

TUESDAY 13 MARCH 2018

ZSL SCIENCE AND CONSERVATION EVENT

The Meeting Rooms, Zoological Society of London,
Regent's Park, London NW1 4RY

AGENDA

**Ecosystems under the microscope: why microbes
matter for conservation**

Chaired by **Dr Xavier Harrison**, Institute of Zoology, ZSL

Receive the following communications:

Professor Matthew C Fisher, Imperial College London

Friend or foe: how do microbes impact disease outcome in amphibians exposed to emerging infections?

Professor Philip Poole, University of Oxford

The role of the microbiome in plant health and global food security

Dr Julia Ferrari, University of York

The insect microbiome and its effects on community interactions

ABSTRACTS

Ecosystems under the microscope: why microbes matter for conservation

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Friend or foe: how do microbes impact disease outcome in amphibians exposed to emerging infections?

Professor Matthew C Fisher, Imperial College London

The Kingdom Fungi is a biodiverse and essential component of our habitable Planet. However, the last 100 years have witnessed an increasing number of virulent emerging pathogenic fungi across ecosystems, with these infections causing the greatest disease-driven losses of biodiversity ever documented. In my lecture I show how human trade has led to an explosion of disease in amphibians worldwide through vectoring infectious chytrid fungi into uninfected species and geographical regions. I will then show how, across newly infected regions where outbreaks are occurring, we see varied host population responses ranging from extinction through to recovery that illustrate complex ecological-modifiers of the host/pathogen interaction. Frogs not only are coated in bacteria, but also other fungi, and we increasingly finding that the resilience of a species depends on their 'microbial cloak of invincibility'. Do these microbial cloaks hold the key to the survival of amphibians worldwide? We think that they do!

Professor Matthew Fisher works on emerging pathogenic fungi and heads a research group at the Department of Infectious Disease Epidemiology, St Mary's Hospital, Imperial College London. His research uses an evolutionary framework to investigate the biological and environmental factors that are driving emerging fungal diseases across human, wildlife and plant species. Wildlife plays a key role in the emergence of human emerging infectious disease (EID) by providing a 'zoonotic pool' from which previously unknown pathogens emerge. Conversely, human action impacts on patterns of fungal disease via the perturbation of natural systems, the introduction, and the spread of pathogenic fungi into naive environments, and by rapid natural selection for phenotypes such as resistance to antimicrobial drugs. These interactions are leading to an upswing of new fungal infections in new places, and causing new human diseases. Matthew Fisher's research group is focused on developing genomic, epidemiological and experimental models to uncover the factors driving these EIDs, and to attempt to develop new methods of diagnosis and control.

The role of the microbiome in plant health and global food security

Professor Philip Poole, University of Oxford

The human population has grown 7-fold since the beginning of the 19th century. This has led to the planet's natural resources being overexploited, with a massive biodiversity loss, climate change, and disturbance of the nitrogen cycle. Biodiversity reduction and climate change have become major issues for social and political consideration. Life on the land is totally dependent on soil which teems with tens of millions of microbes per g of soil. This makes soil one of the richest and most complex of environments on earth. It is sobering to think we all depend on a few cm of top soil for life. Plant growth is strongly influenced by the microbes in soil and with a rich mixture of mostly benign but also the good (like *Rhizobium*, see below) the bad (pathogenic bacteria, fungi and viruses) and the downright ugly (for example anthrax). Just as for the human microbiome there has been a recent seismic shift in the study of soil microbes as communities rather than just as isolated microorganisms. Soil microbes not only directly interact with plant roots but they chemically transform soil, releasing some nutrients and locking others up. Plant productivity is limited by soil nutrients and particularly nitrogen and phosphorous. The largest input of available nitrogen in the biosphere comes from biological reduction of atmospheric N₂ to ammonium. Most of this comes from legume plants interacting with bacteria known as *Rhizobium*. These plant bacterial associations form symbioses, arising from infection of host plants by the bacteria and result in root structures called nodules. The bacteria are trapped by curling root hairs that they enter via infection threads and eventually become intracellular nitrogen factories to support growth of the plant.

