

Using a novel three-dimensional inter-kingdom wound biofilm model to assess antimicrobial treatments

Eleanor Townsend

eleanor.townsend@uws.ac.uk



University of the West of Scotland
in collaboration with University of Glasgow



Outline

- Background
- Aims of study
- Next generation sequencing study
- Designing an *in vitro* chronic wound model
- Testing clinical wound wash and antibiotics



Introduction

- Diabetic foot ulcer (DFU) is a major consequence of uncontrolled diabetes
 - Infection delays healing and is linked to recurrence and chronicity (Dubsky *et al.* 2013)
 - Lack of guided treatment for infected ulcer (Høiby *et al.* 2014)
 - Amputation is a last resort treatment



Hypothesis and Aims

Standard *in vitro* models are not fully representative of *in vivo* responses to treatments

- Create a representative model which can be used to assess clinically used treatments
 - Antiseptics e.g. chlorhexidine (CHX) and povidone iodine (PVP-I)
 - Antimicrobials e.g. fluconazole (FLC), flucloxacillin (FLX), and ciprofloxacin (CIPX)

RESEARCH ARTICLE

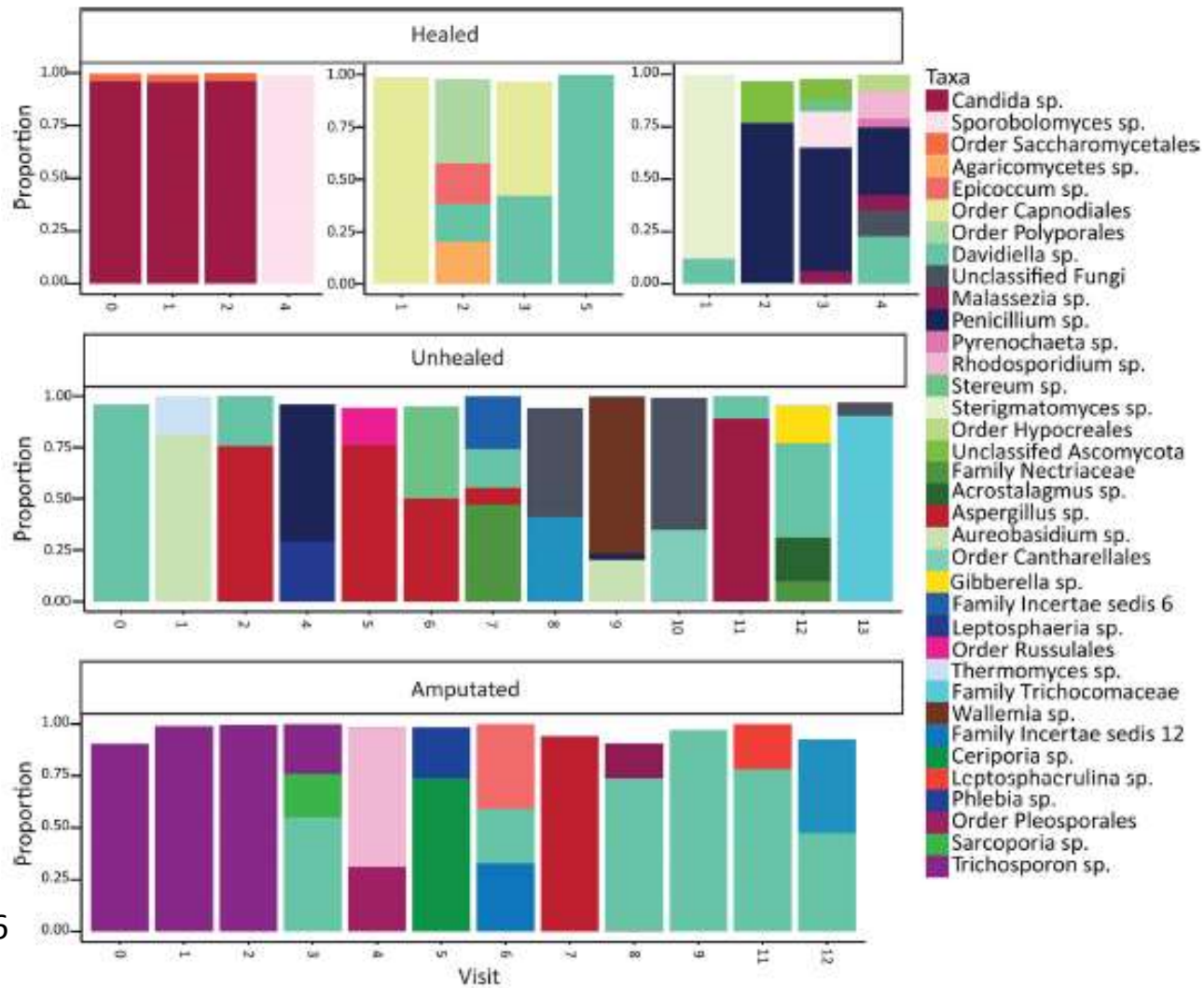
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One step closer to understanding the role of bacteria in diabetic foot ulcers: characterising the microbiome of ulcers

