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# Antibiotics prevalent in European surface waters induce bacterial adaptation

Marie-Claire Danner<sup>\*†1</sup>, Anne Robertson<sup>1</sup>, and Julia Reiss<sup>1</sup>

<sup>1</sup>University of Roehampton – United Kingdom

## Abstract

Antibiotics have been used in large quantities for many decades but it is only in recent years that they have been investigated in order to make an assessment of the environmental risks they may pose. There is extensive evidence showing that antibiotics are ubiquitous in freshwater systems. While the antibiotics are applied to fight pathogenic bacteria, non-target organisms living in these freshwaters will inevitably be exposed. To evaluate the toxicity of chemicals on non-target organisms, specific tests have been developed. The Organisation for Economic Co-operation and Development (OECD) provides guidelines to assess the potential effects of chemicals on the environment and classify the EC50 (concentration of the chemical which induces half-maximal responses within a stated period- usually mortality) under 1 mg/L as very toxic to aquatic organisms. However, even if antibiotics are found at low concentrations in surface waters it is known that sublethal concentrations can select for antibiotic-resistant bacteria. Here, we selected four antibiotics (ciprofloxacin, ofloxacin, sulfamethoxazole and sulfapyridine) which have the highest concentrations in European surface waters and we used an experiment to test the effects of those four antibiotics at four different concentrations (12, 16, 24 and 48  $\mu\text{g/L}$ ) on the bacteria *Pseudomonas fluorescens*, in order to reveal how antibiotics, prevalent in European streams, can affect bacteria abundance and can induce bacterial resistance.

**Keywords:** Antibiotics, bioassays, sublethal concentrations, antibiotic resistance

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\*Speaker

†Corresponding author: dannerm@roehampton.ac.uk