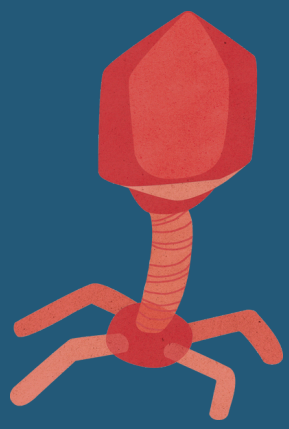
SEPTEMBER 2024

UNIVERSITY OF LEICESTER
CENTRE FOR PHAGE RESEARCH

Phage Therapy for Lyme



PRESENTED TO:
Bay Area Lyme Foundation

PRESENTED BY:
Dr. Martha Clokie
University of Leicester

Phage Therapy for Lyme Disease

When asked to describe her dream experiment, Dr. Clokie's answer is simple: "Using phage to treat Lyme."

I. Contact Information

Applicant Name: Martha Clokie and Jinyu Shan
Title: Professor of Microbiology and Director of the Centre for Phage Research
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II. Applicant Biosketch/CV

Attached to this form. See pages 7-11.

IV. Background:

The fight against Lyme disease and its accompanying co-infections is intensifying, presenting a significant challenge to global public health. Lyme disease, the most common vector-borne illness in the Northern Hemisphere, is caused by the *Borrelia burgdorferi* sensu lato complex. This group includes over 20 species, with *B. burgdorferi* sensu stricto being predominant in the U.S., and *B. garinii* and *B. afzelii* more common in Europe and Asia. The disease, transmitted through tick bites, is witnessing a significant increase in cases. This rise is further complicated by co-infections, such as *Borrelia miyamotoi* and *Bartonella spp.*, which blur the clinical picture and complicate Lyme disease management. Current diagnostic methods, heavily reliant on serological blood tests, often fail in early detection due to limitations like undetectable antibody levels during the early stages and serological cross-reactivity.

Our team is at the forefront of developing a novel diagnostic and therapeutic tool for Lyme disease based on phage technology. Phage therapy is an alternative to antibiotics that uses naturally occurring viruses called phages to treat bacterial infections. In phage therapy, viruses tailored to specific bacteria are found in nature, characterized in the lab, and delivered to the patient, where they infect and kill the bacteria without harming any other cells. The practice has been around for over a century, but research and funding significantly dwindled in the U.S. once methods to commercially mass-produce antibiotics were developed in the 1940s. However, the crisis of antimicrobial resistance has renewed Western interest in phage science, and the field is now growing fast.

At the heart of our approach are two key insights: first, phages outnumber bacteria in nature by ten to one; second, they are exquisitely specific to their bacterial targets. These characteristics make phages ideal for identifying and eliminating the bacteria responsible for Lyme disease and its co-infections. Our research has validated these insights in the context of Lyme disease. By focusing on the detection of these phages, our diagnostic method provides a direct measure of the presence of disease-causing bacteria. This approach marks a significant advance over traditional blood tests, particularly in the critical early stages of infection. Our phage-based diagnostic tool is poised to overcome the inherent limitations of existing tests, paving the way for more timely and effective treatment of Lyme disease.

This phage-based approach has demonstrated significantly enhanced sensitivity and specificity when benchmarked against current methods with clinical and tick samples. Our tests are patented, licensed to a European commercial lab, and currently available. To date, 10,000 diagnostic tests have been conducted, significantly impacting clinical treatment and patient well-being. Our test has already made a substantial impact on patient outcomes, as evidenced by a recent case report.

The work proposed here represents a continuation, expansion, and advancement of these initial efforts. This signifies a pivotal development in infectious disease diagnostics, introducing a novel methodology that can be adapted for a broad spectrum of bacterial pathogens, not limited to those transmitted by ticks.