Karen Smith¹, Andrew Collier², Eleanor M. Townsend^{1,3}, Lindsay E. O'Donnell³, Abhijit M. Bal², John Butcher¹, William G. Mackay¹, Gordon Ramage^{3*} and Craig Williams¹







Biofouling

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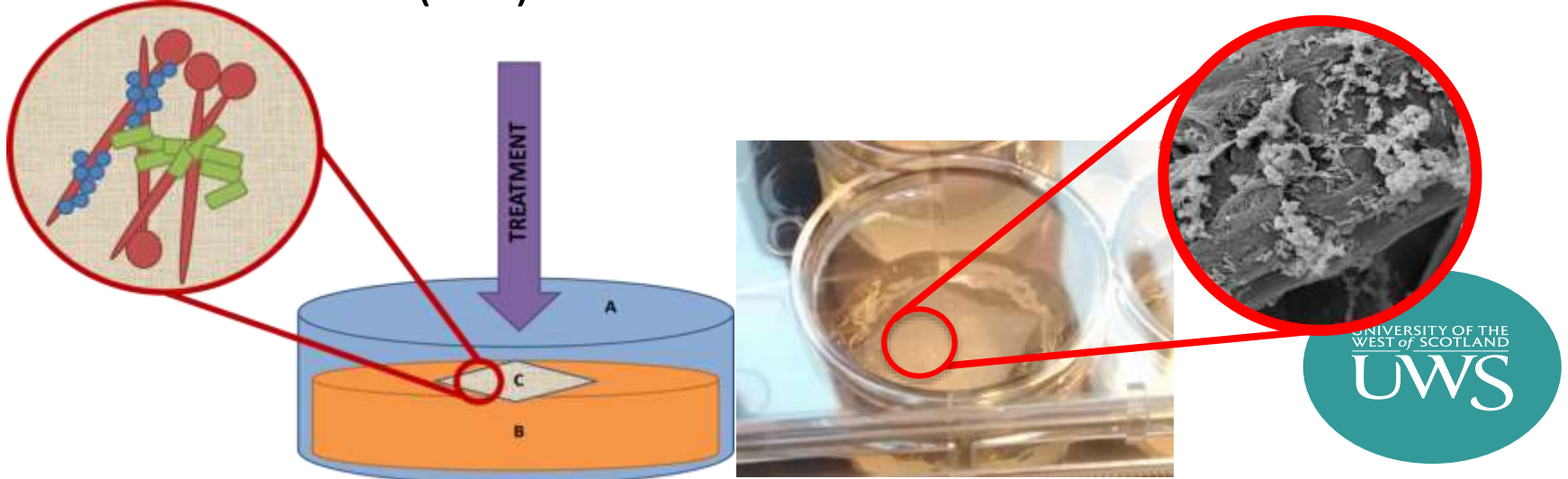
Development and characterisation of a novel three-dimensional inter-kingdom wound biofilm model

