GAMA IPC Tour
Sydney, 12th May 2025

BEYOND THE SURFACE

Disinfectant efficacy testing in the world of biofilms

Dr Issy Centeleghe
Research Fellow (Nursing)
Cabrini Health | Monash University
Melbourne

ICenteleghe@cabrini.com.au
issy.centeleghe@monash.edu

Agenda

01	About Me
02	The Importance of disinfection
03	Key considerations
04	Suspension vs surface/carrier testing
05	Residual activity
06	Limitations of standards
07	PhD - Dry Surface Biofilms
08	Complex drain biofilm model
09	Concluding remarks

About me

- Originally from the UK
- Moved to Australia just over a month ago
- Completed a 3-year postdoc at Cardiff University with Prof. Jean-Yves Maillard
- BSc Marine Biology, MRes Biosciences, PhD Pharmaceutical Microbiology
- Just started A position at Monash University and Cabrini Health as a Research Fellow
- Main interest is biofilms

The importance of disinfection and efficacy testing

Australian Government
Department of Health and Aged Care
Therapeutic Goods Administration

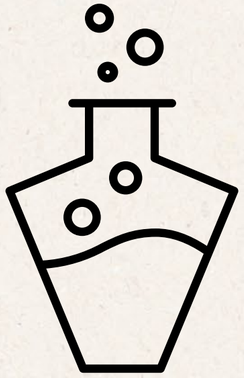
STANDARDS:

- Main function of a disinfectant is the ability to kill/inactivate microorganisms
  - Consistently updated to new, rigorous testing methods
- Stop infection spread and mitigate risks associated
  - Differences between EN, ASTM and TGA
- Keep patients, staff and equipment safe
  - Provide reliable information to give end user assurance
- Chemical or physical based
  - Validation of claims and agreement of definitions

