ANTIMICROBIAL ENVIRONMENTAL SURFACES IN HEALTHCARE SETTINGS

CAN THEY REALLY BE BENEFICIAL?

Jean-Yves Maillard
Cardiff School of Pharmacy and
Pharmaceutical Sciences
Cardiff University

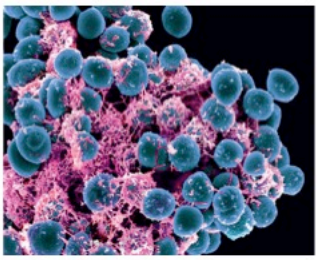
Hosted by Bruce Gamage
Provincial Infection Control Network of British Columbia

www.webbertraining.com October 27, 2016

OVERVIEW

- Antimicrobial & surfaces
- Principle for activity
- Test for antimicrobial surfaces
- Dry biofilms
- Considerations

ANTIMICROBIAL & SURFACES



3

J-Y Maillard - Teleclass 2016

ANTIMICROBIAL & SURFACES

Some facts

- **HCAIs cost the NHS: £1 billion annually (£3,154 per patient)**
  26-33$billion annually 99000death

  HPA 2012
  Plowman *et al. J Hosp Infect* 2001;47:198-209.
  National Audit Office, *The management and control of hospital acquired infection in acute NHS trusts in England.*, 2009, The Stationary Office: London
  IFIC 2011

- **20-30% of HCAIs could be avoided with better application of existing knowledge and realistic infection control practices**

