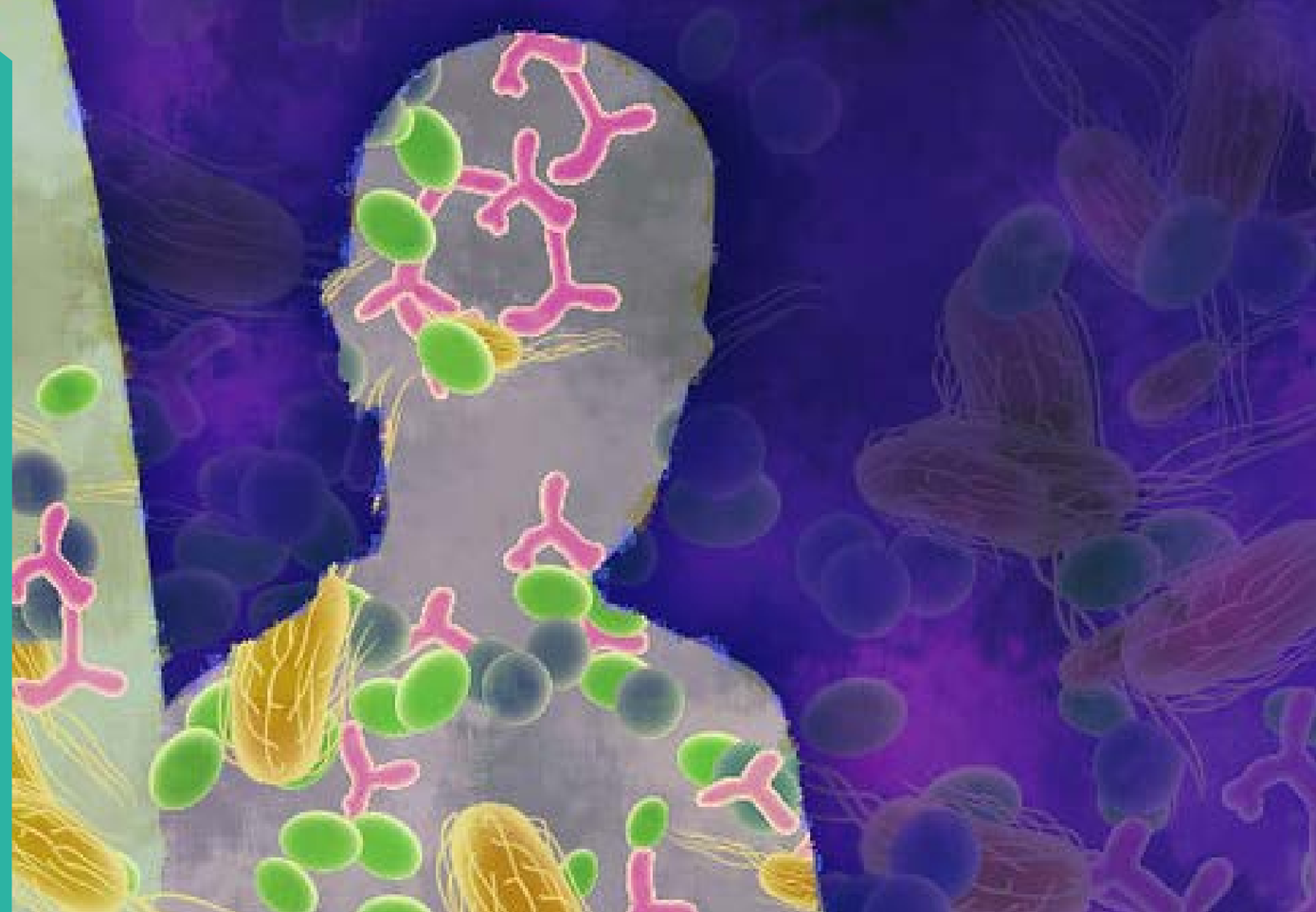
University *of* Exeter

Microbes and Society
@ Exeter Research Network

newsletter summer 2024



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Dear All,

Welcome to the summer edition of the Microbes and Society newsletter!

We are busy planning for our next symposium, which will be held at **Reed Hall, Streatham campus, on Monday 24 and Tuesday 25 June**. As well as a range of flash talks from network members discussing their exciting, cutting-wedge work in their fields, the programme includes a joint session with the Exeter Food network on Microbes and Food Systems Sustainability, and a session dedicated to Planetary Health. We look forward to seeing lots of you there!