Our approach, which aligns with BAL's guidelines and commitment, focuses on meticulously refining and validating our diagnostic tool to encompass various genotypes of *Borrelia* species implicated in Lyme disease, as well as two prevalent co-infections: relapsing fever and *Bartonella* infection. Over the past decade, we have also investigated the use of phages to treat Lyme disease, with preclinical laboratory data showing promising results. After completing these aims, we will pursue a clinical trial of our phages to treat Lyme disease under a compassionate use agreement. This project will produce a transformative diagnostic and therapeutic platform that holds the potential to revolutionize the management of tick-borne diseases, thereby alleviating their impact on global public health.

V. Aims of Project:

Despite notable progress in the field, a significant gap persists in the diagnostic arsenal for Lyme disease and its co-infections. This gap is particularly pronounced in the accurate identification and differentiation of various genotypes of Lyme disease-causing *Borrelia* species—such as *Borrelia burgdorferi s*ensu stricto, prevalent in North America, and European genotypes like *B. afzelii* and *B. garinii*—as well as *Borrelia* species associated with relapsing fever. Additionally, current diagnostics fail to effectively identify a prominent Lyme disease co-infection, *Bartonella* species, including *Bartonella*

henselae (responsible for cat scratch disease), *Bartonella quintana* (causing trench fever), and *Bartonella bacilliformis* (linked with Crohn's disease). This diagnostic inadequacy hampers clinicians' ability to prescribe targeted antibiotic regimens, as different *Borrelia* and *Bartonella* species and genotypes exhibit varied susceptibilities to antibiotic combinations. Such deficiencies undermine effective clinical management and contribute to prolonged patient suffering due to misdiagnosis or underdiagnosis.

Our initiative aims to address this gap in Lyme disease diagnostics by expanding our phage-based methods to detect a broader range of *Borrelia* genotypes across North America and Europe, including diverse strains of *B. miyamotoi*, and by optimizing assays for *Bartonella* species detection, considering their role in Lyme co-infections.

This comprehensive strategy seeks to improve the identification of tick-borne pathogens and provide clinicians with precise tools for targeted antibiotic treatments, thereby enhancing patient outcomes, reducing the impact of undiagnosed tick-borne diseases, and ultimately improving the quality of life for those affected.

Project Plan and Methodology

The following outlines the progression from the initial optimization of phage-based markers, through bioinformatic analysis and laboratory validation, to future project planning and implementation.

1. **Optimization of Phage-Based Markers and Isolation of Phages Specific for Lyme Disease (1-30 Months):** The initial phase involves selecting *Borrelia* and *Bartonella* strains that are critically relevant to Lyme disease and its co-infections, focusing on their prevalence and pathogenicity. With collaborators Dr. Paul Turner and Dr. Ben Chan at Yale University, we will identify phages with high specificity toward these bacteria, minimizing cross-reactivity with non-target species. This stage is crucial for establishing a robust foundation for the development of our diagnostic tool. For phage isolation, we will use our high-throughput screening method to identify phages from environmental samples specific to different genotypes of *Borrelia* strains.
2. **Bioinformatic Analysis (6-10 Months):** We will perform comprehensive bioinformatic analyses on the genomes of the identified phages to isolate unique genetic markers suitable for diagnostic purposes. These markers will undergo stringent in silico validation to ensure specificity across different strains of the target species. This step is essential for refining diagnostic markers before their practical application in laboratory settings.
3. **Laboratory Validation (11-18 Months):** After identifying potential genetic markers, we will design primers and TaqMan probes for PCR-based assays to detect these specific sequences. The validation process will involve titration of primers and probes, analysis of human DNA interference, and optimization of conditions for both

singleplex and multiplex PCR reactions. We will also test various bacterial DNA concentrations and combinations, as well as blood samples spiked with *Borrelia* and *Bartonella* bacteria, to evaluate the assays' sensitivity, specificity, and detection limits. This rigorous validation ensures the reliability and accuracy of our diagnostic assays under clinical conditions.