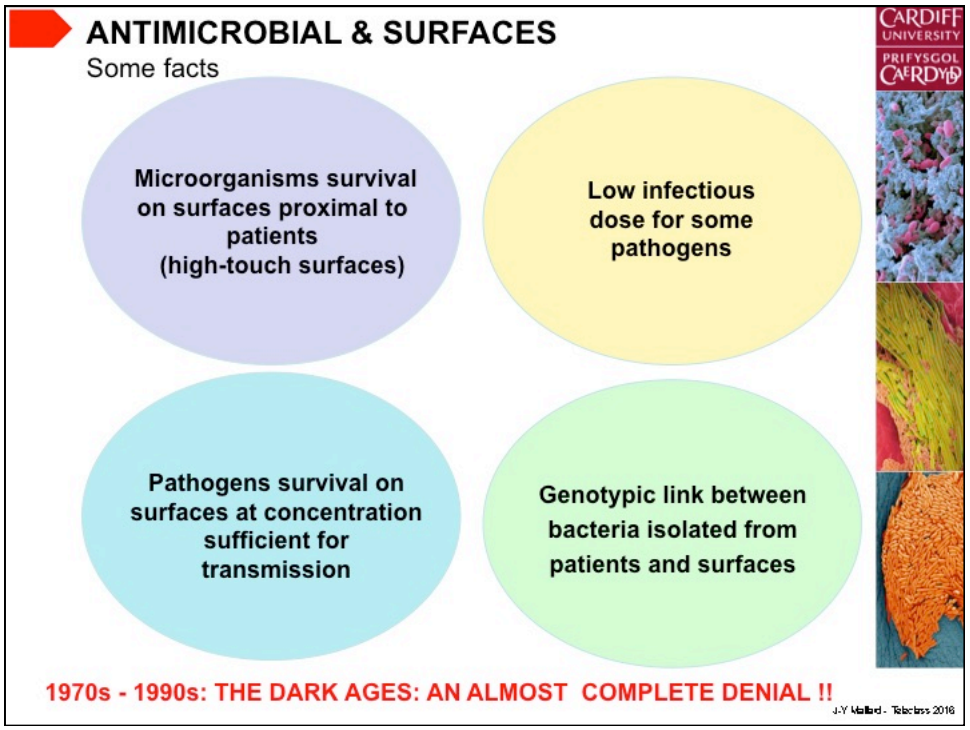
  National Audit Office 2009

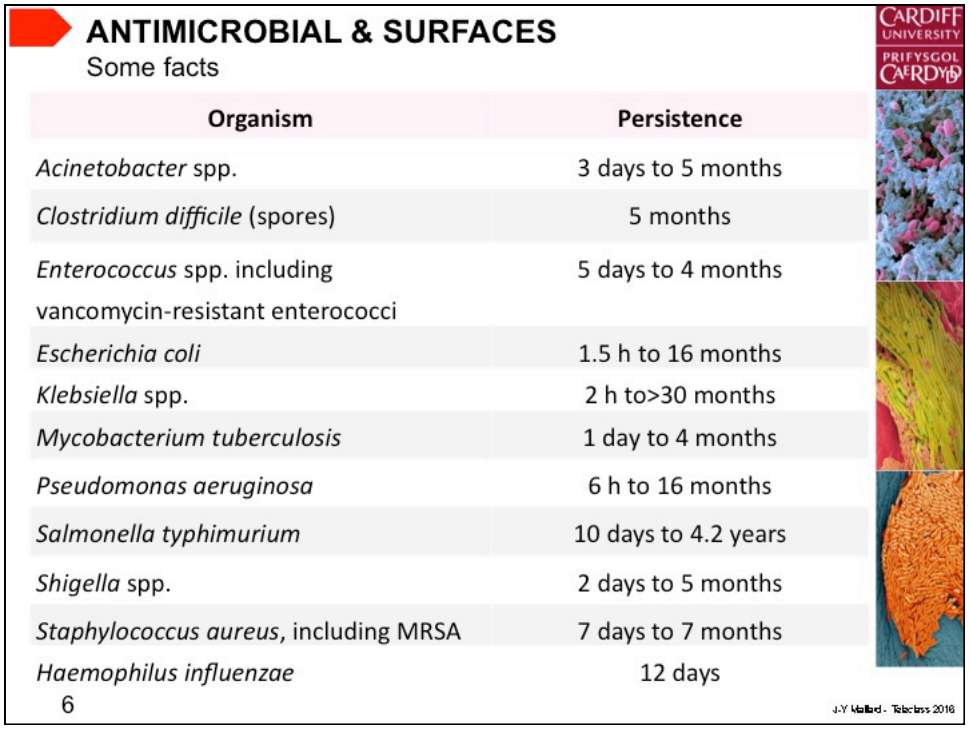
- **Enhanced cleaning practices are reported to save hospitals between £30,000–£70,000 additional cleaner calculation based on MRSA – 27% reduction**

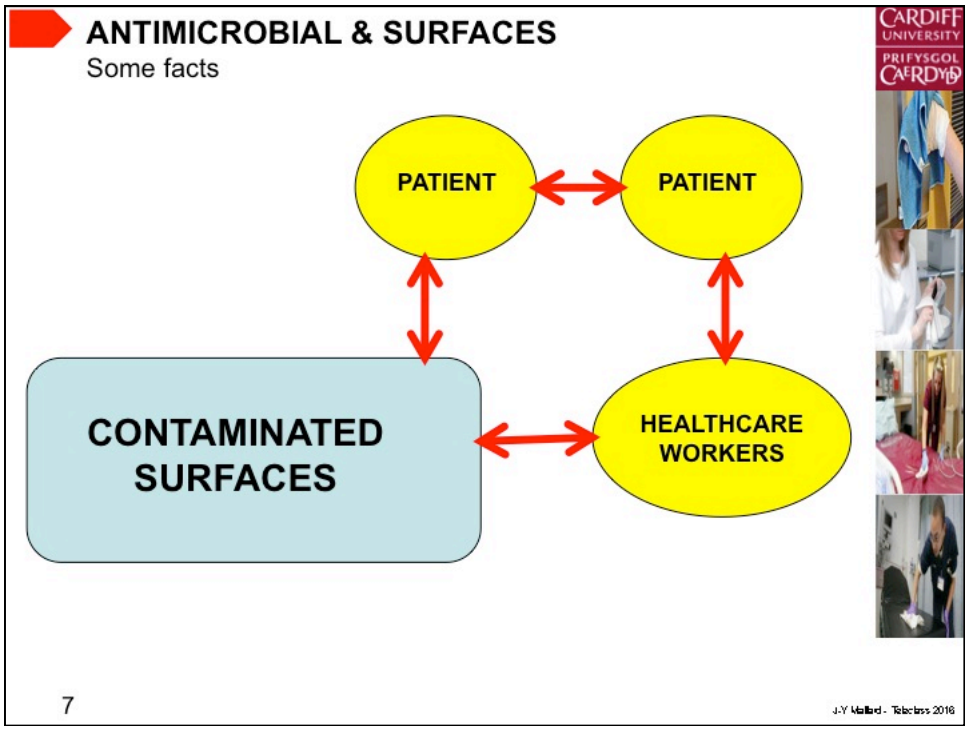
  Dancer *et al. BMC Med* 2009;7:28.

