

BIOGRAPHICAL SKETCH

NAME: Federici, Ermanno

POSITION TITLE: Associate Professor of Microbiology, Università degli Studi di Perugia

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
Università della Tuscia, Viterbo (Italy)	MS	05/1998	Biological Sciences
Nestlé Research Center, Lausanne (Switzerland)	Grad student	11/2002	Nutrition and Bone Biology
Université de Lausanne (Switzerland)	PhD	03/2004	Life Sciences
Ecole Polytechnique Federale de Lausanne (Switzerland)	Post-doc	03/2004	Bone Biology
University of Oxford (UK)	Post-doc	04/2005	Bone Biology
Università di Perugia (Italy)	Post-doc	12/2007	Microbiology

A. Personal Statement

I am Associate Professor of Microbiology and Applied Microbiology at the Department of Chemistry, Biology and Biotechnology of the University of Perugia (Italy). My research fields are microbial ecology and environmental microbiology. I lead the Laboratory of Applied and Environmental Microbiology, a research group with one post-doctoral scientist, one research assistant, two PhD students and several under-grad students, that features knowledge and technical expertise in applying cultural approaches as well as genomics and molecular tools (e.g. qPCR, dPCR, Next Generation Sequencing, bioinformatics) to investigate environmental microbial communities and their role in ecological, biotechnological and pathological processes. In recent years, one of the main research lines of my Laboratory has regarded wastewater-based epidemiology, a novel tool to monitor the circulation of pathogens, including antimicrobial resistant bacteria, within the population.

The proposed project seeks the application of the Nanopore sequencing service provided by the National Genomics Facility to obtain whole genomes of clinically relevant antibiotic-resistant bacteria from wastewater. These culturomics data will be integrated with metagenomics analysis to gain a deep understanding of antimicrobial resistance in urban, hospital and university building wastewater as representative of the whole population, hospitalized patients and young and healthy people, respectively.

The relevance of the project is represented by the uniqueness and dimension of the collection of antibiotic-resistant bacteria from wastewater (> 1000 isolates) that has been established in my Laboratory. Its feasibility relies in our experience, equipment and technical expertise for analyzing sewage samples developed in the frame of the Italian National Wastewater Surveillance (SARI) network and of funded projects in collaboration with well-known research institutions, such as the Italian National Institute of Infectious Diseases "Lazzaro Spallanzani". The genomic data produced by the sequencing service of the National Genomics Facility will be fully exploited thanks to the bioinformatics expertise implemented in my research group and based on national and international collaborations. My roles as Responsible for the environmental aspects of the National Action Plan on Antimicrobial Resistance (PNCAR) for the Umbria Region and as Coordinator of the Italian National Working Group for the

development of molecular analyses of antimicrobial resistance in wastewater, further ensure the feasibility and potential relevance of the proposed research.

B. Positions and Scientific Appointments

2025-Present	Associate Professor in Microbiology (SSD BIO/19), University of Perugia;
2024-Present	National Action Plan on Antimicrobial Resistance (PNCAR), Responsible for environmental aspects, Region Umbria;
2024-Present	Coordinator of the Italian National Working Group for the development of molecular analyses of antimicrobial resistance in wastewater within the SARI network;
2024-Present	Member of the Water Safety Plan committee for the Perugia-Trasimeno aqueduct system, Umbra Acque SpA;
2023-Present	Member of the editorial board of <i>Frontiers in Public Health</i> ;
2022-Present	Member of the PhD School in Biological and Natural Sciences, University of Perugia;
2021-Present	Head of Reference Laboratory for Region Umbria in the SARI Network (SARS-CoV-2 in urban wastewater in Italy);
2019-Present	Member of the Specialization School in Microbiology, University of Perugia;
2017-2020	Member of the PhD School in Biotechnology, University of Perugia;
2008-2025	Assistant Professor (<i>Ricercatore Universitario</i>) in Microbiology, University of Perugia;
2008-Present	Head of the Applied and Environmental Microbiology Laboratory, Department of Chemistry, Biology and Biotechnology University of Perugia;
2006-2017	Member of the PhD School in Environmental Sciences, University of Tuscia, Viterbo

C. Contributions to Science

While my early career as a PhD Student and Post-Doc started in nutrition and bone biology, my research activities as an independent researcher and group leader have developed in the field of microbial ecology and environmental microbiology. In these research areas, I have been investigating for several years the microbiological aspects of environmental biotechnologies, such as bioremediation, composting and industrial wastewater treatment, granting the participation to several research projects and the publication of several scientific publications. In particular, my studies have regarded the structural and functional dynamics of microbial communities during bioremediation of PAH and PCB polluted soils through bioaugmentation with fungi and biostimulation with surfactants. I have also investigated the role of environmental communities in the valorisation of agro-industrial wastes, such as in composting and re-utilization in cultivation practices, as well as in the aerobic treatment of industrial wastewaters.

Another relevant set of studies among my research lines, is represented by the characterization of microbial communities in atmospheric particulate matter and bioaerosol from different origins, such as desert dust intrusions and sub-Arctic marine air as well as urban and working environments. My studies have demonstrated the impact of Saharan dust in the bacterial populations present in PM10 and in glaciers in southern Europe. I have also participated to research projects aimed to show how leaves-associated microorganisms coming from bioaerosol in polluted cities could be useful for atmospheric pollutants degradation. Finally, I have been involved in projects focusing on airborne microorganisms in working environments such as wastewater treatment plants and livestock facilities.

Since 2015, my Laboratory has been in charge of monitoring the presence of opportunistic premise plumbing pathogens, with a focus on *Legionella*, in the buildings of the University of Perugia. This task has provided me the opportunity to studying this waterborne pathogen naturally occurring in man-made water systems as building water networks. In this respect, beside the contribution to the routine practices for Legionella risks assessment and monitoring, my Laboratory has also implemented a deeper characterization of Legionella contaminations carried on through cultural and molecular approaches. Further, in the frame of a recent PhD thesis, we have used phenotypic and genotypic assays to

investigate the virulence potential of environmental *Legionella* strains and their correlation with genomic traits.

During SARS-CoV-2 pandemic, sewage surveillance served as a complementary tool to clinical epidemiology for monitoring viral spread and variants, pinpointing the potential of Wastewater Based Epidemiology in facing human health treats. Since December 2021, I am involved in the National SARS-CoV-2 wastewater surveillance system (SARI-network), led by the Italian National Institute of Health (*Istituto Superiore della Sanità, ISS*), as responsible of the reference laboratory for the Umbria Region. This research activity has recently become one of the main research lines of my laboratory, thanks to collaborations with well-known research institutions (Italian National Institute of Infectious Diseases “Lazzaro Spallanzani” and Italian National Institute of Health) and to the granting of projects funded by the Italian National Recovery and Resilience Plan (PNRR) and by the Regional Water and Waste Authority (AURI). In this framework, we are involved in studies aiming to assess the potential of Wastewater Based Epidemiology to monitor emerging-reemerging pathogens (virus and bacteria) and antimicrobial resistance and investigating the potential reuse of treated wastewater to face water scarcity.

Full list of scientific publications:

<https://scholar.google.com/citations?user=smEze7AAAAAJ&hl=it>