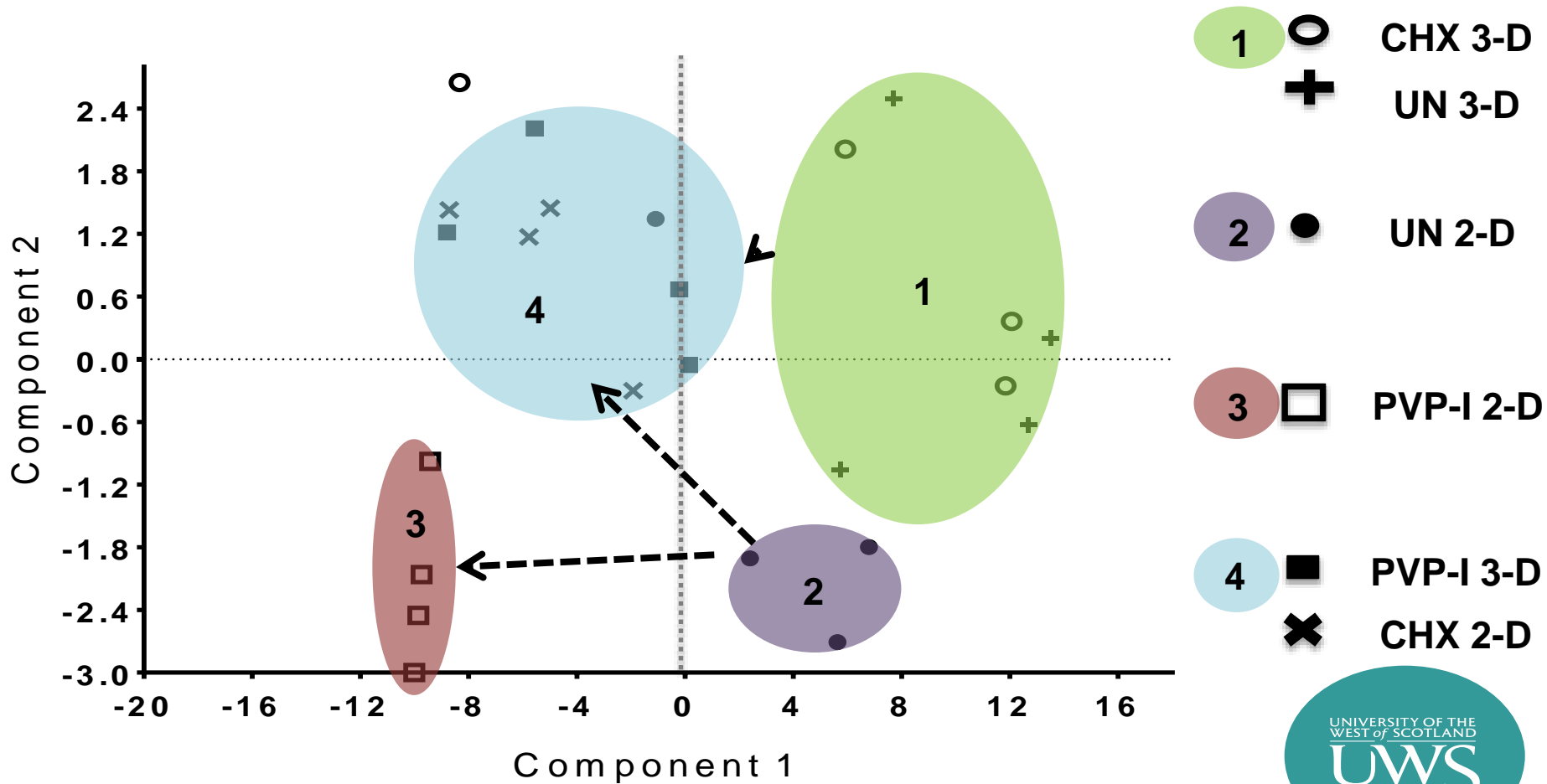
Eleanor M. Townsend, Leighann Sherry, Ranjith Rajendran, Donald Hansom, John Butcher, William G. Mackay, Craig Williams & Gordon Ramage