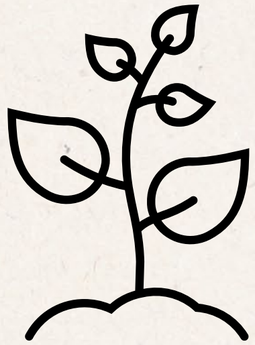
European Committee for Standardization

Key criteria for manufacturers: Contact time and concentration

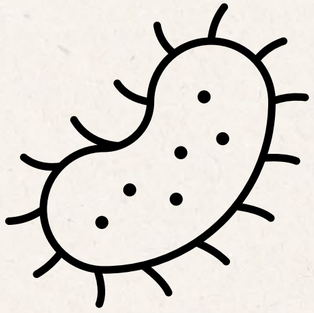
Key considerations for standard testing



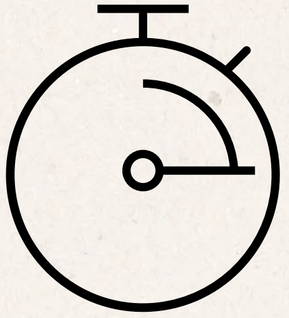
Neutralisation



Level of Soiling



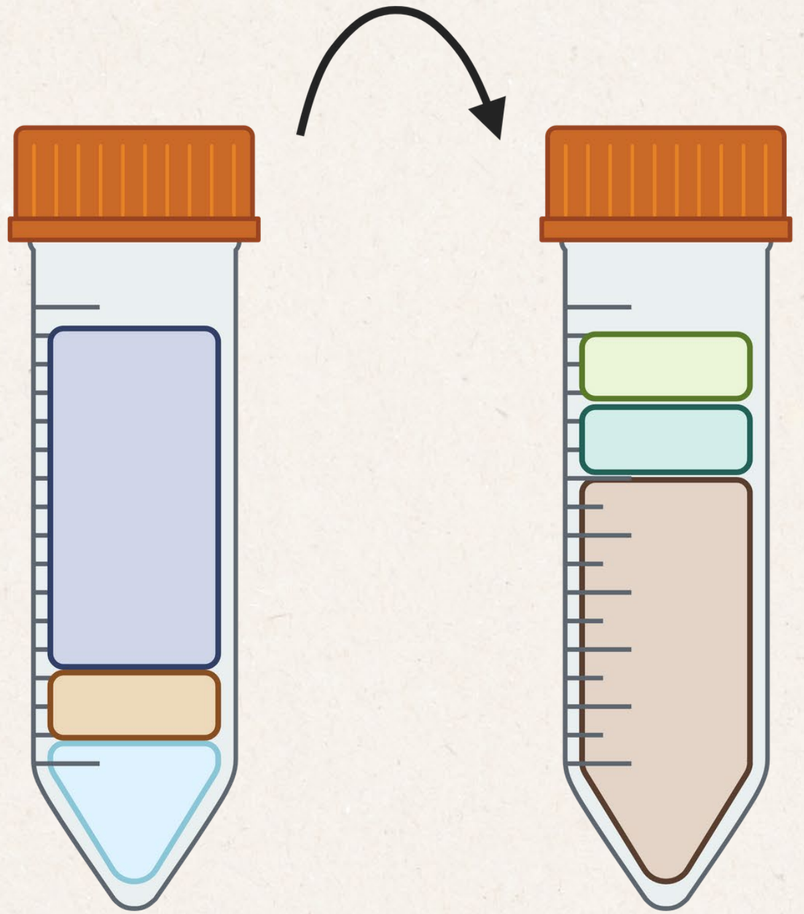
Test organisms



Contact times

SUSPENSION VS SURFACE/CARRIER TESTING

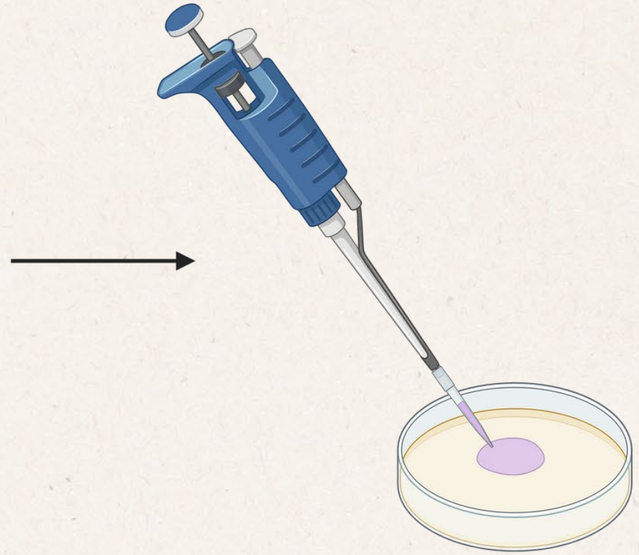
TGA | EN13727 (bacteria)
Planktonic liquid suspension
Disinfectant added directly to bacterial solution
Different log reduction for different microorganisms



SOLUTION A:
Bacterial suspension
Interfering substance
Disinfectant

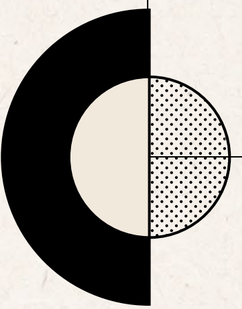
SOLUTION B:
Solution A
Neutraliser
Distilled water