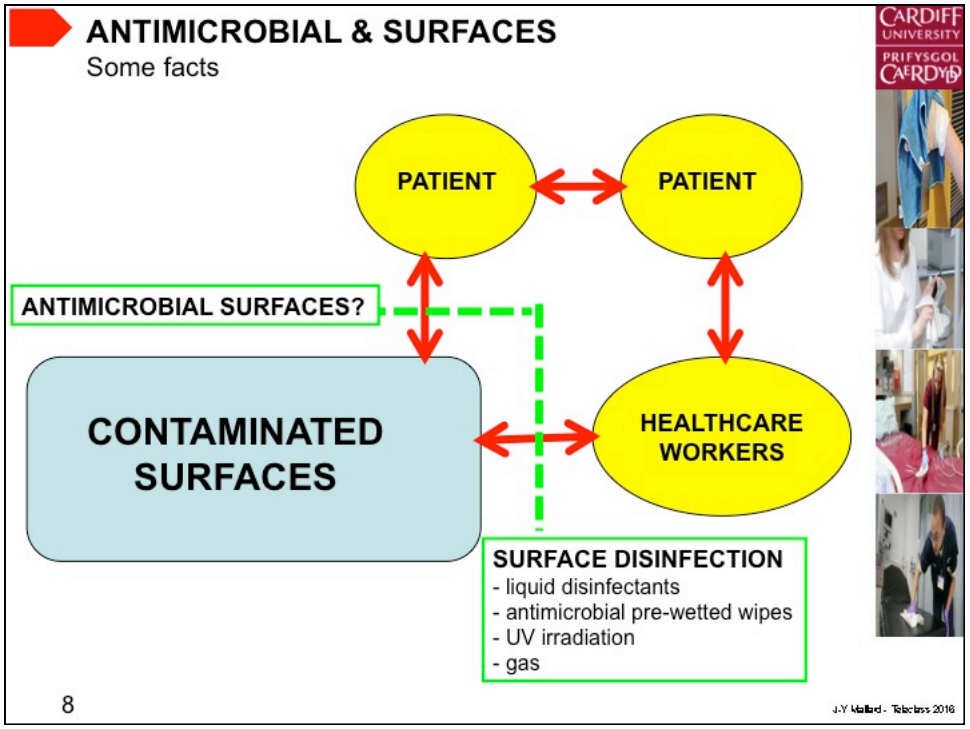
4

J-Y Maillard - Teleclass 2016


ANTIMICROBIAL & SURFACES
Some facts
Microorganisms survival on surfaces proximal to patients (high-touch surfaces)
Low infectious dose for some pathogens
Pathogens survival on surfaces at concentration sufficient for transmission
Genotypic link between bacteria isolated from patients and surfaces
1970s - 1990s: THE DARK AGES: AN ALMOST COMPLETE DENIAL !!
CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD
J-Y Maillard - Teleclass 2016