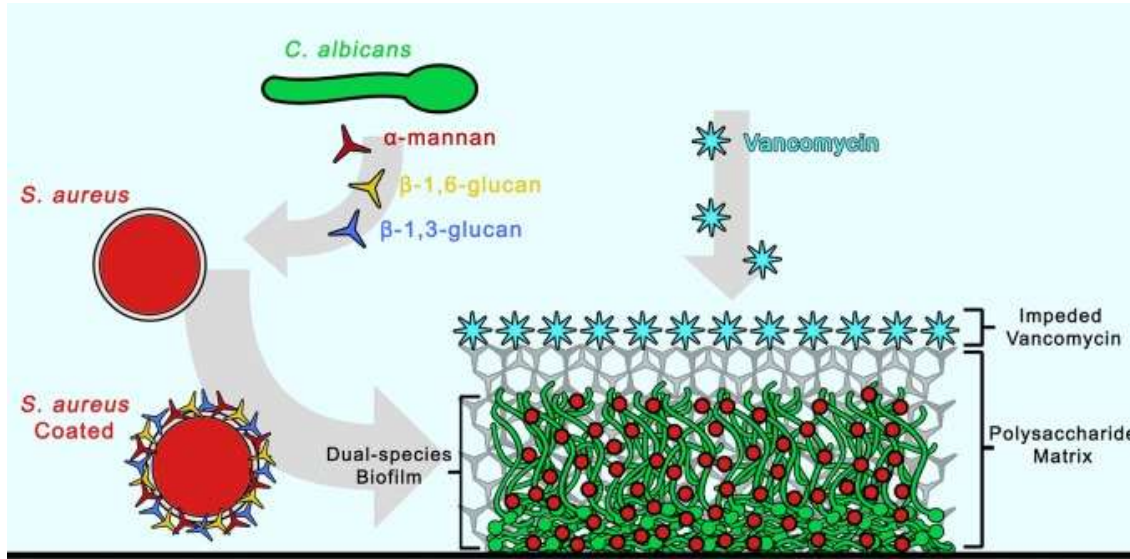
Designing an *in vitro* model

- *Candida albicans*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*
- Comparing standard laboratory plastic (2-D) and novel hydrogel-cellulose matrix (3-D) substrate.

