AC21 Special Project Fund
Final Report

Please submit AC21 Special Project Fund Final Report in **400-600 words**. Applicants should submit this report **along with your final budget summary** to the **AC21 Communicator** at their institution.

Final Report: DUE March 1, 2023

Full name and title of applicant (Project Lead)	Dr Katharina Richter
Department	Richter Lab, Surgery Department, Basil Hetzel Institute for Translational Health Research & Institute for Photonics and Advanced Sensing
University	**University of Adelaide, Australia**
AC21 Communicator's name	Dr Glen Stafford
Project Title	Plasma technology to treat multidrug-resistant infections in cystic fibrosis

Final Report (400-600 words)

Introduction: Cystic fibrosis causes mucus overproduction in the lungs which traps bacteria, commonly *Pseudomonas aeruginosa* (*PA*) and *Staphylococcus aureus* (*SA*), causing recurrent infections and irreversible damage. Best healthcare prescribes life-long oral and inhaled antibiotic therapy, but over 40% of sufferers are infected by antimicrobial resistant bacteria that form biofilms (bacterial clusters in a protective slime), resulting in treatment failure with most sufferers dying of lung failure. Therefore, innovative antibiotic-free treatments are urgently needed.

Our approach: A novel antimicrobial strategy using cold plasma technology for antibiotic-free treatment of infections. Cold plasma is an ionized gas of energized ions, free electrons and radicals. Plasma discharged in water (plasma-activated water; PAW) enriches water with reactive oxygen and nitrogen species, creating an antimicrobial environment that we have shown to destroy pathogens, including *PA* and *SA*.

Activities: We nebulised PAW to create a localized inhalation therapy against *PA* and *SA* with potential application in cystic fibrosis. We conducted research in Adelaide for antibacterial efficacy, collaborated with Freiburg for the development of a nebulised PAW product and collaborated with Strasbourg to determine interactions of nebulized PAW and cell membranes.

Achievements of activities:

- New research collaboration between the University of Adelaide and the University of Strasbourg

- Strengthening an existing collaboration between the University of Adelaide and the University of Freiburg
- Scholarly engagement and research training through a research visit at the University of Strasbourg, exchanging knowledge, sharing expertise, creating data for upcoming joint publication
- Ongoing discussion for upcoming joint grant applications and joint PhD students
- Data on efficacy of nebulised PAW against cystic fibrosis-related biofilm infections, effects on wound healing and safety in human cell culture
- Data on interactions of nebulised PAW with bacterial and human cell membranes using cutting-edge technique: solid-state NMR spectroscopy
- A PhD scholarship has been successfully awarded and a PhD student has been recruited to continue working on the nebulised PAW project. Future lab visits in Strasbourg and Freiburg are envisaged.
- Poster presentation at the Eurobiofilms conference, 31 August-3 September 2022, Palma de Mallorca, Spain
- Poster presentation at the One Health Antimicrobial Resistance Summit, 15-16 March 2023, Adelaide, Australia

Conclusion:
This project has resulted in a **new research collaboration** between the University of Adelaide and the University of Strasbourg, while an existing collaboration with the University of Freiburg and the industry partner Plasmatreat has been strengthened by collaborating on a new project.
This seed funding supported scholarly engagement and research training to validate an innovative solution to tackle the global threat of antimicrobial resistance. This combined effort addresses the United Nations' Sustainable Development Goal 3 to "Ensure healthy lives and promote well-being for all at all ages".

Achievement(s) made beyond AC21 SPF 2022:

Item	Please check the appropriate box
1.Type	**☐ Launched a new project proposal for a third-party funding** **X Joint publication** **X Others, please specify: New PhD student recruited to continue AC21 project_____**
2.Status	**X in preparation** **☐ submitted/launched (date: _____)** **☐ approved (date: _____)** **☐ rejected -will be re-submitted**
3.Project title/Publication	Molecular effects of plasma-activated water on antimicrobial-resistant pathogens in cystic fibrosis
4. Project leads, Affiliation	Dr Katharina Richter, University of Adelaide, Australia
5. Name of journal	mBio

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