We also want to draw your attention to a recent press release from the UK government, who are pledging £85 million to support the international community to tackle antimicrobial resistance.

Steve, Bridget, Jane and Will
Microbes & Society Network Co-Leads

AMR & Microbiology news

Emily Stevensons Earth Day talk

As part of the ESI's Earth Day focus on 22 April, PhD student Emily Stevenson gave a talk on 'Planet versus Plastic', which you can catch here.

Microbiologists present at Microbiology Society Annual Conference

A number of UoE colleagues presented flash talks at the Microbiology Society Conference between 8 and 11 April in Edinburgh:

Meaghan Castledine: 'Diverse and predictable evolutionary responses to phage therapy across multiple case studies'

Anuj Tiwari: 'DeepDrop: Deep learning and Droplet microfluidics for single cell level label free bacterial analysis'

Andy Matthews: 'Exploring the evolutionary ecology of microbes associated with the common garden snail'

Seána Duggan: 'A Copper Economy Underlies Synergy of Candida albicans and Staphylococcus aureus Dual-Species Biofilms'

Aleksei Agapov: 'Understanding cooperative interactions of antiphage systems in Pseudomonas aeruginosa'

Benoit Pons: 'SOS response helps Pseudomonas aeruginosa overcome phage infection'

While **Stefano Pagliara** was invited to speak on 'Understanding the role of membranes in microbial responses to stress'.

Seána Duggan

Register now

Join BlueAdapt's Symposium:
Reducing health risks in coastal waters

Hear from researchers across Europe investigating the links between climate change, pollution and health risks in our coastal waters.

12 June 2024

Online or the Headland Hotel, Newquay (UK)

www.blueadapt.eu/symposium

Blue Adapt

Co-funded by the European Union

UK Research and Innovation

climate-health cluster

GW4 AMR ANTIMICROBIAL RESISTANCE ALLIANCE

Dear Microbes & Society Network members,

I am Gözde, the Coordinator for the GW4 AMR Alliance - an antimicrobial resistance (AMR) research consortium across the Universities of Bath, Bristol, Cardiff and Exeter. This consortium is taking a collaborative, interdisciplinary and One Health approach to tackling AMR.

Please Sign Up to Become a Member: By signing up to become a member of the GW4 AMR Alliance, you will be able to gain access to our new SharePoint site, which serves as a central communication hub for AMR Alliance news, information, events, funding opportunities, and a directory of all members (with contact details) to aid collaboration across the consortium. Looking forward to you joining us soon.

Many thanks and best wishes,
Gözde Burger (GW4 AMR Coordinator - amr@gw4.ac.uk)

CMM news

From the MRC Centre for Medical Mycology

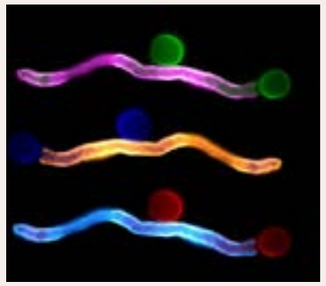
Seána Duggan wins Tony Trinci award for excellence in Medical Mycology

Seána Duggan has become the third winner of the award which was jointly established by the British Mycological Society and Microbiology Society to celebrate mycology and honour late Professor Trinci, who was President of both societies. Read more

MRC CMM announce new £3.4m global funding for solutions to antifungal drug resistance

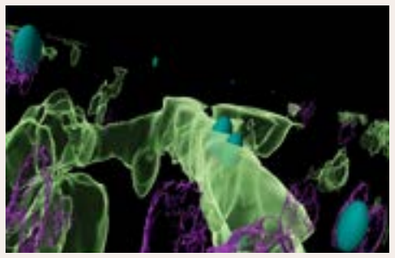
Researchers working on solutions for antifungal resistance in human pathogens are being encouraged to apply to a new £3.4 million fund, called **FAILSAFE** (Fungal AMR Innovations for LMICS: Solutions and Access For Everyone), launched this month by the MRC CMM in partnership with the UK Department of Health and Social Care's Global AMR Innovation Fund (GAMRIF). For more information, visit http://cmm-failsafe.com, or read more here

Rhizopus images feature in ECCMID conference and art gallery



Credit: Alyssa Hudson

Alyssa Hudson, whose Fellowship project is funded by Noah's Pink Balloon Leukaemia Fund, has been accepted for presentation at the ECCMID conference and given a top-rated recognition. Three images from the project have been published in the ECCMID 2024: Art Gallery. The image 'A mould of many guises' has been selected to be printed on a canvas and included in the art gallery display at the conference.