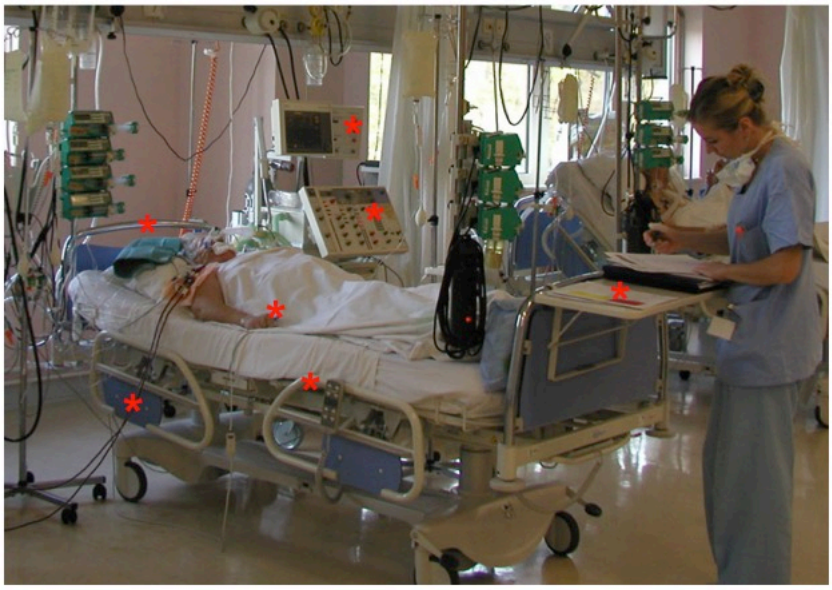

ANTIMICROBIAL & SURFACES
Some facts
Organism | Persistence
Acinetobacter spp. | 3 days to 5 months
Clostridium difficile (spores) | 5 months
Enterococcus spp. including vancomycin-resistant enterococci | 5 days to 4 months
Escherichia coli | 1.5 h to 16 months
Klebsiella spp. | 2 h to>30 months
Mycobacterium tuberculosis | 1 day to 4 months
Pseudomonas aeruginosa | 6 h to 16 months
Salmonella typhimurium | 10 days to 4.2 years
Shigella spp. | 2 days to 5 months
Staphylococcus aureus, including MRSA | 7 days to 7 months
Haemophilus influenzae | 12 days
6
CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD
J-Y Maillard - Teleclass 2016


ANTIMICROBIAL & SURFACES
Some facts
CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD
PATIENT
PATIENT
CONTAMINATED SURFACES
HEALTHCARE WORKERS
7
J-Y Maillard - Teleclass 2016


ANTIMICROBIAL & SURFACES
Some facts
CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD
PATIENT
PATIENT
ANTIMICROBIAL SURFACES?
CONTAMINATED SURFACES
HEALTHCARE WORKERS
SURFACE DISINFECTION
- liquid disinfectants
- antimicrobial pre-wetted wipes
- UV irradiation
- gas
8
J-Y Maillard - Teleclass 2016

ANTIMICROBIAL & SURFACES

Some facts



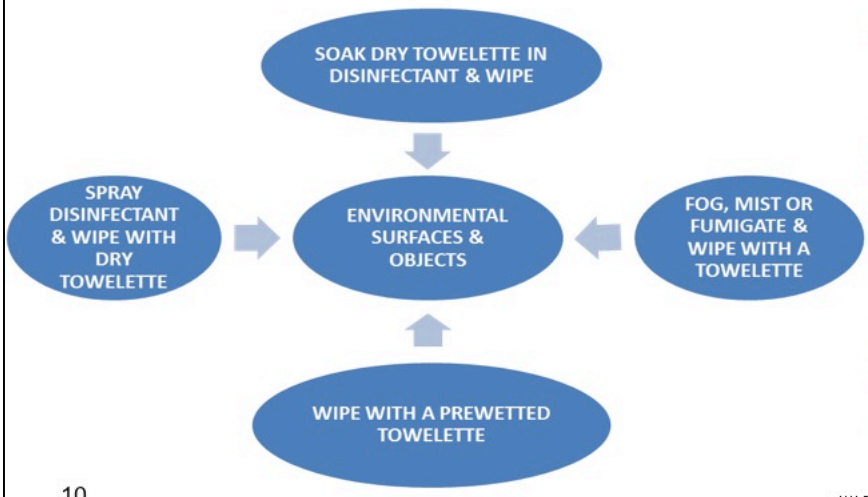
9

ANTIMICROBIAL & SURFACES

Some facts

Possible scenarios for decontaminating high-touch environmental surfaces by wiping