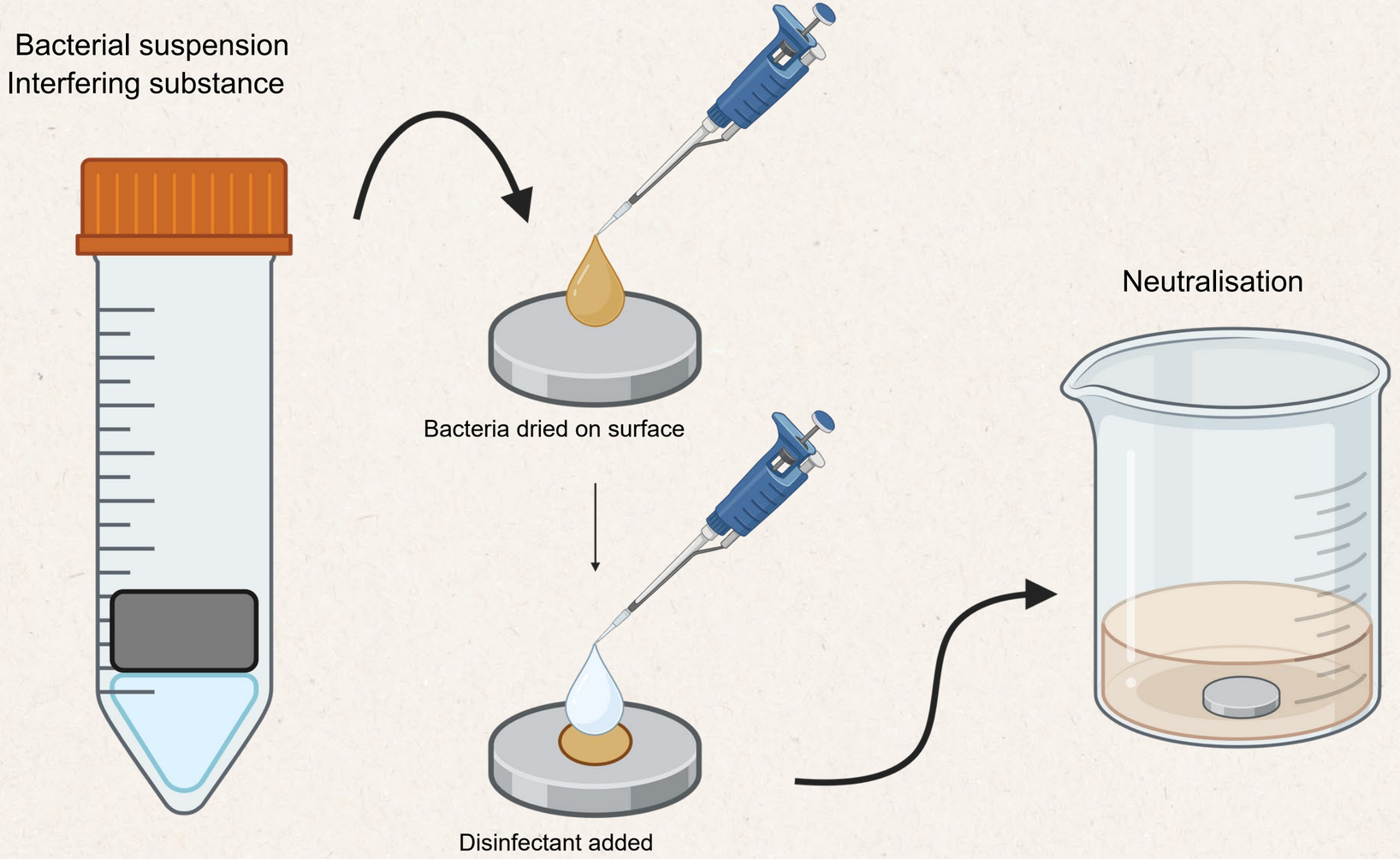
Plate and enumerate bacteria



SUSPENSION VS
SURFACE/CARRIER TESTING

EN16615 (4 field)
ASTM E2967-15 (Wiperator)
TGA | EN14561(Carrier)
Dried onto surface





Residual activity

PAS 2424 :2014

- Companies wanting to claim up to 24 hours residual activity
- Test suspension inoculated onto surface followed by disinfectant
- Dry and wet abrasion cycles
- Re-contamination of surface
- Repetition
- Enumeration when finished

Limitations/concerns of standards

Array of different standards and differences between geographical areas

How do they place in real world scenarios?

Environmental surfaces readily become soiled and recontaminated

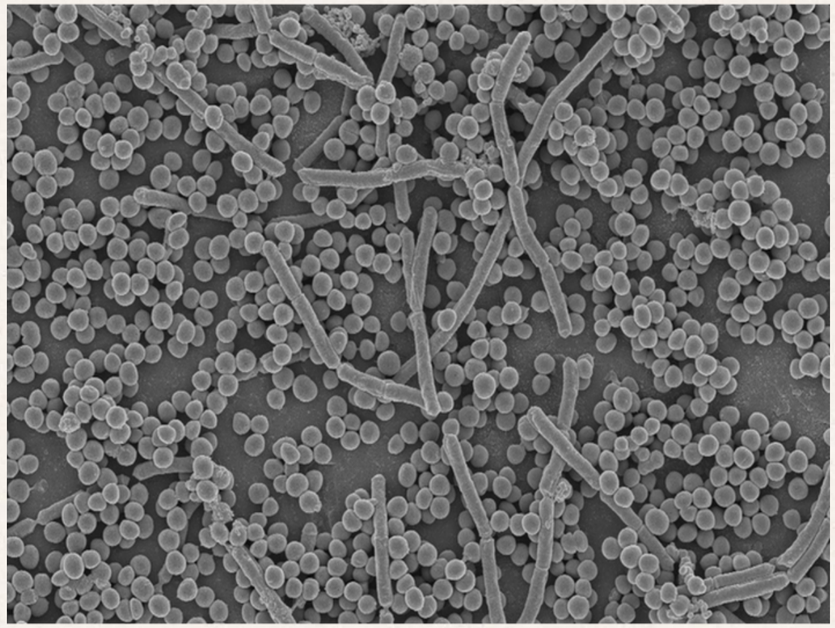
Only utilise “clean” and “dirty” conditions