4. **Validation Against Clinical, Tick, and Veterinary Samples (19-30 Months):**
   In collaboration with the University of Leicester's Research and Enterprise Division, we will expand our team and establish partnerships, including with NHS Scotland and academic institutions in Highland Scotland, for clinical sample and tick collection. We will also work with the International Lyme and Associated Diseases Society (ILADS) for clinical insights and network expansion in North America. Additionally, we plan to engage with Lyme disease charities for patient feedback and consult with diagnostic market leaders to explore opportunities for integrating our technology, enhancing Lyme disease diagnostics, and improving patient care.

A central element of our strategy is scaling up the Citizen Science program in Scotland to expand tick collection efforts. This will increase sample diversity and provide epidemiological data for preventive strategies. Additionally, we will collaborate with regulatory bodies, including the MHRA in the UK and the FDA in the US.

Project Deliverables and Success Criteria:

- **Successful Design and Optimization of Phage-Based Primers and Probes:** Leverage our expertise to mitigate risks and build on our established track record.
- **Development of a Multiplex PCR Diagnostic Tool:** Create an advanced diagnostic tool capable of identifying dominant *Borrelia* genotypes and multiple *Bartonella* species in one assay.
- **Evaluation of Diagnostic Effectiveness:**
  Assess the tool's effectiveness based on--
  - Sensitivity and Specificity: Through testing against bacterial DNA samples and blood samples spiked with bacterial cells.
  - Analytical Detection Limit: Achieve a detection limit of 1-5 copies per PCR assay and 1-5 bacterial cells per millilitre of blood, setting a new standard for diagnostic accuracy.
- **Regulatory Approval:** Demonstrate the tool’s performance to facilitate regulatory approval and readiness for large-scale clinical validation.
- **Incorporation of Multiple Genetic Markers:** Ensure comprehensive pathogen coverage by including multiple genetic markers for each target bacterium, enhancing the diagnostic tool’s robustness and reliability.
- **Isolation of Phages Specific to Borrelia Species:** Complete the isolation of phages specific to relevant *Borrelia* species for diagnostic and therapeutic applications.

VI. Project Timeline

TASK	TIME (months)	RESOURCE
Optimization of Phage-Based Markers	6	Research Team
Bioinformatic Analyses	4	Bioinformatics Team
Laboratory Validation	8	Lab Team
Validation against clinical, tick, and veteranarian samples	12	Research & Collaboration Team
Isolation of Lyme-Specific Phages	30	Research & Collaboration Team

VII. Project Budget

We are requesting $300,000 for researcher salaries, consumables, travel and conference expenses, and the communication/dissemination of results.

VIII. Rigor & Reproducibility

Our team, comprising Dr. Martha Clokie, Dr. Jinyu Shan, and Dr. Ying Jia at University of Leicester, as well as collaborators Dr. Paul Turner and Dr. Ben Chan at Yale University, brings together a synergistic blend of expertise to drive significant advancements in Lyme disease diagnostics. This collaborative effort leverages the unique strengths of each member to generate new ideas, tools, methodologies, and knowledge.

- Project Lead **Dr. Martha Clokie** brings a wealth of experience in microbiology and phage therapy, providing strategic oversight to ensure the project's goals align with the broader aims of enhancing Lyme disease diagnostics. Her leadership is critical for guiding the project through its milestones, ensuring that the research adheres to rigorous scientific standards and ethical considerations.
- Research Co-Lead **Dr. Jinyu Shan** brings unparalleled expertise in phage biology, qPCR validation, quality assurance, and the management of diagnostic labs in regulated environments. Jinyu's responsibilities span the entire project lifecycle—from initial design to critical stages of quality control, external collaborations, manuscript preparation, presentations at conferences, and troubleshooting. Jinyu ensures the reproducibility and reliability of the data by implementing stringent validation protocols and overseeing all experimental workflows. This comprehensive oversight is pivotal in transitioning molecular diagnostics from research to clinical application. Her role is crucial in meeting project milestones, including data generation and validation.
- Researcher **Dr. Ying Jia** is responsible for executing experimental designs, conducting experiments, performing data analysis, and drafting manuscripts.