Images of Research competition

Credit: Phuong Tuyen Nguyen

Congratulations to Phuong Tuyen Nguyen, a PhD student in Peter Cook's group, whose image of lung airway epithelial cells and Aspergillus fumigatus within a murine lung slice was featured as part of the 'Images of Research' competition.

Understanding Life in a Changing Planet: 20+2 Years of Egenis, the Centre for the Study of the Life Sciences conference

A symbiotic view of philosophy: Celebrating the work of John Dupré and the Egenis Centre

In April 2024, friends of the Egenis Centre for the Study of Life Sciences converged on Exeter for a (slightly delayed, due to Covid) 20th birthday celebration for the centre. The event featured talks from those working on, in and with the life sciences, particularly those influenced by and connected with work done by centre founder John Dupré.

Several themes from John's work connected an otherwise diverse set of talks: pluralism about the nature of reality; change as a fundamental feature of the universe; a strong role for values in scientific processes; the intertwining of the social and the biological; the ubiquity of symbiosis; and the need for a processual view of nature to make sense of all of this.

Thomas Pradeu, Catherine Kendig, Ford Doolittle, Jane Calvert, Scott Gilbert and Dan Nicholson - amongst others - spoke to the potent mix of symbiosis research and philosophical theory which has been a hallmark of John's career and much of the work at Egenis, particularly a string of influential articles on the philosophy of microbiology with former Egenis member Maureen O'Malley.

Many attendees spoke also to the symbiotic nature of such work itself, at Egenis and beyond: webs of personal and professional connections leading to production of stunning and impactful articulations of the nested hierarchy of living processes we find ourselves born into. The contributions of Egenis co-founders Steve Hughes and Barry Barnes, as well as former co-director Staffan Müller-Wille and outgoing director Sabina Leonelli, to the creation of a vibrant interdisciplinary research centre were also made abundantly clear. Talks highlighted the diversity of approaches - studies on/in/with science - for fruitful interdisciplinary collaborations.

Change was, as always in John's work, ever-present. The event featured updates on the work done across Egenis' core research strands, including cutting-edge perspectives on cognition, stigma, mental illness, the environment, AI and data science. A poster session offered insights into current trends in philosophy, with – amongst other topics – posters on biochemistry, proteins, agriculture, psychiatry, and environmental sciences. Posters from the event will be made available on Zenodo.

The event was a great success, and offered an opportunity to reflect on the development of the centre itself, marking the appointment of new director Adam Toon. Many thanks to organisers and attendees for putting together such an interesting and engaging celebration.

More information about the event is available at the conference webpage: https://www.exeter.ac.uk/research/centres/egenis/conference/

Written by Elis Jones, Konrad Lorenz Institute

Events

22 May
British Mycological Society Talk: 19.30-21.00
Funding Fungi in the West Midlands. Online. More information

22 May
CEC Annual Symposium, 9.00-18.00. Princess Pavilion, Falmouth. More information

22 May
HASS Inaugural Lecture, 16.00-18.00
Professor Catriona McKinnon: Endangering Humanity: An International Crime? More information

23 May
LSHTM event 12.30-14.00 Decoloniality and indigenous methods in global health evaluation – Prof Bagele Chilisa. More information

30 May
MycoTalks: Oliver Kurzai 'Monitoring fungal infections into Germany' and Pushpa Pandiyan, 'Dectin signalling in HIV infections and oral cancer'. More information

30 May
Pharma Pollution Hub, 13.00-14.00, online: Integrating pharmaceutical pollution into sustainable finance initiatives. More information

3 June
EGENIS Seminar, 15:30-17:30 What Makes an Experiment Beautiful?' – Dr Milena Ivanova (University of Cambridge). More information

3-5 June

Wellcome Conference: Ancient Biomolecules of Plants, Animals and Microbes. Wellcome Genome Campus, UK.More information

4-6 June

Microbiology Society: Aerosols and Microbiology: Connecting disciplines in the post-pandemic era. Bristol, UK. More information