No long-lasting residual activity EN standards

Focus on log reduction only

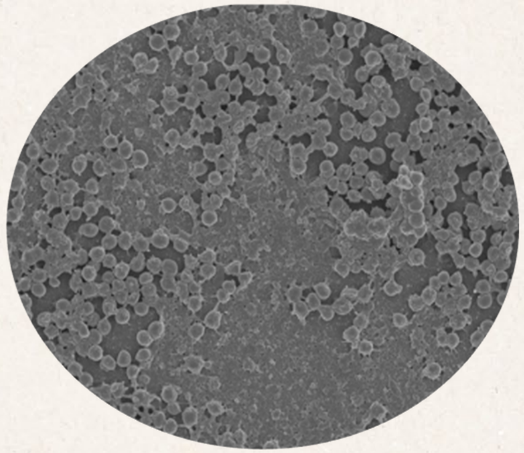
Limited diversity of test surface materials used

Typically, in the environment, bacteria are present in biofilms and are multispecies



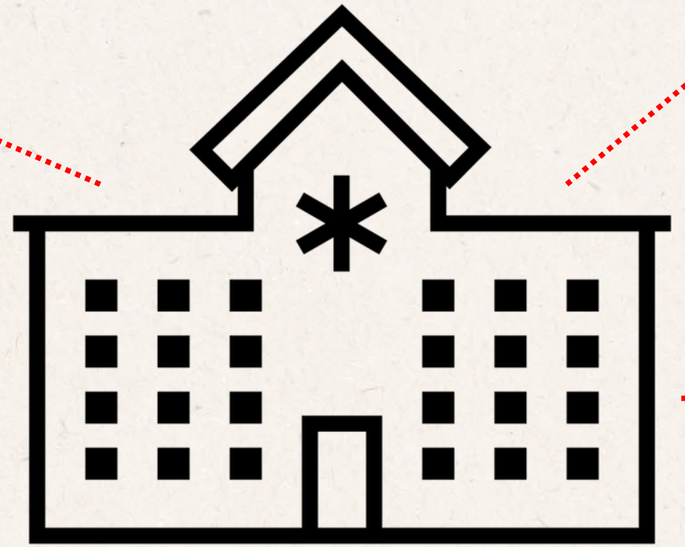
PhD: Dry Surface Biofilms

Understanding the resilience of DSB to disinfection



- Complex communities exposed to repeated desiccation periods
- Exposed to lower water potential, reduced nutrient sources and varied temperatures
- Have been found on hospital surfaces including keyboards, patient folders, blinds, mattresses
- Harbour multi-drug resistant organisms
- Highly tolerant to disinfection protocol

Why are DSB a problem?



Staff and patient safety

Cannot detect through routine swabbing

Increased hospitalisation costs

Increased mortality and outbreaks

Less responsive to biocidal products

DSB formation

Day 12 - DSB ready!