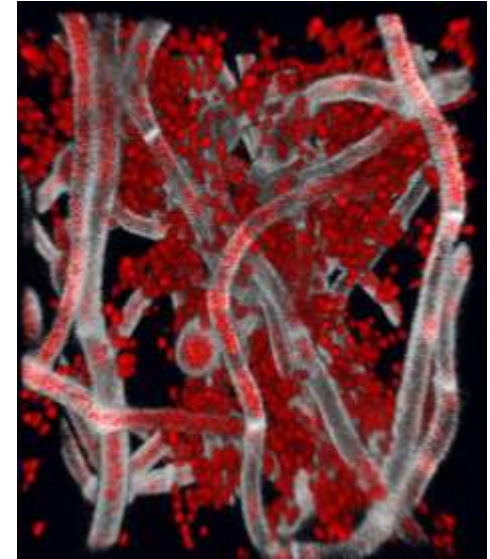




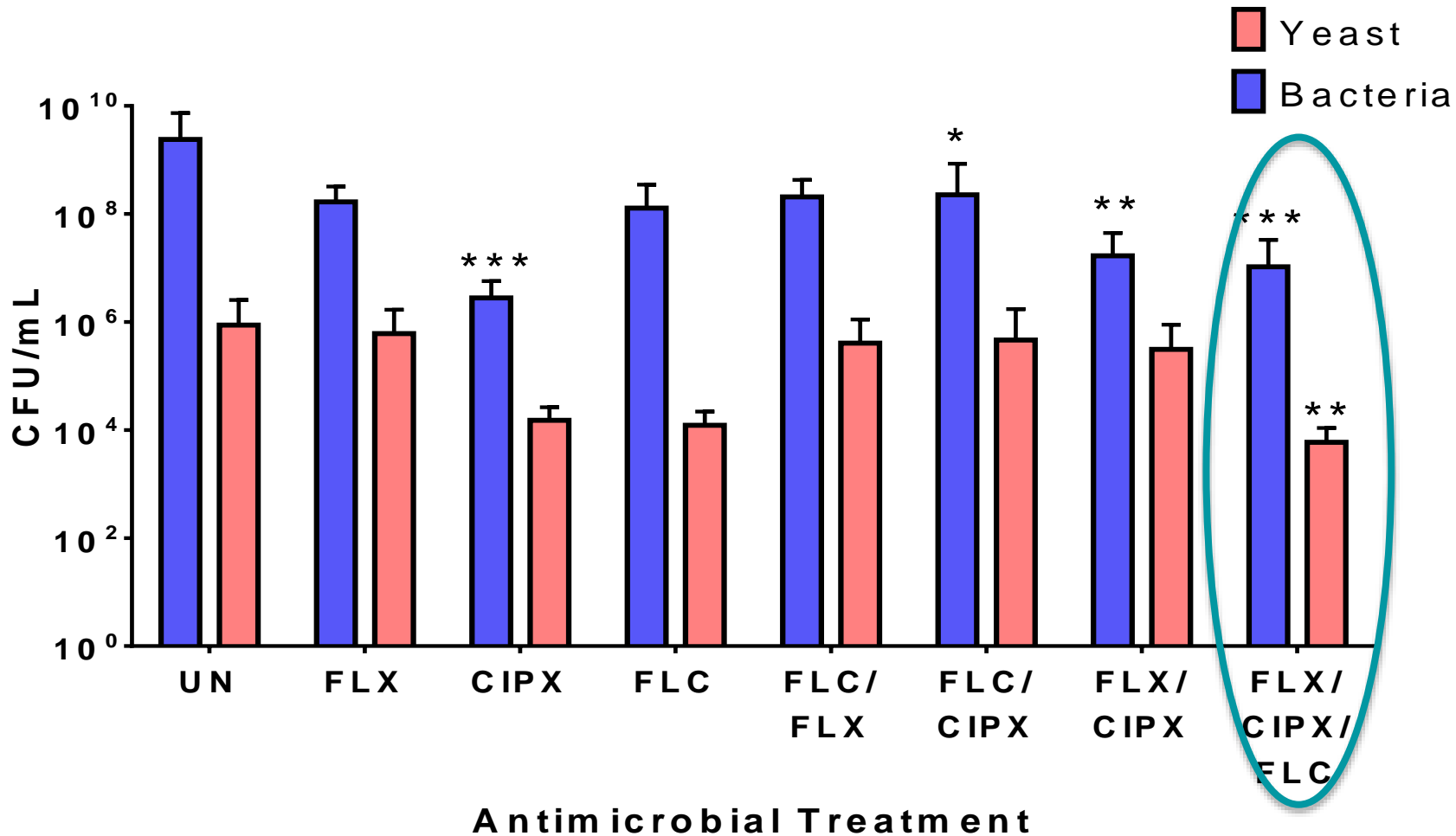
Kong *et al.* 2016