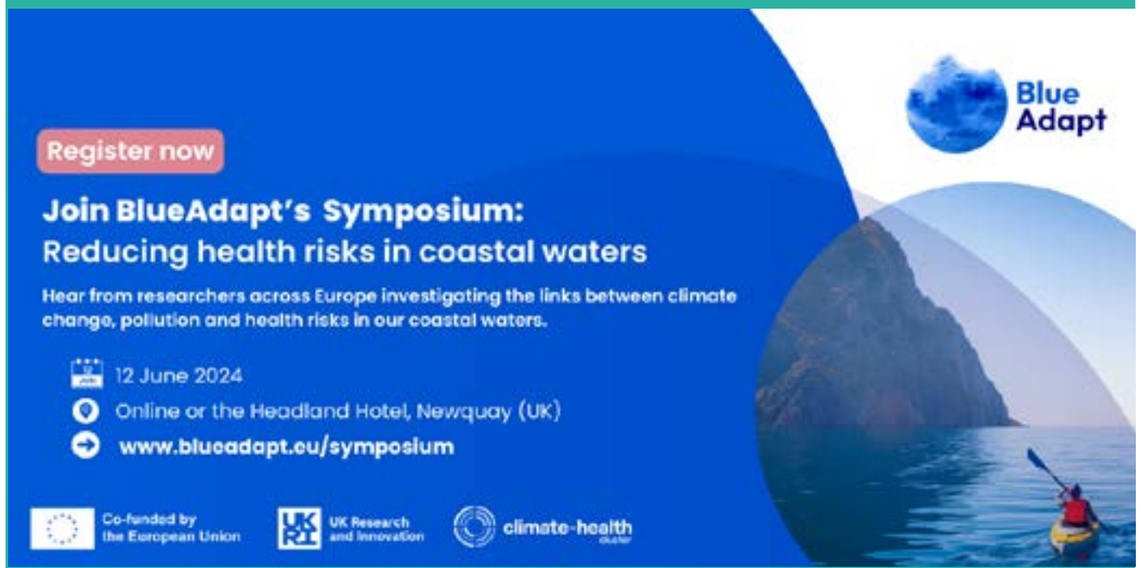
10 June
EGENIS Seminar, 15:30 – 17:00 Rethinking Epidemic Narratives: Combining Historial and Ecological Methods in the Anthropocene, Dr Emily Webster (Durham University) more information

10-12 June
Wellcome Conference: Single Cell Biology. Wellcome Genome Campus, UK. More information

11 June
LSHTM event 12:50 – 13:50: Drivers of antimicrobial resistance in Uganda and Malawi. More information

12 June
LSHTM event, 12:45 – 13:45: The role of empanelment and gatekeeping in primary health care. More information

12 June



20-21 June
Amr Insights Advancing Data Technologies to Corner AMR – Online conference. More information

27 June
MycoTalks: Yong-Sun Bahn and Wendy van de Sande.

Funding calls

Large funding opportunities

Royal Society - Faraday Discovery Fellowhips. The programme will provide the most talented mid-career researchers with the time and freedom to focus on their research, providing long-term, stable funding to allow them to tackle difficult and intractable problems. Up to £8m available. Opens August 2024. More info

Royal Society - Wolfson Fellowships. The objectives of the fellowships are to enable UK universities and research institutions to strategically recruit and attract outstanding research leaders to the UK from overseas by offering long-term support and flexible funding to conduct high-quality research; strengthen research and help build a critical mass of excellence in the UK's best university departments and research institutions in fields considered to be strategically important by the institution. £300,000 max award. More info

NIHR Global Advanced Fellowships - Round 1. This £750,000 award will fund research projects, training and development, and institutional capacity strengthening. The programme funds researchers undertaking research that aims to specifically and primarily benefit people in LMICs eligible for Official Development Assistance (ODA). More info

Daphne Jackson Fellowship. Applications are invited for 3 x three-year part-time (0.5 FTE) Daphne Jackson Fellowships to be hosted and sponsored by Queen's University Belfast. The Daphne Jackson Fellowships offer professionals wishing to return to a research career after a break of two or more years, the opportunity to balance an individually tailored retraining programme with a challenging research project in a suitably supportive environment. Deadline 3 June. More info

Applied Microbiology International Horizon Awards - recognising individuals and teams at the forefront of microbiological research. Deadline for nominations is 26 July 2024. More info

NERC - Delivering training courses for environmental scientists 2024. Apply for funding to deliver training short courses within the NERC remit, focusing on areas of identifiable training need. Award max £60,000. Closing date 26 June. More info

Smaller funding opportunities

BBSRC - Innovation to Commercialisation of University Research (ICURe) Discover. Apply for funding to discover more about the potential market of your bioscience-based idea, increase market awareness and gain deeper understanding of potential technology applications. BBSRC will fund up to £3,700 for an eight-week part-time online market discover programme. Opens 4 June, closing date 10 September. More info

British Academy/Leverhulme - Small Research Grants. Available to support primary research in the humanities and social sciences. These awards, up to £10,000 in value and tenable for up to 24 months, are provided to cover the cost of the expenses arising from a defined research project. Up to £10,000 available, closing date 5 June. More info