Day 0
- Inoculation phase - Bacteria + TSB + 3g/L BSA
- Shaking

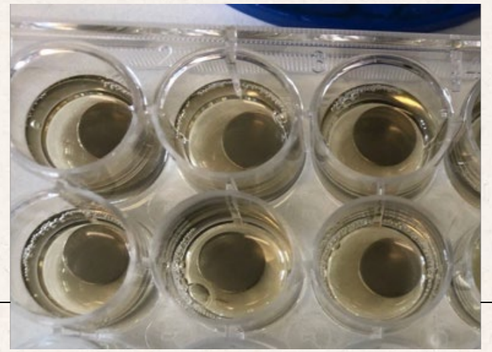
Day 2
- Dry phase - media drained
- Incubation

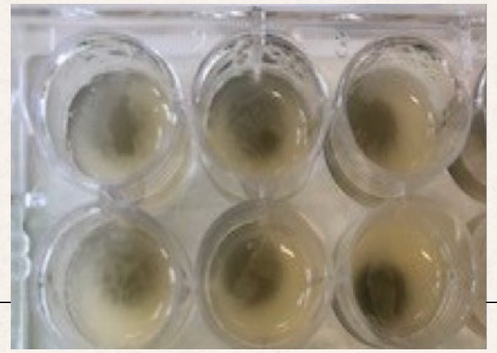
Day 4
- Wet phase - TSB + 3g/L BSA
- Shaking

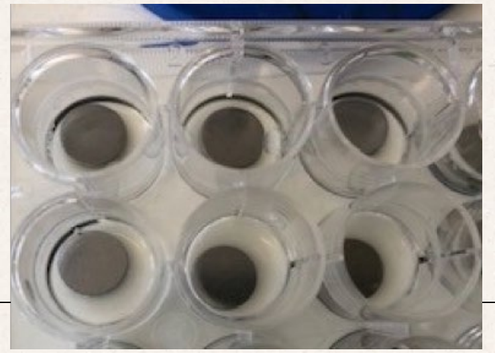
Day 6
- Dry phase - media drained
- Incubation

Day 8
- Wet phase - TSB + 3g/L BSA
- Shaking

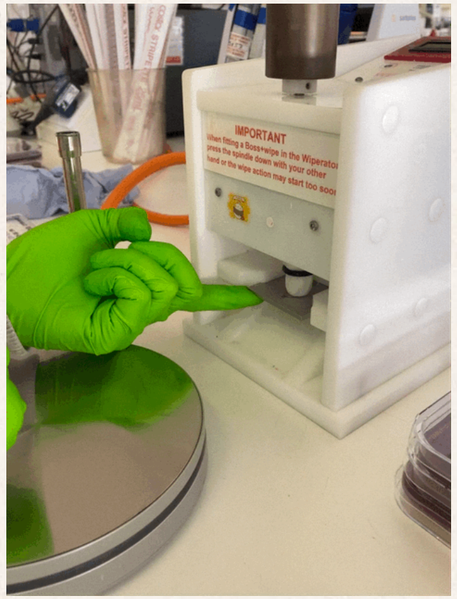
Day 10
- Dry phase - media drained
- Incubation







DSB testing



Carrier test

Testing disinfectant solutions against DSB through submersion in liquid

Wipe testing

Using the wiperator to test commercially available products

Culturabilty

How long can bacteria in DSB survive on surfaces?

Virulence

Testing pathogenicity of bacteria after being in DSB

SEM imaging

Imaging of bacteria in DSB on surfaces

Controlling DSB

Log reduction

Transferability

Regrowth

Improve hand hygiene

Improve cleaning protocols

Focus on disinfectants targeting DSB

Improve monitoring of contamination levels

The development of a drain biofilm model at Cardiff

Journal of Hospital Infection 106 (2020) 757–764

Available online at www.sciencedirect.com

Journal of Hospital Infection

journal homepage: www.elsevier.com/locate/jhin

It's a trap! The development of a versatile drain biofilm model and its susceptibility to disinfection

K. Ledwoch [a], A. Robertson [a], J. Lauran [a], P. Norville [b], J-Y. Maillard [a,*]

[a] School of Pharmacy and Pharmaceutical Sciences, Cardiff University, Cardiff, UK
[b] GAMA Healthcare, Watford, UK