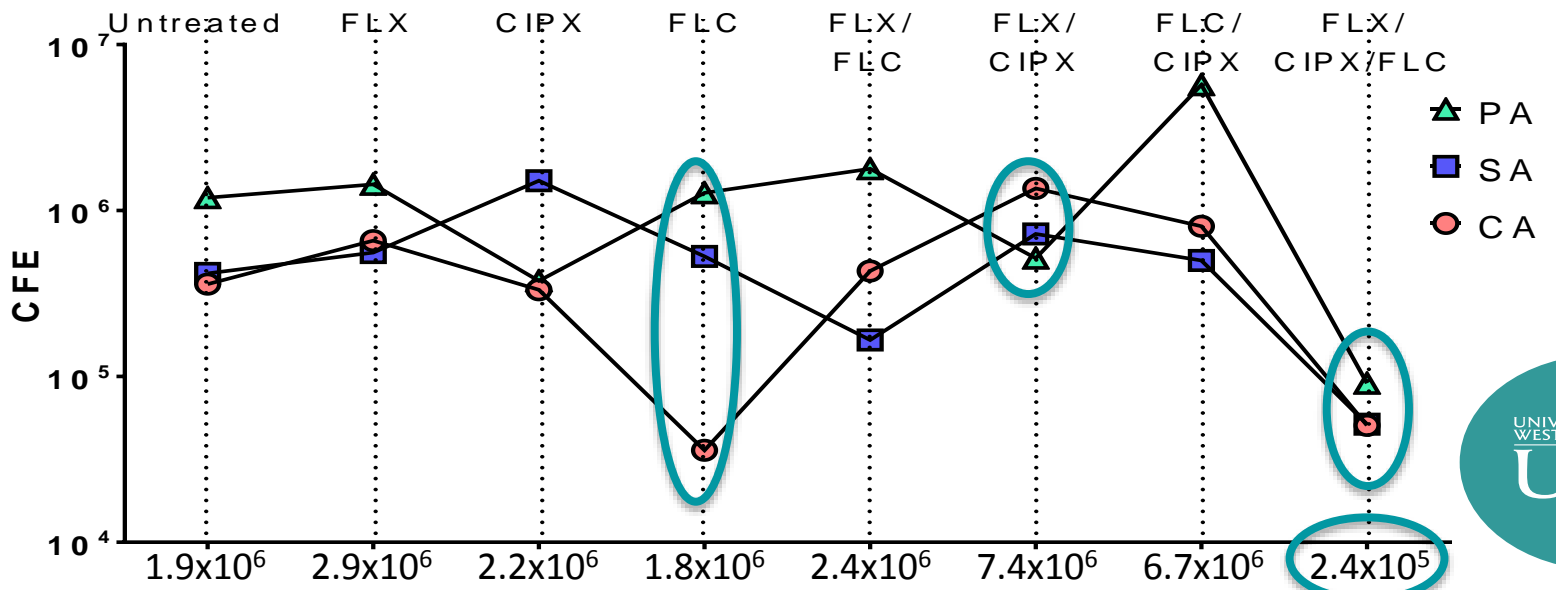
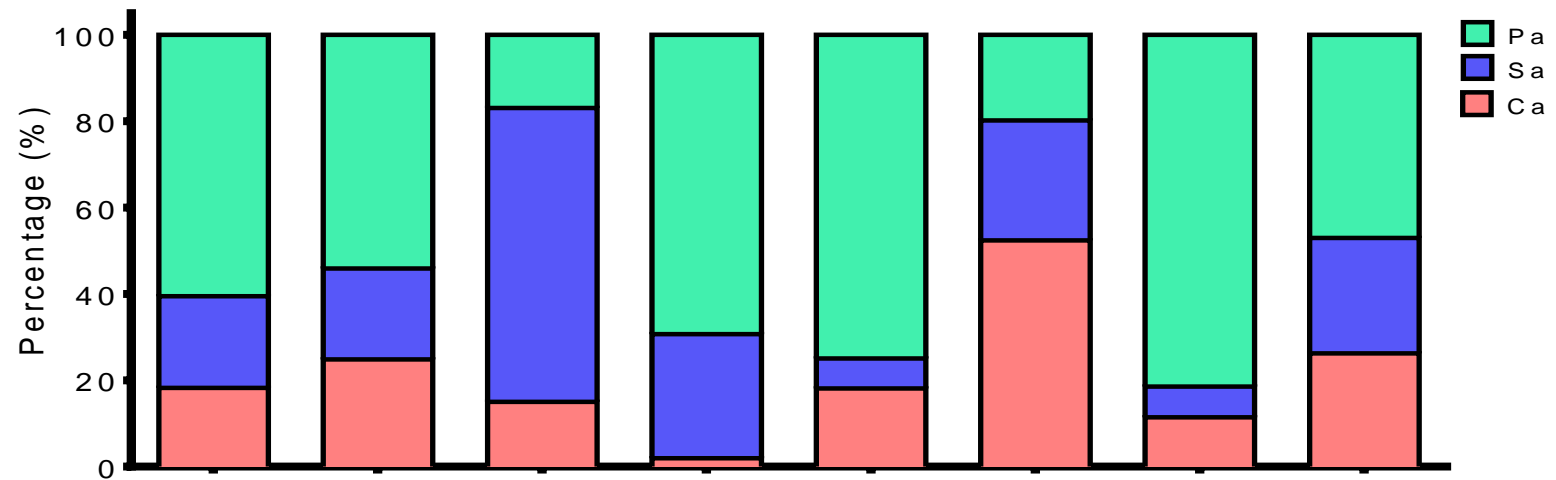


Kean *et al.* 2017



IMPACT OF ANTIMICROBIALS?