Healthcare Infection Society - Career Development Bursary. Bursary supports the continuing professional development of career grade members. £2,500 available. More info

Wellcome Trust – course bursaries available for a number of Wellcome Trust training courses. Up to 50% of course fee covered. More info

ISAC Project Grants. Applications for up to £15,000 are invited to support low-resource antimicrobial/infectious diseases research projects. One country must be LMIC. Closing date 1 September. More info

Publications

Clarke LM, O'Brien JW, **Murray AK, Gaze WH**, Thomas KV. A review of wastewater-based epidemiology for antimicrobial resistance surveillance. *Journal of Environmental Exposure Assessment*

Shekhova E, **Salazar F**, Da Silva Dantas A, **Chakraborty T**, **Wooding EL**, White PL, **Warris A**. Age difference of patients with and without invasive aspergillosis: a systematic review and meta-analysis. *BMC Infectious Diseases*

Agapov A, Baker KS, Bedekar P, **Bhatia RP**, Blower TR, Brockhurst MA, Brown C, Chong CE, Fothergill JL, Graham S, Hall JP, **Maestri A**, McQuarrie S, **Olina A**, **Pagliara S**, **Recker M**, Richmond A, Shaw SJ, Szczelkun MD, Taylor TB, **van Houte S**, Went SC, **Westra ER**, White MF, Wright R. Multi-layered genome defences in bacteria. *Current Opinion in Microbiology*

Dewidar O, McHale G, Al Zubaidi A, Bondok M, Abdelrazeq L, Huang J, Jearvis A, Aliyeva K, Alghamyan A, Jahel F, Greer-Smith R, Tufte J, Barker LC, Elmestekawy N, Sharp MK, Horsley T, Prats CJ, Jull J, Wolfenden L, Cuervo LG, Hardy BJ, Roberts JH, Ghogomu E, Obuku E, Owusu-Addo E, Nicholls SG, Mbuagbaw L, Funnell S, Shea B, Rizvi A, Tugwell P, Bhutta Z, Welch V, **Melendez-Torres GJ.** Motivations for investigating health inequities in observational epidemiology: a content analysis of 320 studies. *Journal of Clinical Epidemiology*

Watson BNJ, Capria L, Alseth EO, **Pons BJ**, Biswas A, Lenzi L, **Buckling A**, **van Houte S**, **Westra ER**, Meaden S. CRISPR-Cas in Pseudomonas aeruginosa provides transient population-level immunity against high phage exposures. *ISME Journal*

Jansen AME, Eggermont MN, Wilms EB, Aziz S, Reijers M, Roukema J, **Warris A**, Brüggemann RJM, van der Meer R. Evaluation of the drug-drug interaction between triazole antifungals and cystic fibrosis transmembrane conductance regulator modulators in a real-life cohort. *Medical Mycology*

Bell AG, McMurtrie J, **Bolaños LM**, Cable J, **Temperton B, Tyler CR**. Influence of host phylogeny and water physicochemistry on microbial assemblages of the fish skin microbiome. *FEMS Microbiology Ecology*

Deakin K, Savage G, Jones JS, Porter A, Muñoz-Pérez JP, Santillo D, **Lewis C**. Sea surface microplastics in the Galapagos: Grab samples reveal high concentrations of particles <200 µm in size. *Science of the Total Environment*.

Fletcher J, **Manley R**, Fitch C, Bugert C, Moore K, Farbos A, Michelsen M, Alathari S, Senior N, Mills A, Whitehead N, Soothill J, **Michell S, Temperton B**. The Citizen Phage Library: Rapid Isolation of Phages for the Treatment of Antibiotic Resistant Infections in the UK. *Microorganisms*