Log reduction

Removal of bacteria from drain tubing after treatment

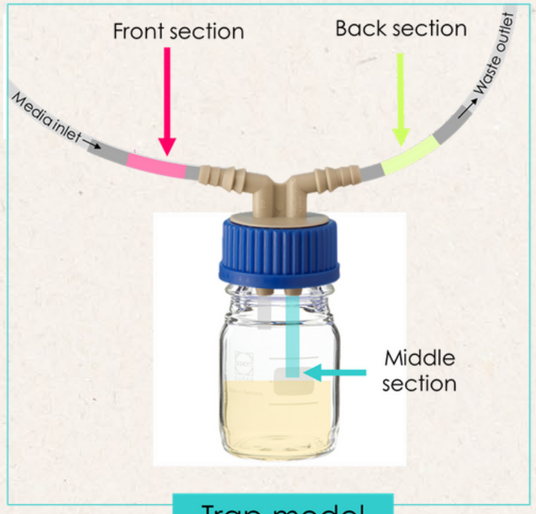
Regrowth

Time taken for bacteria remaining in the drain to recover post treatment

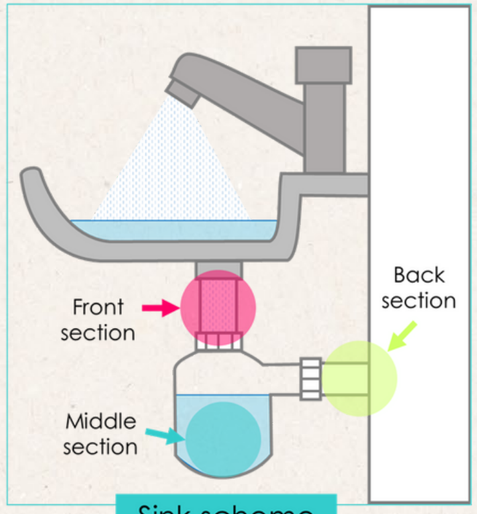
The development of a drain biofilm model at Cardiff

COMBAT
Complex Biofilms and AMR Transmission

- Mixed species drain culture taken from trap
- Taken from One Health areas – veterinary, healthcare and home environments
- Peristaltic pump used to grow biofilm and allow disinfectant into the system



Trap model

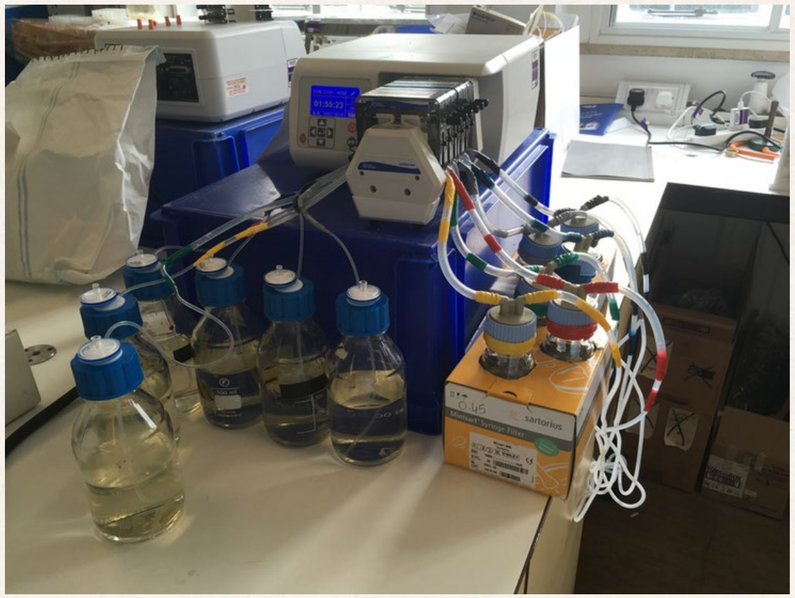


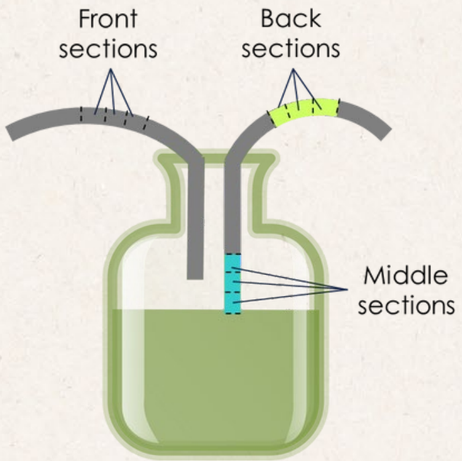
Sink scheme

The development of a drain biofilm model at Cardiff

COMBAT
Complex Biofilms and AMR Transmission

- Drain biofilm is inoculated in tubes for 2 days
- Tubes are connected to peristaltic pump with a 1:10 TSB media supply
- Drain biofilm is flushed every 2 hours for 10 seconds
- After 6 days the drain biofilm is ready for testing