Philip Poole was Professor of Microbial Physiology at the University of Reading until he moved to the John Innes Centre in Norwich in 2007. In 2013, he took up a personal chair as Professor of Plant Microbiology at the University of Oxford. His group studies the physiology of bacterial growth and survival in the rhizosphere, colonisation of roots and how bacteria establish symbiotic interactions with plants. A further focus of his research is the physiology and biochemistry of nitrogen fixation in legume nodules. Recently he has developed new methods to study how plants control the plant root microbiome.

The insect microbiome and its effects on community interactions

Dr Julia Ferrari, University of York

Most insects carry microbial symbionts that help them survive in their environment. These microbes can have a huge variety of effects on the insect, ranging from coping with unbalanced diets to protection from stresses such as attack by natural enemies or extreme temperatures. Other microbes can severely alter the reproductive systems of their hosts, which can have major consequences for the population. All of these effects do not only affect the insect and its microbial partner, they have the potential to have cascading effects on interacting species and the entire ecological community. I will give an overview of the microbial partners of insects, with examples from diverse insect groups such as butterflies, bees and aphids. Aphids, for example, can carry different types of symbionts, one that allows the aphid to feed on sugar-rich phloem sap that is deficient in proteins, and others that provide functions that are helpful under certain environmental conditions. These latter ones can, for example, protect from natural enemies that would otherwise kill the aphid. There should thus be strong selection for the presence of protective symbionts, yet not all aphids in a population carry them.

After introducing a number of examples, I will explore how ecological communities might be affected by microbial symbionts, a currently understudied field, and I will then discuss the implications for conservation.

Julia Ferrari is interested in the ecology and evolution of species interactions and this has been a common theme throughout her career. In the last ten years, she has been focussing on the role that bacterial symbionts play in these interactions. Julia did her undergraduate degree at the University of Göttingen (Germany). She then moved to Britain to do a PhD at Imperial College London (Silwood Park Campus) with Prof. Charles Godfray. She stayed at Silwood as a Post-doc (2001-2006) and then moved to the University of Oxford as a Departmental Lecturer (2006-2009). In 2009, she moved to the University of York as a Lecturer, now Senior Lecturer.

FORTHCOMING SCIENCE AND CONSERVATION EVENTS

www.zsl.org/science/whats-on

Cetacean by-catch: casting the net for solutions

Tuesday 10 April 2018, 6pm - 7.45pm

ZSL Science and Conservation Event

By-catch is defined as the accidental entanglement of non-target species in fishing gear and is reported as a principal cause of strandings for cetaceans. Join CSIP experts to explore what pathological data collected from over 3,000 cetacean post-mortems conducted by the team to date can tell us about the threat of by-catch, and how future policy could potentially reduce its impacts on endangered cetacean populations around our shores.



© Common Dolphin, Porthbeor beach © Joana Doyle

FIND OUT MORE www.zsl.org/science/whats-on/cetacean-by-catch-casting-the-net-for-solutions

Establishing a career in conservation science: a ZSL early career event

Tuesday 24 April 2018, 9am-5pm

Workshop Event

This one day event, aimed principally at advanced PhD students and early post-docs, will review the key skills and knowledge that can enhance prospects for establishing a career in conservation science.

BOOK TICKETS

www.zsl.org/science/whats-on/establishing-a-career-in-conservation-science-a-zsl-early-career-event



A new era for shark conservation? Protecting 'flat sharks', rays and angels

Tuesday 8 May 2018, 6pm - 7.45pm

ZSL Science and Conservation Event

Join us to explore a new era of shark conservation, focusing on better protecting the lesser-known 'flat sharks' and rays. Large, coastal sharks and rays have a greater exposure to habitat degradation and fishing compared to offshore and pelagic species. This means that some taxonomic groups are more at risk of extinction due to their ecology, such as sawfishes, angel sharks, wedgefishes, sleeper rays, stingrays and guitarfishes



Angel Shark © Carlos Suarez Océanos de Fuego

FIND OUT MORE www.zsl.org/science/whats-on