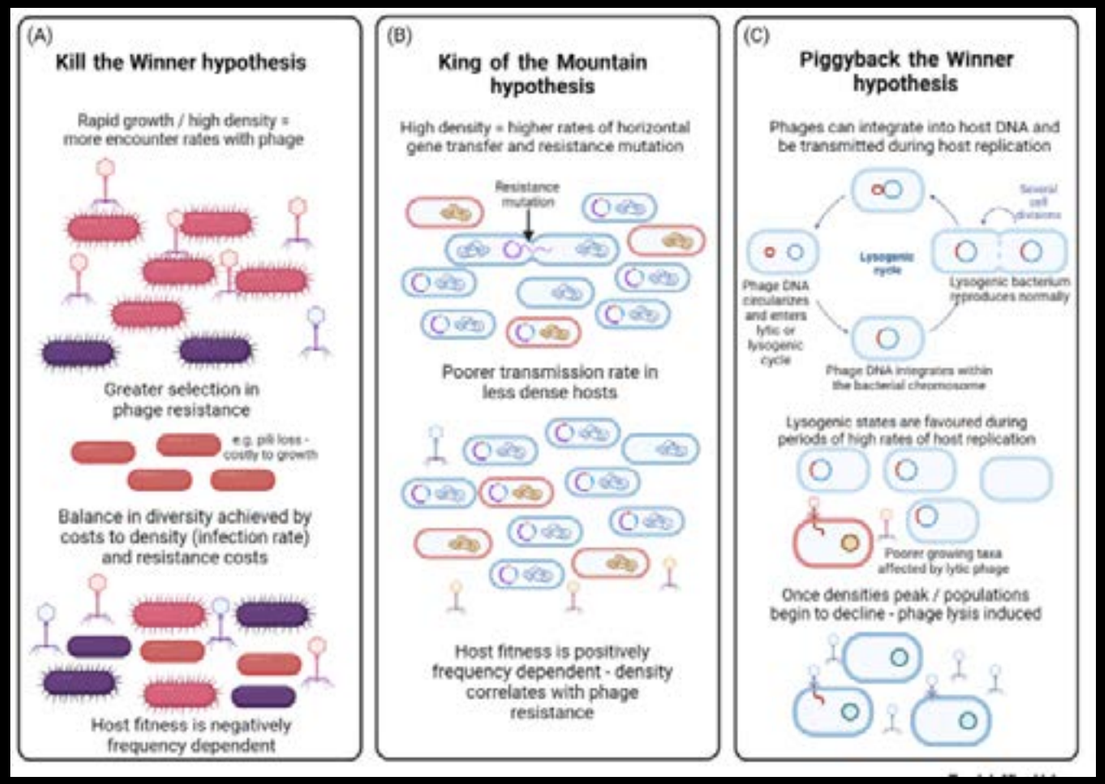
Webster VL, Hemmings S, Pérez M, Fisher MC, Brown MJF, **Farrer RA**. Revealing the genome of the microsporidian Vairimorpha bombi, a potential driver of bumble bee declines in North America. *G3*

Murray LM, Hayes A, Snape J, Kasprzyk-Hordern, **Gaze WH, Murray AK** Co-selection for antibiotic resistance by environmental contaminants. *npj antimicrobials*

Campbell JS, **Pearce JC**, Bebes A, **Pradhan A, Yuecel R, Brown AJP, Wakefield JG**. Characterising phagocytes and measuring phagocytosis from live Galleria mellonella larvae. *Virulence*

Publication Spotlight

Meaghan Castledine & Angus Buckling, Critically evaluating the relative importance of phage in shaping microbial community composition, *Trends in Microbiology*



Nev OA, Duvenage L, **Brown AJP**, Dangarembizi R, Hoving JC. Slicing through the challenge of maintaining Pneumocystis in the laboratory. *mBio*

Recker M, Fleischmann WA, Nghia TH, Truong NV, Nam LV, Duc Anh D, Song LH, The NT, Anh CX, Hoang NV, My Truong N, Toan NL, Kremsner PG, Velavan TP. Markers of prolonged hospitalisation in severe dengue. *PLOS Neglected Tropical Diseases*

Castledine M, Bucking A. Critically evaluating the relative importance of phage in shaping microbial community composition. *Trends in Microbiology*

Pelletier C, Shaw S, Alsayegh S, **Brown AJP**, Lorenz A. Candida auris undergoes adhesin-dependent and -independent cellular aggregation. PLOS Pathogens

Hanson MA, Westlake HE, Schrankel CS. Sculpting the microbiome. *Philosophical Transactions of the Royal Society B*

Hanson MA. When the microbiome shapes the host: immune evolution implications for infectious disease. *Philosophical Transactions of the Royal Society B*

