EDAR8
Environmental Dimensions of Antimicrobial Resistance
Brisbane, 2-7 August 2026

WORKSHOP OVERVIEW

Workshop Title	Mechanistic and analytical advances for AMR abatement in wastewater systems
Facilitators and contributors Details of the individuals leading and contributing to the workshop, including: • Workshop facilitators • Guest speakers or contributors • Their roles in the session	Despo Fatta-Kassinos, University of Cyprus Peiying Hong, King Abdullah University of Science and Technology Jianhua Guo, The University of Queensland Celia Manaia, Universidade Católica Portuguesa Sotirios Vasileiadis, University of Thesally Thomas Berendonk, TU-Dresden Uli Klümper, TU-Dresden Ishi Keenum, Michigan Technological University Christophe Merlin, University of Lorraine
Background An overview of the context and rationale for the workshop, outlining the key issue, challenge, or opportunity it addresses, and why this topic is timely and relevant.	Antimicrobial resistance (AMR) is increasingly recognized as an environmental as well as a clinical crisis, with wastewater treatment plants representing key nodes for its proliferation and potential containment. Secondary biological processes, such as conventional activated sludge, membrane bioreactors, and granular sludge, can reduce antimicrobial-resistant bacteria but often fail to fully eliminate antibiotic-resistance genes, and mobile genetic elements that persist or even propagate under selective pressures. Post-treatment steps including filtration, advanced oxidation, and disinfection offer additional barriers, yet their mechanistic efficacy and integration remain poorly harmonized. As global wastewater regulations and reuse targets expand, the need for evidence-based interventions within the wastewater continuum becomes urgent. This workshop will critically examine the current scientific understanding of AMR abatement across treatment stages, identify knowledge gaps and leverage points, and chart a path toward engineered, measurable, and sustainable interventions for genetic pollution control in wastewater systems.
Workshop Aims A description of the purpose of the workshop and its intended focus. This section highlights what participants can expect to explore, learn, or develop during the session.	The workshop will unify current knowledge on the mechanistic basis of antimicrobial resistance (AMR) persistence and attenuation in wastewater systems. Participants will examine how biological processes, separation technologies, adsorption processes, and oxidative or disinfection treatments influence the fate of resistant bacteria, genes, and mobile genetic elements under varying selective pressures such as antibiotics, metals, biocides, and operational stress. The discussion will focus on how and what we measure—from metagenomic tools to indicators linking genetic signals with functional transfer potential, and on how these metrics can guide process optimization. By integrating molecular biology, process engineering, and chemical analytics, the workshop aims to redefine how AMR abatement is quantified, modelled, and engineered. Ultimately, it will develop a shared scientific framework for linking selective pressures, mechanistic pathways, and measurable outcomes toward verifiable AMR mitigation across wastewater treatment.
Participant Takeaways A summary of what participants will gain from attending the workshop. This may include new knowledge, practical skills, tools, frameworks, or shared resources, as well as any tangible outputs (e.g. ideas, draft materials, or collaborative outcomes).	Participants will leave the workshop with a better understanding of how antimicrobial resistance determinants behave and interact across biological, physical, and chemical treatment barriers. Together, they will co-develop a scientific framework for quantifying AMR abatement, integrating microbial, genetic, and chemical indicators with operational parameters and selective pressures. Key outputs will include: • A matrix linking what we measure with how we measure *it* (sampling design, normalization, and data interpretation). • A conceptual model describing how selective pressures shape the persistence and transformation of AMR within treatment systems. • A consensus roadmap defining research and monitoring priorities for engineered AMR mitigation across wastewater.

	• Draft outlines for a collaborative **white paper or perspective article** proposing harmonized indicators and reporting metrics for genetic pollution control. Ultimately, participants will gain deeper insight, a shared scientific language, and an actionable platform for cross-disciplinary collaboration toward measurable AMR abatement.
Expected Impact An outline of the broader value of the workshop, including how it may: • Influence research, policy, or practice • Support collaboration and knowledge exchange • Contribute to future work or ongoing initiatives	This workshop will catalyse a paradigm shift from descriptive monitoring of antimicrobial resistance (AMR) in wastewater toward mechanistic, quantitative, and intervention-oriented science. By integrating the perspectives of engineers, microbiologists, chemists, and data scientists, it will establish a shared understanding of how selective pressures, treatment conditions, and molecular mechanisms jointly shape the fate of resistance determinants. The expected impact is expected to be threefold. First, it will generate a **science-based foundation for practice**, enabling utilities, researchers, and regulators to evaluate treatment performance not only by pathogen removal but by measurable reduction of genetic pollution. The workshop will define what constitutes meaningful metrics, linking operational parameters to molecular outcomes, and promote harmonized analytical protocols for antibiotic resistant bacteria (ARB), antimicrobial resistance genes (ARGs), and Mobile Genetic Elements (MGEs). Second, it will **strengthen interdisciplinary collaboration** by creating a cross-sector network focused on AMR abatement within engineered wastewater systems. Participants will identify complementary expertise and potential joint projects, including shared data repositories and coordinated field trials. Third, it will **inform future research and policy frameworks** by articulating the evidence needs for assessing AMR risk and mitigation efficacy under the One Health paradigm and in relation to specific reclaimed water/wastewater reuse/discharge environment. The resulting conceptual models and consensus statements will serve as references for European and international initiatives on water reuse, circular economy, and AMR. Ultimately, this workshop aims to transform fragmented insights into a coherent, predictive, and operationally relevant understanding of AMR control, supporting the transition from observation to intervention in the global management of environmental resistance
Who should attend? Information on the intended audience for the workshop, including: • Relevant backgrounds, sectors, or expertise • The level of participation expected (e.g. discussion, group work, problem-solving)	The workshop is designed for approximately 80 participants representing a balanced mix of disciplines essential for advancing AMR intervention science. Ideal participants include environmental and chemical engineers, molecular biologists, analytical chemists, environmental microbiologists, and data scientists working on wastewater treatment, metagenomics, or AMR risk assessment. We aim to invite representatives from water utilities, regulatory agencies, and policy experts to ensure translation of research outcomes into practice and governance. Participants will be recruited through existing international research networks and targeted invitations to ensure diverse geographic and sectoral representation; limited assistance from the conference secretariat may be requested for open calls. Active participation is expected: attendees will engage in structured discussions, group problem-solving, and real-time synthesis of conceptual and analytical frameworks. The workshop will emphasize co-creation, combining mechanistic understanding, methodological harmonization, and applied insight, to formulate actionable strategies for measurable AMR mitigation in wastewater systems.