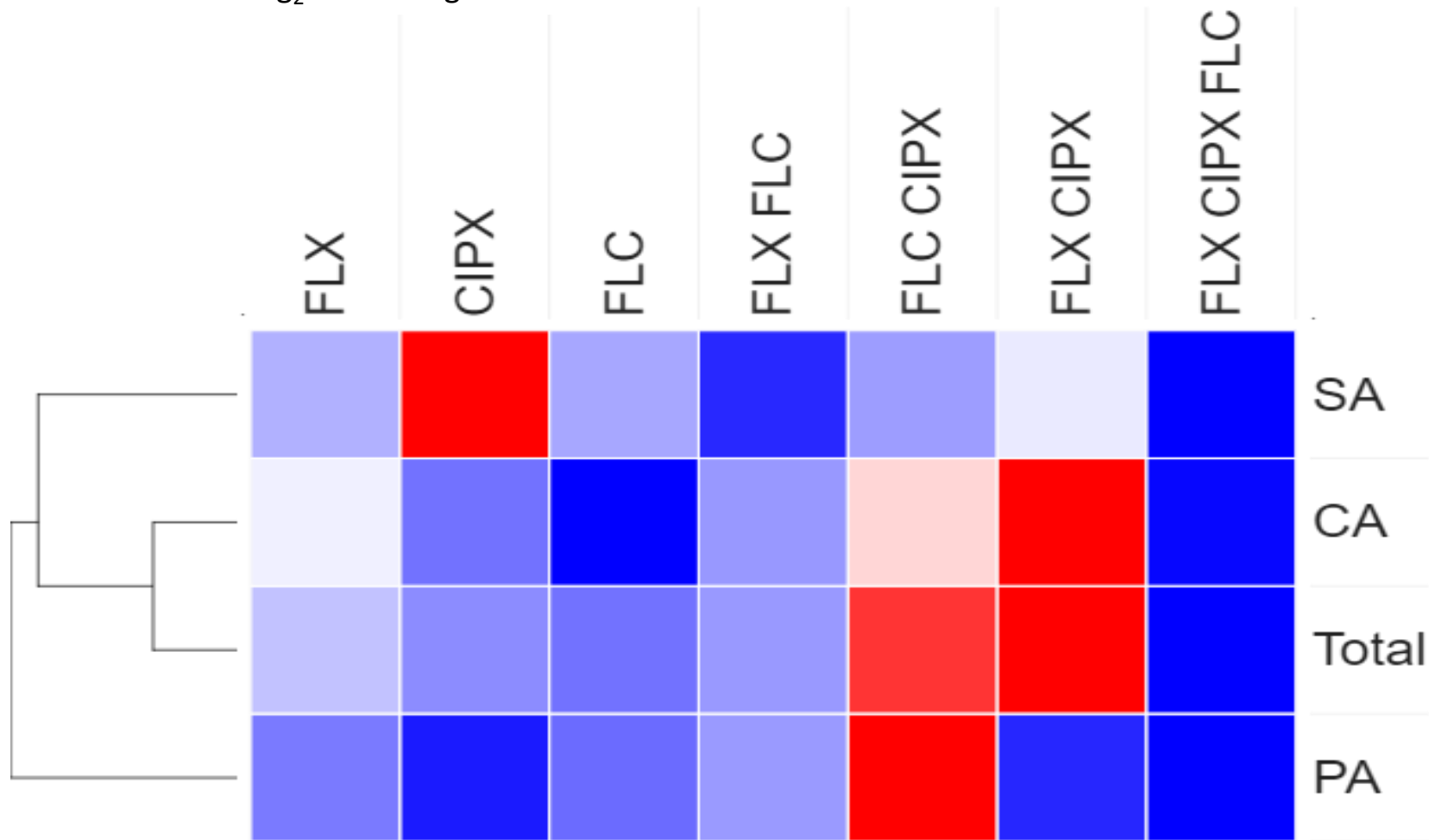




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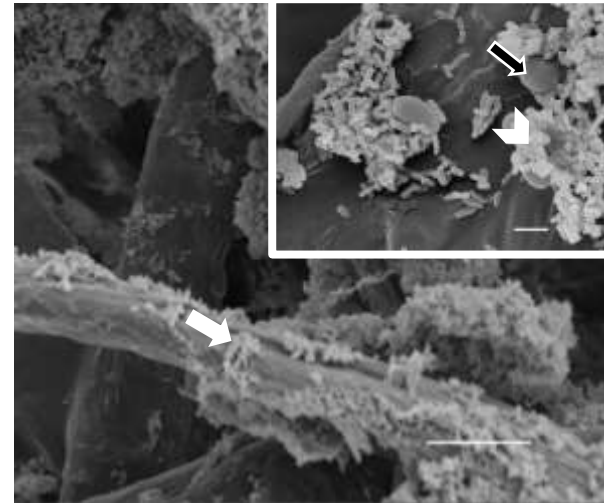
Log₂ Fold change