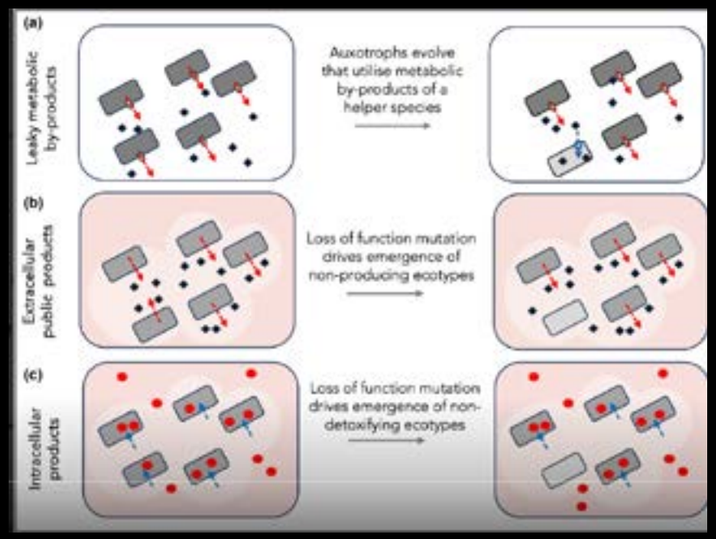
Bagratee TJ, **Studholme DJ.** Targeted genome sequencing for tuberculosis drug susceptibility testing in South Africa: a proposed diagnostic pipeline. *Access Microbiology*

Erdos Z, **Studholme DJ**, Sharma MD, Chandler D, Bass C, **Raymond B**. Manipulating multi-level selection in a fungal entomopathogen reveals social conflicts and a method for improving biocontrol traits. *PLoS Pathogens*.

Do bacteriophages shape microbial community composition? The ubiquity of bacteriophages (phages) and the major evolutionary and ecological impacts they can have on their microbial hosts has resulted in phages often cited as key drivers shaping microbial community composition (the relative abundances of species). There is evidence of bacteriophages driving microbial community composition from natural examples, such as cholera outbreaks, during phage therapy, experiments, and mathematical models. However, many studies suggest little or no role of phages in shaping community dynamics, suggesting that viruses may instead follow microbial population dynamics. Here, we critically review the theory and data exploring the role of phages in communities, identifying the conditions when phages are likely to be important drivers of community composition. Evidence from coevolutionary studies suggests that phages may have a greater role in shaping composition at the strain rather than the species level (where evolutionary mechanisms predominate). Phages are most likely to affect community composition when encounter rates with susceptible hosts is high, over short timescales with novel phage, and in relatively simple communities.

Publication Spotlight

Elze Hesse and Siobhan O'Brien, **Ecological dependencies and the illusion of cooperation in microbial communities, composition**, *Microbiology*



Organisms often rely on others for their survival. For example, symbionts provide essential vitamins and amino acids to their multicellular hosts and legume plants similarly rely on nitrogen-fixing rhizobia to convert atmospheric nitrogen to ammonia. In some cases, dependencies can arise via loss-of- function mutations that allow one partner to benefit from the actions of another. It is common in microbiology to label ecological dependencies between species as cooperation. However, in many cases, such traits are not (at least initially) cooperative, because they are not selected for because of the benefits they confer on a partner species. In contrast, dependencies in microbial communities may originate from fitness benefits gained from genomic-streamlining (Black Queen Hypothesis, BQH). Here, we outline how the BQH predicts the formation of metabolic dependencies via loss-of-function mutations in microbial communities, without needing to invoke any cooperation-specific explanations. Furthermore, we outline how the BQH can act as a blueprint for true cooperation as well as discuss key outstanding questions in the field. The nature of interactions in microbial communities can predict the ability of natural communities to withstand and recover from disturbances. Hence, it is vital to gain a deeper understanding of the factors driving these dynamic interactions over evolutionary time.

Publications contd

Penkova, E., Raymond, B. When does antimicrobial resistance increase bacterial fitness? Effects of dosing, social interactions, and frequency dependence on the benefits of AmpC ☒-lactamases in broth, biofilms, and a gut infection model. *Evolution Letters*

HesseE, O'BrienS. Ecologicaldependencies and the illusion of cooperation in microbial communities. *Microbiology*

Mugo-Kamiri L, Querejeta M, **Raymond B**, Herniou EA. The effect of diet composition on the diversity of active gut bacteria and on the growth of Spodoptera exigua (Lepidoptera: Noctuidae). *Journal of Insect Science*

GirottoCD, BehzadianK, MusahA, **ChenAS**, DjordjevicS, NicholsG, CamposLC. Analysis of environmental factors influencing endemic cholera risks in sub-Saharan Africa. *Science of the Total Environment*

McMullan B, Govender N, Carlesse F, Singhal T, Sati H, **Warris A;** PENTA Child Health Fungal Infection Working Group. Children and fungal priority pathogens. *The Lancet Child & Adolescent Health*

Francis VI, Liddle C, Camacho E, Kulkarni M, Junior SRS, **Harvey JA**, **Ballou ER**, **Thomson DD, Brown GD**, Hardwick JM, Casadevall A, Witton J, **Coelho C**. Cryptococcus neoformans rapidly invades the murine brain by sequential breaching of airway and endothelial tissues barriers, followed by engulfment by microglia. *mBio*.