Workshop Schedule and Duration

A summary of the structure and flow of the workshop, including:

- Key session components
- Interactive or breakout activities

14:00 – 14:10 | Opening and Context – Despo Fatta-Kassinos
Brief welcome, objectives, and framing of the workshop.
Overview of session structure, group composition, and expected outcomes.

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14:10 – 14:40 | Scientific Insights
Three concise keynote presentations will establish the mechanistic and analytical foundation for the breakout discussions, offering a panoramic view of AMR dynamics across engineered and environmental compartments:

Mechanistic pathways in wastewater treatment – Peiying Hong
Processes driving resistance selection, persistence, and horizontal gene transfer within biological reactors and treatment systems.

Metagenomics for streamlining wastewater treatment technologies – Sotirios Vasileiadis
Environmental DNA shotgun sequencing for the identification and quantification of pathogens and AMR determinants in wastewater; gaps addressed, opportunities and limitations in the assessment of treatment performance and identification of reliable proxies for resistance attenuation.

Translational Relevance – Celia Manaia
Toward measurable and verifiable indicators for policy and engineering practice.

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14:40 – 15:30 | Breakout Sessions — Four Parallel Groups
Participants will work in **four thematic clusters** to analyse key processes and knowledge gaps:

- **Group A:** Biological treatment processes (e.g. Conventional Activated Sludge, Membrane Bioreactors, etc): what influences AMR persistence or attenuation? **Group Lead: Celia Manaia**
- **Group B:** Filtration and separation processes, adsorption processes, Advanced Oxidation Processes (AOPs), and disinfection: what influences AMR persistence or attenuation? **Group Lead: Jianhua Guo**
- **Group C:** Sludge and biosolids management: persistence and transformation of AMR determinants during thickening, anaerobic digestion, thermal drying, evaluation of mitigation strategies for ARGs and MGEs. **Group Lead: Peiying Hong**
- **Group D:** Quantification and metrics: defining what and how to measure; integrating genetic (ARGs, MGEs), microbial, and chemical indicators into standardized frameworks linking molecular signals to functional risk reduction. **Group Lead: Sotirios Vasileiadis**

The role of rapporteur to help each group will be pre-assigned.

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15:05 – 15:15 | Cross-Group Exchange
*One participant from each of the **four groups** will rotate to another group to share emerging insights, hear alternative perspectives, and identify overlapping mechanisms or analytical challenges. Each "traveller" will then return to their original group and report back the most relevant cross-cutting ideas for integration.*

***Purpose:** to stimulate interdisciplinary dialogue and prevent conceptual silos.*

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15:15 – 15:30 | Group Consolidation
Each group will integrate the insights gained from the cross-group exchange and prepare concise key messages for the synthesis session.

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15:30 – 16:00 | Afternoon tea

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16:00 – 16:30 | Synthesis and Collaborative Mapping
Group leaders will present key findings from the **four thematic groups**, followed by the **Resistance Pathways Mapping** activity — a live visual system model tracing AMR fate and intervention leverage points across the

	wastewater/downstream environment continuum – **Ishi Keenum and Christophe Merlin** **Outcome:** creation of a shared conceptual **"AMR Fate & Intervention Map"**, serving as a unifying figure for the post-workshop white paper. _____ **16:30 – 17:15 | Mechanistic–Translational Consensus Matrix and Reflection** Participants will co-develop an **"AMR Intervention Landscape"**, which visualizes where understanding is strong, where mechanisms remain uncertain, and which strategies are nearest to scalable control of AMR determinants. **Discussion Lead: Thomas Berendonk /Uli Klümper** _____ **17:15 – 17:30 | Closure & Next Steps – Despo Fatta-Kassinos / Jianhua Guo** Summary of insights, agreement on follow-up actions, and invitation to co-author a joint white paper on AMR abatement in engineered water/wastewater systems.