

Novel Patented Porphyrin Works Synergistically with Bacteriophage PEV2 in the Removal of *Pseudomonas aeruginosa* Biofilms on Medically Relevant Substrata

Jessica Geyer, Hannah Gordon, Dr. Jayne Robinson

Introduction

The rise of multidrug resistant (MDR) pathogens is one of the greatest medical concerns of the century. The use of antibiotics in these infections is almost entirely useless, with almost 80% of human infections involving biofilms which can be up to 1000-fold more resistant to antibiotics than planktonic cells, leaving patients at a higher risk of mortality. One primary pathogen of concern is

Pseudomonas aeruginosa, a deadly biofilm-producing bacterium that causes severe human infections and exhibits a high mortality rate for

immunocompromised individuals. This resistance has sparked an urgent need to look for alternative antimicrobial therapies, such as phage therapy. In phage therapy, lytic bacteriophages eliminate bacteria that cause infection, even those caused by MDR pathogens. Our lab has examined a successful combinational therapy that treats biofilms of *P. aeruginosa* using a lytic bacteriophage (PEV2) and our novel patented porphyrin (ZnPor).

Acknowledgements

Funding:
Graduate Student Summer Fellowship
STEM Catalyst Grant

Results

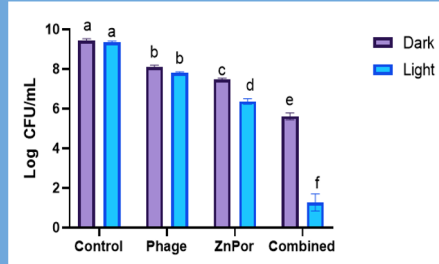


Figure 1: Biofilms grown on polyethylene coupons and subjected to a combination treatment consisting of ZnPor (25µM) and phage PEV2 (MOI 10:1) then treated for 20 mins with and without light

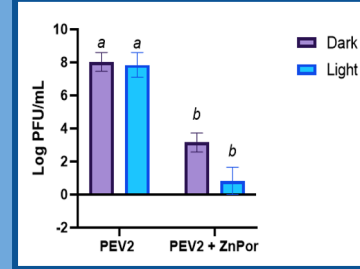


Figure 2: Phage quantifications after combination treatment residing on polyethylene coupons

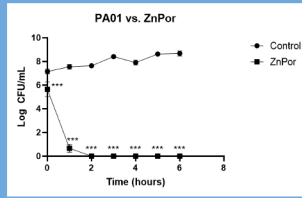


Figure 3: Planktonic PAO1 is completely killed by ZnPor (25µM) by 2 hours

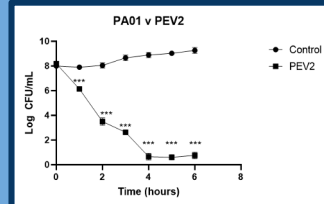


Figure 5: Planktonic PAO1 is completely lysed by PEV2 (MOI 10:1) at 4 hours

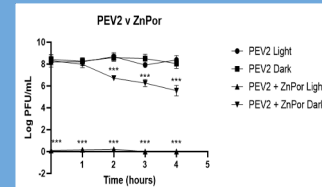
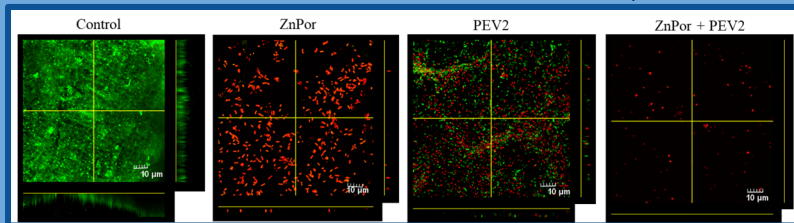


Figure 4: Phage subjected to ZnPor (25µM) in the presence of light (300W) showed complete and immediate virucidal activity.



Discussion

While ZnPor retains significant dark toxicity, photoactivation of ZnPor has complete virucidal activity.

-Obligately lytic bacteriophage PEV2 has significant bactericidal activity against *Pseudomonas aeruginosa*.

-There is a significant synergistic effect against *P. aeruginosa* biofilms when ZnPor is used in combination with PEV2 that can be seen quantitatively & qualitatively (confocal laser scanning microscopy)

-The significance of the combination therapy is increased when photoactivated

Significance

The significance of our novel approach of antimicrobial management is that, unlike other protocols involving biofilm eradication, our strategy addresses the issue of resistance.