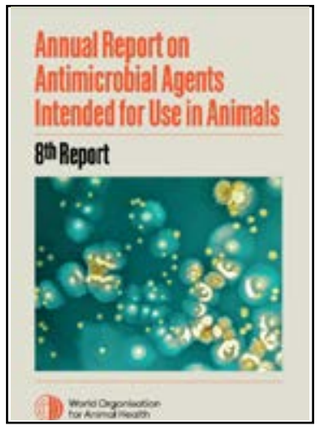
Iwasaki J, Bzdyl NM, Lin-Sullivan DJM, Scheuplein NJ, Dueñas ME, de Jong E, **Harmer NJ**, Holzgrabe U, Sarkar-Tyson M. Inhibition of macrophage infectivity potentiator in Burkholderia pseudomallei suppresses pro-inflammatory responses in murine macrophages. *Frontiers in Cellular and Infection Microbiology*

Grellier J, White MP, de Bell S, Brousse O, Elliott LR, **Fleming LE**, Heaviside C, Simpson C, **Taylor T**, Wheeler BW, Lovell R. Valuing the health benefits of nature-based recreational physical activity in England. *Environment International*

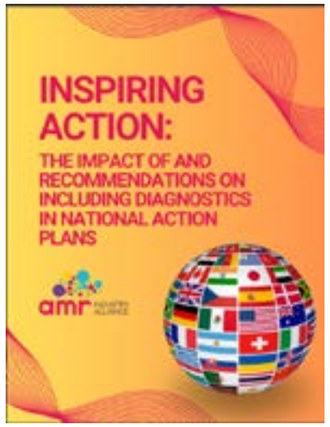
Alseth EO, **Custodio R**, Sundius SA, Kuske RA, Brown SP, **Westra ER**. The impact of phageandphageresistanceonmicrobial community dynamics. *PLOS Biology*

Reports, Policy Briefs

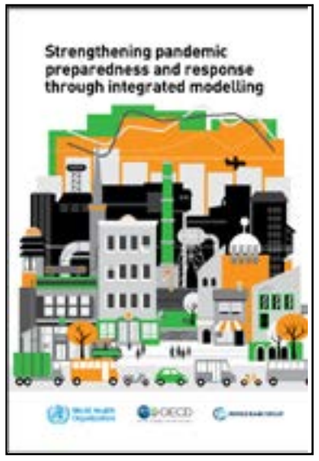
Confronting antimicrobial resistance 2024 to 2029 - UK Government, May 2024



Annual Report on Antimicrobial Agents Intended for Use in Animals - World Organization for Animal Health, May 2024



Inspiring Action: Impact of and recommendations on including diagnostics in national action plans - AMR Industry Alliance, May 2024



Strengthening pandemic preparedness and response through integrated modelling - WHO, May 2024

State of our Rivers Report - Rivers Trust, February 2024

Benefits and risks of using artificial intelligence for pharmaceutical development and delivery - WHO, May 2024

Other publications

Interdisciplinarity

Tytler R, Mulligan J, White PJ, Kirk M. Promoting Effective Interactions Between Mathematics and Science: Challenges of Learning Through Interdisciplinarity. Chapter in *Disciplinary and Interdisciplinary Education in STEM*, Springer.

Kim K, Kogler DF, Maliphol S. Identifying interdisciplinary emergence in the science of science: combination of network analysis and BERTopic. *Humanities and Social Sciences Communications*

Xiang S, Romero DM, Teplitskiy M. Evaluating Interdisciplinary Research: Disparate Outcomes for Topic and Knowledge-Base. *SSRN*

Pfenning-Butterworth A et al. Interconnecting global threats: climate change, biodiversity loss, and infectious diseases *The Lancet Planetary Health*

Policy studies

Jober A. Private actors in policy processes. entrepreneurs, edupreneurs and policyneurs. *Journal of Education Policy*

Eruaga MA. Policy strategies for managing food safety risks associated with climate change and agriculture. *Scholarly Research and Reviews.*

AI and Data Science

Konya A, Nematzadeh P. Recent applications of AI to environmental disciplines: A review. *Science of the Total Environment*

Bail, CA. Can Generative AI improve social science? *PNAS*