changes in climate and land use are increasingly bringing humans into contact with Oropouche virus as rising temperatures expand the geographical range of transmitting insects and habitats of wild-animal reservoirs are depleted. Currently, there is no readily available point-of-care diagnostic test for Oropouche fever that could be used in low-resource settings. By producing high-quality Oropouche virus antigens and specific nanobodies we aim to (1) interrogate the immune response to infection, (2) develop accessible, low-cost diagnostics and (3) build novel vaccines and anti-viral therapeutics.

2.25pm Q&A

2.55pm Keynote: Human malaria and its prospects in a climate-changed world

Catherine Merrick, University Associate Professor, Division of Microbiology and Parasitology

Malaria kills over half a million people every year. Hundreds of millions more are debilitated with episodes of morbidity. Countries throughout the tropics and subtropics are affected by malaria, with most of the deaths occurring in young children in sub-Saharan Africa. The disease is caused by protozoan parasites called Plasmodium, which are vector-borne by Anopheles mosquitoes. Therefore, the survival of suitable mosquito species is a key factor that limits the ranges of human malaria parasites. Mosquito breeding patterns can be affected by climate change (duration of rainy seasons, ambient temperatures, etc.) and future patterns of human malaria may be affected accordingly.

3.10pm Pestilence, Famine and Climate: Understanding the spatial dynamics of bubonic plague across Eurasia and the Mediterranean littoral between 1850 and 1960

Elizabeth Isaac, PhD Student, Department of Geography

There were 15 million global fatalities in the Third Wave of plague. We do not fully understand the conditions and events that contribute to plague occurrences and pandemics over multi-continental scales. I offer an overview of the spatial dynamics of the plague outbreaks across Eurasia and the Mediterranean littoral between 1850 and 1960, using a novel, diverse, plague dataset to map and understand how events such as famines and climate variations can help to explain plague occurrence and proliferation over a large spatial scale.

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3.20pm Management of Physical Infrastructure Systems to Protect Public Health from Climate-Related Hazards

Maria Ikonomova, PhD Student, Department of Engineering

Climate change will increase the frequency and intensity of climate-related hazards such as heatwaves, flooding, wildfires, and storms, which can damage public health. This talk will provide an overview of the role of physical infrastructure systems in the pathways between climate-related hazards and damage to public health. The presentation will then explore why siloed approaches, which have been traditionally used to manage physical infrastructure systems, are insufficient to protect public health in a changing climate.

3.30pm Q&A

3.50pm Break

4.00pm Keynote: Flavivirus (re)-emergence: are we facing a new pandemic?

Nerea Irigoyen, Research Group Leader, Virology, Department of Pathology

Flaviviruses, such as Dengue virus, encompass many of the mosquito-borne RNA viruses that have (re-)emerged in the last decades due to increased global travel, urbanization, and climate change. These viruses are now globally distributed and infect up to 400 million people annually. Flavivirus infection ranges from mild illness to severe and life-threatening disease (haemorrhagic fever, encephalitis, or congenital disease). In this talk, we will investigate how a previously overlooked flavivirus, the Zika virus, became an explosive epidemic in the Americas in 2015 causing severe neurological defects, especially in foetuses. We will also explore the potential threat of emerging flaviviruses worldwide and how concerned we should be in Europe.

Lightning Talks

4.15pm Are arboviruses the next pandemic? The case of chikungunya

Mariana Perez Duque, MD Public Health - PhD researcher, Department of Genetics

Chikungunya virus (CHIKV) is a mosquito-borne disease that can lead to severe morbidity. Despite the significant burden of disease, there remains a poor understanding of how it is spreading, and entire epidemics are frequently completely missed by disease surveillance systems. We will use CHIKV genetic sequences from throughout South and Southeast Asia together with human mobility data. This will be integrated with climate data which provide information on the suitability of the environment for mosquitoes. These models will be able to reconstruct the underlying spread of CHIKV and provide much needed insight into how a major threat to human health is spreading and identify optimal approaches for its control.

4.17pm Wildlife pathogens surveillance in aquatic environments in Nunavik, Canada

Olesya Kolmakova, Postdoctoral Researcher, Department of Plant Sciences

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Climate change triggers emergence of new wildlife pathogens and spread of existing diseases. I will develop wildlife pathogens surveillance method through screening for environmental DNA and RNA of viruses, bacteria, protists and parasites in natural waterways. The surveillance system will be implemented in collaboration with local communities in Nunavik, Northern Quebec, to monitor wildlife health, tackle food insecurity and take early action to prevent zoonoses.

4.19pm Understanding the drivers of mass mortality events in freshwater mussel (Unionid) populations

Dan Cossey, PhD student, Department of Zoology

Freshwater mussels (Unionida) provide significant ecosystem functions and services, from maintaining water quality, providing habitat complexity, and improving nutrient cycling, to cultural values and food production. Considering that they are one of the most threatened faunal groups globally, it is extremely concerning that since the 1960's enigmatic unionida mass mortality events have been reported. To this day, freshwater mussel mass mortality events are occurring without clearly understood causes. My PhD research aims to shed light on the factors driving these mass mortality events and so enable the suggestion and implementation of appropriate management actions to save these highly imperilled species and the important functions they serve in ecosystems. I will summarise the reasons my research is important and some of the plans I have to investigate mussel mass mortality events during the presentation.

CATS funding opportunity presentation

4.21pm "Future of therapeutics" Wellcome Translation Partnership Award (TPA) funding
Caroline Reynolds, Senior Research Facilitator, Cambridge Academy of Therapeutic Sciences (CATS), Research Operations Office

CATS manage the University of Cambridge Wellcome TPA which provides £2.25M for three years. Funding is intended to allow researchers to bridge the gap between discovery science and early-stage translation of projects and to encourage and support scientists to realise the translational potential of their research. Under this award, funding has been allocated for cross school interdisciplinary work to encourage knowledge exchange and collaboration to enable researchers to apply for large collaborative bids.

CATS has selected three Wellcome themes to focus on:

- *Climate change and health relating to infectious diseases, emerging threats and mental health*
- *Healthy ageing*
- *Smart diagnostics*

4.31pm Q&A

5.05pm Drinks Reception

6.00pm End