1.5



Conclusions

- Antifungals should be considered for routine therapy alongside antibiotics
- Inspection of biofilm before treatment
 - Avoid manipulation of community
- Other considerations
 - Diversity of wounds
 - Microenvironments within the wound



Thank you for listening

Any questions?

eleanor.townsend@uws.ac.uk

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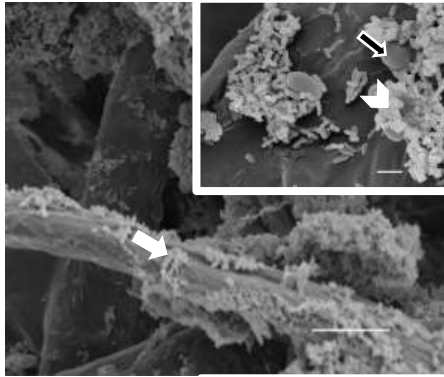
Dr Lindsay O'Donnell

NHS Ayrshire and Arran

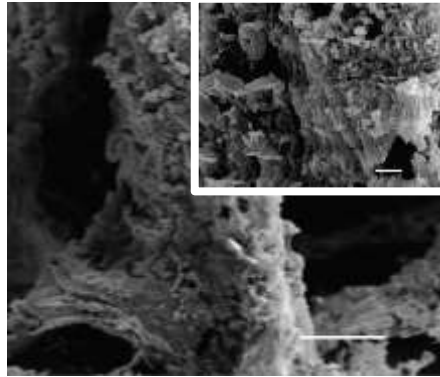
Prof Andrew Collier



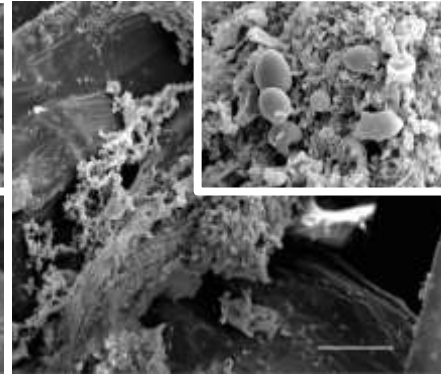
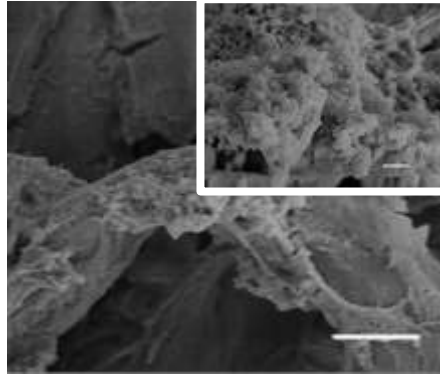
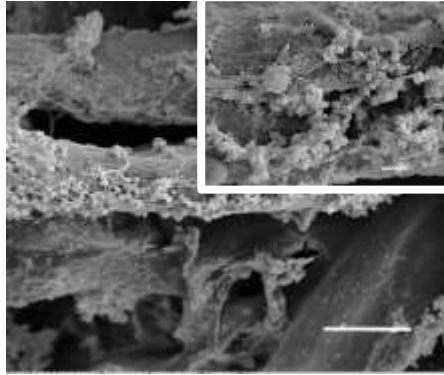
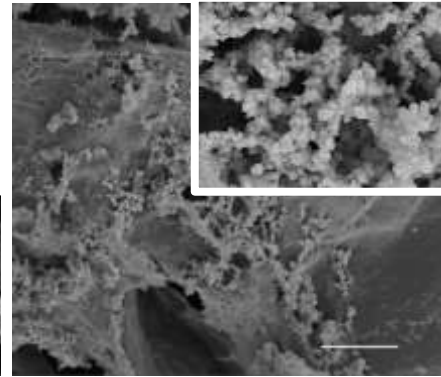
UNTREATED



FLUCLOXACILLIN



POVIDONE IODINE



CIPROFLOXACIN

FLUCONAZOLE

CHLORHEXIDINE