Ying's rigorous approach to experimentation, troubleshooting, and data interpretation ensures the reliability and reproducibility of the results. She employs standardized methodologies, repeat experiments, and statistical analyses to ensure consistency, further contributing to the project's success.

Together, the team's synergy and individual expertise will:

- Introduce an innovative diagnostic and therapeutic tool for the precise detection and differentiation of tick-borne pathogens, bridging the gap between laboratory research and clinical practice.
- Develop and validate new qPCR methodologies for Lyme disease diagnostics, enhancing sensitivity, specificity, and the overall reliability of pathogen detection. Our team will implement rigorous quality control measures, including inter-laboratory comparisons and blind sample testing, to ensure the reproducibility of results.
- Expand the scientific and medical community's knowledge of the genetic diversity and epidemiology of tick-borne diseases, guiding future research and clinical practices.

We are committed to ensuring the reproducibility and reliability of our data through meticulous experimental design, rigorous validation protocols, and transparent data-sharing practices. All experiments will be conducted in accordance with Good Laboratory Practices (GLP), and results will be cross-validated through independent replication studies. Regular audits and peer reviews will further ensure data integrity.

Through this project, we aim not only to improve patient outcomes by enabling early and accurate diagnosis but also to enrich the scientific literature with valuable insights into tick-borne diseases, fostering further research and innovation in this critical area of global public health.

Dr. Martha Clokie
Project Lead

- Professor of Microbiology
- Academic lead of **Phages for Global Health**, a charity that disseminates phage research to low-income countries
- Selected as leading phage expert on a recent **World Health Organization** delegation
- Recently cited in the first **UK Government Phage Inquiry**
- Regularly featured in news, media, and **BBC programming**

The American Friends of the University of Leicester, Inc. (AFUoL), is a charitable 501(c)(3) tax-exempt organization.
Contact: mrjc1@leicester.ac.uk

Name	Professor Martha Clokie

Education and Professional Qualifications

Positions Held

July 2022 – present	Director of the Centre for Phage Research
April 2015 – present	Professor of Microbiology at the University of Leicester
April 2011 – March 2015	Reader (Associate Professor) in Microbiology at the University of Leicester
Sept 2006 – March 2011	New Blood Lecturer at the University of Leicester
June – Aug 2006	Visiting Scholar at Scripps Institution of Oceanography, San Diego
Jan 2004 – May 2006	Post-doctoral Researcher at the University of Warwick.
Jan 2001 – Dec 2003	Post-doctoral Researcher at the University of Warwick.

Academic Education

1997 – 2000	University of Leicester, PhD Molecular Ecology
1996 – 1997	University of Edinburgh, MSc Plant biodiversity & taxonomy
1992 – 1996	University of Dundee BSc (Hons) Biology 1st class

Other Relevant Professional Activities/Honours/Awards*

Summary:

I am an internationally renowned expert in bacteriophage biology with 142 published papers and an H index of 47. Over the last 15 years, I have pioneered studies of developing phages for therapeutic purposes for humans and animals. I have pioneered work to develop a phage-based Lyme disease diagnostic – this is currently licenced to the RED laboratory in Belgium where it has been used to diagnose Lyme for over 10,000 patients. I have a track record of carrying out the fundamental science needed to use phages in applied settings evidenced by my work on human associated Clostridium difficile and Salmonella associated with pigs. Much of my work uses genomic and structural approaches to identify key traits associated with phage efficacy to clear infection. My work also incorporates studying phage-bacterial interactions in physiologically relevant models and in animal trials. My recent publications led to two recent British Research Council awards to design phage products for use in livestock. I have had projects funded directly by Industry (eg. Enbiotix funded *C. difficile* phage therapeutic programme) and others with close Industry collaborations (eg. ABagri on phages for use in poultry). I developed and regularly run a course to teach phage biology to African academics, as part of a Gates funded 'Phages for Global Health' Yale-Leicester collaboration. All of my applied work is routed in fundamental biology and my early phage research was focussed on understanding how ocean bacteriophages controlled their marine bacterial hosts. My work paved the way for a new research field which is still very much active, that of determining complex ways that phages interact with their bacterial hosts.