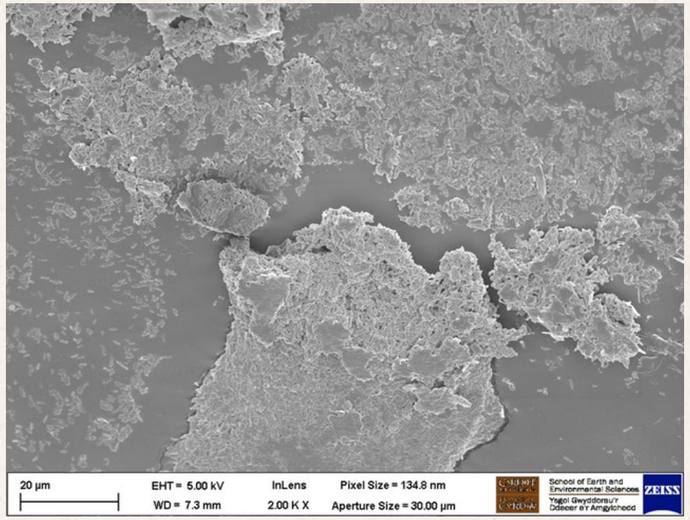


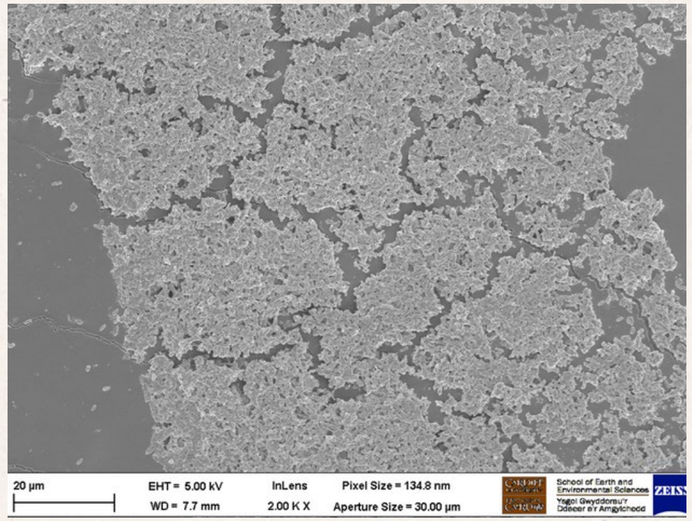


SEM imaging of drain biofilm

COMBAT
Complex Biofilms and AMR Transmission

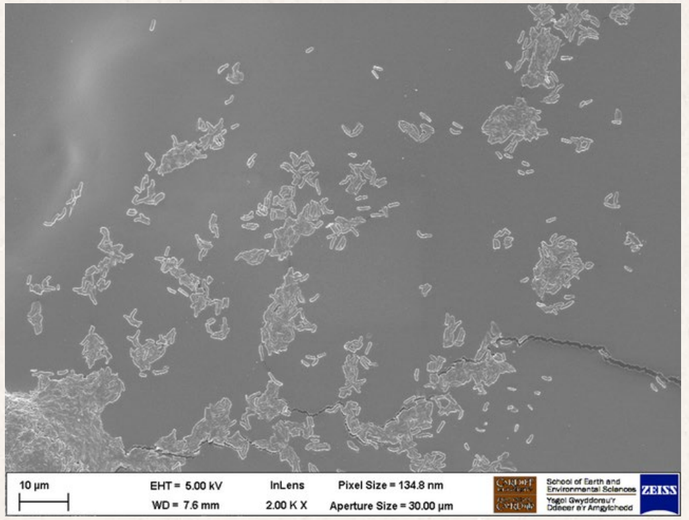
FRONT





MIDDLE

BACK



Concluding remarks

There is currently only one standard for testing biofilms

The standards available do not focus on what is actually happening in the environment

Biofilms remain a challenge in healthcare

Companies should look to testing multispecies cultures

Thank you!

Any questions?

www.linkedin.com/in/icenteleghe