My research is aimed at addressing critical global challenges in medicine, infectious diseases, agriculture and food sustainability. I have demonstrated exceptional dedication and leadership, leading large international projects and mentoring young research staff both post-doctoral staff and PhD students – many of whom have gone on to have successful careers in academia or in industry.

My work contributes to the advancement of scientific knowledge to underpin phage development. My collaborative actively with regulators, policymakers, and stakeholders has been instrumental in to starting to establish frameworks and pathways for the public to access phage products and showcases my commitment to research and societal welfare. I also have a strong media presence and am the person that the BBC turns to when they need a phage expert.

Awards:

- Targeting Phage Therapy 2023 awards - Best Scientific Contribution (presentation)
- East Midlands Outstanding Woman in STEM 2020
- Shandong Friendship Award. Of 40,000 foreigners, 20 awarded 'Friendship Award', (2019)
- Invited prize lecture at the UCL Institute of Child Health, as part of their prestigious Otto Wolff Lecture series, (May, 2016).
- Awarded the 2015 Frank May Prize for Research at Leicester: Gave a public presentation,'.(September, 2015). This prize is given to the most highly rated medical research in the College of Life Sciences at the University of Leicester

Professional Experience*

Projects

Clostridium difficile: When I started my laboratory, I applied my environmental background to medically relevant pathogens. I initially chose and continue to work on phages that infect the gut pathogen *C. difficile*. This organism causes infectious diarrhoea and kills more people than any other bacterium in the UK. I am proud that I overcame several technical hurdles to become the first scientist to isolate phages that target clinically relevant strains of this pathogen. I patent protected a set of my *C. difficile* phages that have good clinical properties, and I am developing them as a new treatment for *C. difficile*. In parallel I have been unravelling the mechanistic basis of their biology.

Salmonella: My work on *Salmonella* phages is to identify and developing phages that target and kill *Salmonella* strains that are major pathogens affecting humans but carried extensively by swine and poultry. My research involves isolating these phages, characterising their genetic and structural features, and assessing their efficacy to remove *Salmonella* from the food chain. I aim to create effective phage-based therapies as alternatives to antibiotics, particularly to combat antibiotic-resistant *Salmonella* strains. To date this work has resulted in 3 BBSRC grants, significant commercial funding, 15 publications and one patent. I have recently expanded work to build on my Clostridial experience and explore phages that target poultry associated *C. perfingens*.

Lyme: I have pioneered work to develop a phage-based Lyme disease diagnostic – this is currently licenced to the RED laboratory in Belgium where it has been used to diagnose Lyme for over 10,000 patients.

UTI: My urinary tract infection (UTI) phage work is to develop phage-based therapies to treat UTIs, particularly those caused by antibiotic-resistant bacteria such as multi-drug-resistant *Escherichia coli* and *Klebsiella* species. Having isolated effective phages, we are now determining how they work in in bladder models, in combination with antibiotics and in mice. This work is part of a broader effort to create alternative UTI treatments that are less reliant on traditional antibiotics, that will improve patient outcomes and reducing the reliance on conventional antibiotics. We have received UKRI and charitable funding for this work, published two manuscripts and have several in progress that will form the basis of our human clinical trial.

Respiratory pathogens: My phages and respiratory pathogens work focuses on understanding the roles of phages in diseases such as COPD and ultimately to develop phage-based interventions to combat bacterial infections in the respiratory tract. We have focused on using viromics to unravel their dynamics and have identified phages that target common respiratory infections. I have also explored how these phages can be effectively delivered and sustained in the respiratory environment to maximize their ability to clear infections.

Patents: Inventor on patent filed by the University of Leicester on therapeutic C. diff phages, patent granted in Europe and the USA (European Patent Application No 13759275.4). Inventor on patent filed in 2017 on Lyme disease phage diagnostic; PCT/GB2017/053323. Inventor on *Salmonella* phage patent PCT/GB2019/052695, 2019.

Centre for Phage Research (CPR) Establishment:
Co-founding the CPR with Dr Andy Millard was a strategic initiative, nationally and internationally positioning the University of Leicester as a pioneer in phage research. The Centre launched with an inaugural conference attended by 220 delegates from diverse sectors and showcased our leadership in interdisciplinary dialogue and collaboration. All Case studies presented were from our Leicester team. The event was captured and can be see here [https://www.youtube.com/watch?v=WmVN0OpxaCY].

Strategic Partnerships:
Opening the CPR led directly to strategic partnerships with regulators MHRA and the VMD and dialogues with, both entities are needed to address the major bottleneck in translating phage technology to allow it to progress from laboratory settings to be used in clinical and agricultural

International Representation and Government Engagement:
My global representation of the CPR and the University involved direct engagement with the UK government where I gave written and spoken evidence on behalf of the CPR during an Inquiry in the House of Commons Committee of Science and Technology Committee into Bacteriophages
[http://tiny.cc/UkPhageEvidence]. I was extensively cited in the report that was made and invited to talk on the Today Programme the day the report came out.

Community Engagement and Operational Excellence: My engagement academic program in SE Asia (in Manilla in May 2023) as part of the Charity Phages for Global Health), reflects my commitment to being a Citizen of Change.

Steering committees: on BBSRC committee panel B, advisor to International Phage projects CURE (phages in Asthma), Viro-Plant (phages in agriculture) KLEB-GAP () and xxx a New Zealand based phage project.

External consultancy:
Consultancy roles with commercial companies such as GSK, Eligo BioSciences, BiomX and Parallel Health. In a veterinary/food context I've consulted to Carus Animal Health and APS, Dundee.

Editorial roles:
Editor in Chief for a journal launched in 2020 PHAGE; research, therapy and applications [now Impact factor of 3.5]. Edited and wrote chapters in Bacteriophages: Methods and Protocols Volumes 1 and 2 were published by Springer in 2010. These have sold thousands of copies and are the recognised authority on phage methods. Volume 3 was released in January 2018 and volume 4 Feb 2019. Regularly review manuscripts for many journals and grants for UK grant agencies; MRC, BBSRC, NERC, Wellcome Trust and US agencies NSF and NIH

Media:
My work is regularly and recently featured on the BBC, for example on Melyvn Bragg's 'In Our Time', inn Bacteria: the tiny Giants, the Life Scientific, the Infinite Monkey Cage', and the Today Programme. I often work with other media outlets to raise public awareness and engagement with phage Therapy with articles published in the Guardian, Financial Times, Food Safety News and Microbiology Today.

Teaching Experience including the delivery of teaching etc. in a clinical setting*

- In 2023, I taught 122 hours in total on first, second- and third-year modules and contributed to MSc and taught PhD modules (BS1040, BS2030, BS3013, MB7309 and BS4309 and on the Infection and Immunity MSc and MIBTP programmes). I am the co-convenor of BS3013 which took a further 5 hours of time to manage.
- In terms of supervision of experimental projects, in 2023 I supervised 2 experimental and 1 analytical projects and 9 PhD students
- I am on the Genetics and Genome Biology Executive team and contributed to 2 offer holder days, giving presentations and tours
- I was Invited by the Swedish National Doctoral Programme in Infections and Antibiotics to give a lecture on their Antibiotics and Antibiotic Resistance course (2024)
- Examined 27 PhD thesis: International; Leuven, Belgium x2, Copenhagen (x3), Aahus, University of Los Andes, (Colombia), Cork x2; National: Imperial, Cambridge Lancaster, Cardiff, Plymouth, Warwick (x3), Liverpool, Edinburgh, Edinburgh Napier, Nottingham, Nottingham Trent x2, Lincoln

Research Experience*

Research staff/student supervision:

- I coordinate the Centre for Phage Research (CPR) (launched May 2023), which involves chairing 3-hours/week of meetings with all members (academic, PDRAs and students) and a further at least 12 hours/week of meetings with staff and senior researchers.
- I mentor and manage 11 research staff (and 8 PhD students) and help them to progress. In addition to standard specific help I started initiatives such as 3 hour bi-weekly 'writing club' to help them get their outputs out
- Coordinating the CPR also involves meeting people outside of the University, for example, government representatives, industry personal and with clinicians, vets and farmers who are interested in using phage technology
- To resource research within the Centre, in 2023 I submitted 25 grants and had a 60% success rate with funding totalling ~£2 million.
- I mentor junior staff to write their grants and other colleagues within CPR and the department. In 2023 I hosted a research fellow from Benin who subsequently attained a permanent research position.
- In 2023, I published 16 papers, many were high impact. This contributes to my total of 150+ published papers with an h-index of 47. These outputs underscore the significant volume and scientific impact of my research.
- 28 PhD students and 30 MSc students have successfully completed their studies

Publications*

See complete list of over 150 publications on Google Scholar

Invited Presentations* (selection)

Microbiology Society, Edinburgh, 2024, ELRIG (Manchester) 2024, Association of Molecular Pathology, Madrid, Spain, 2024, WHO and the Global AMR R&D Hub, Tbilisi, Georgia, 2024, Oxford Phage Meeting annually 2012 – 2024, 6th World Conference on Targeting Phage Therapy 2023, Paris, France; Evergreen Phage Conference, Olympia USA, 2023; Qilu Forum, China 2023, Fundamentals of Phage Biology 2023, Lund, Sweden; Phage Workshop, Manilla, Philippians 2022;

BSAC Conference, London, 2022, German Society of Virology, Munich, Germany 2021; Future of Phages, Washington DC, 2019; 3rd Chinese Phage meeting 2018; Microbiology Society, Birmingham, May 2018; iMed Conference Portugal, presented to 400 Portuguese doctors, November 2017;100 Years of Bacteriophages, Pasteur Institute, Paris, June 2017; Gordon Conference on Viruses and Cells II Ciocco, Italy, May 2017; Diabetes UK. Manchester. March 2017; Moscow Phage Conference, Moscow Russia, October, 2016; Microbiome R&D and Business Collaboration Forum, London April 2014; BioVision, Alexandria, Egypt, April 2016

Membership of Professional Societies*

- Member of the PACE Scientific Projects Advisory Group (2024)
- Invited guest and speaker to a WHO Mission to Georgia to explore the clinical and agricultural use of phage (2024)
- Member of the Rosetrees Translational Award panel (2024)
- Member of the EUCAST PST committee (2023 – present)
- Member of the Scientific Advisory Board for the European Partnership on Animal Health and Welfare (EUP AH&W) (2024)
- Invited to give evidence at the House of Commons Science and Technology Committee in relation to the antimicrobial potential of bacteriophages inquiry (2023)
- Advisory Board member for Innovate UK KTN's Phage Innovation Network (2022 – present)
- Committee member of the BBSRC for Plants and Microbial research (ongoing)
- Worked with the Department of Health and Wellcome Trust to inform debate and prioritisation of alternative therapies to antibiotic/antimicrobial drugs (2016)
- Served on FSA (Food Standards Agency) Committee to advise on phage regulation in food (2016)
- Served on MRC funding committee for Antimicrobial Resistance Cross-Council Initiative Theme 2 (2015/2016)