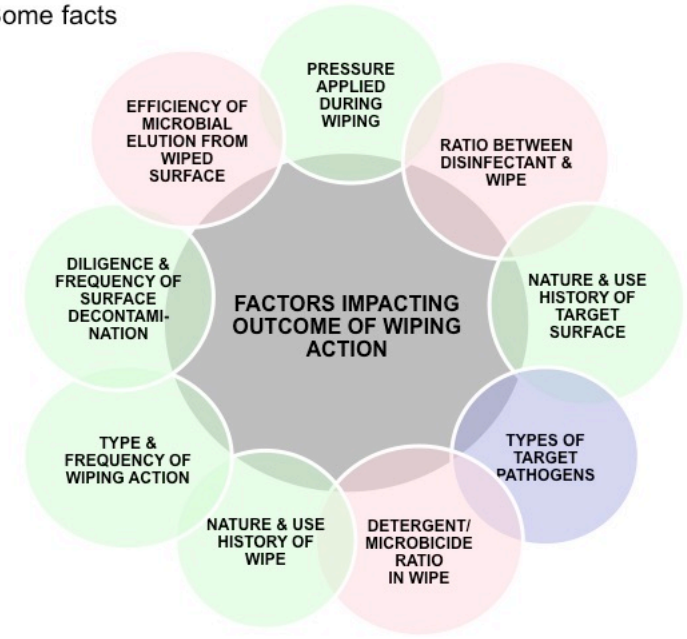
Sattar & Maillard *AJIC* 2013;41:S97-S104.



10

ANTIMICROBIAL & SURFACES

Some facts



11

Sattar & Maillard *Am J Infect Control* 2013 41;S97-S104

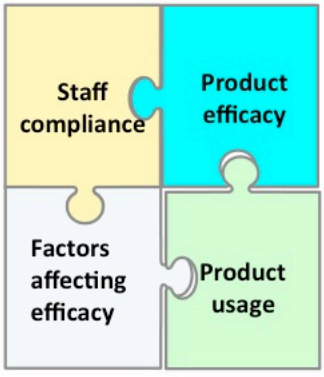
J-Y Maillard - Teleclass 2016

ANTIMICROBIAL & SURFACES

Some facts

Increasing body of knowledge which highlights improved infection control practices can help break the chain of transmission

Otter *et al. ICHE* 2011;32:687-99.
Rutala & Weber. *J Hosp Infect* 2001;48:S64-8.
Boyce. *J Hops Infect* 2007;65:50-4.



12

J-Y Maillard - Teleclass 2016

ANTIMICROBIAL & SURFACES

Antimicrobial surfaces

Environmental surfaces – not medical devices such as implants etc.

Aim

✓To reduce microbial surface bioburden in conjunction with current surface cleaning protocols

✓To minimise interventions but **NOT** to replace it

NHS Rapid Review Panel concerned with the reality of antimicrobial surface manufacturer's performance claims

13

J-Y Maillard - Teleclass 2016

ANTIMICROBIAL & SURFACES

Antimicrobial surfaces – global usage

14

J-Y Maillard - Teleclass 2016

Antimicrobial Environment Surfaces in Healthcare Settings
Prof. Jean-Yves Maillard, Cardiff University, Wales
A Webber Training Teleclass

ANTIMICROBIAL & SURFACES

Antimicrobial surfaces – global usage

15

J-Y Maillard - Teleclass 2016

ANTIMICROBIAL & SURFACES

Antimicrobial surfaces

Silver	Copper	Triclosan
Electrical switches	Arms of chair	Cutting boards
Flooring	Bed rails	Plastic lunchboxes
Keyboards	Door handles	Refrigerators
Showers	Door locks	
Waste bins	Door push plates	
Water machines	Dressing trolleys	
Laptop screens	Electrical switches	
Mobile phone screens	Floor drains	
	Handrails	
	IV drip poles	
	Keyboards	
	Nurses' call devices	
	Over bed tables	
	Table tops	
	Taps	
	Toilet flush plates	
	Toilet seats	
	Towel rails	

16

J-Y Maillard - Teleclass 2016

Hosted by Bruce Gamage
www.webbertraining.com

ANTIMICROBIAL & SURFACES

Antimicrobial surfaces – healthcare settings

HOSPITALS • CARE HOMES • GENERAL PRACTICES • KITCHENS • LABORATORIES

It's a fact!

Proven bacterial reduction in real-life hospital environment

INVESTIGATION The first ever trial to investigate the effectiveness of silver-based products at reducing levels of bacteria in an actual hospital environment has shown a 95.8% reduction in bacteria.

95.8% reduction in bacteria

92.6% reduction in bacteria

43.5% reduction in bacteria

17

J-Y Maillard - Teleclass 2016

ANTIMICROBIAL & SURFACES

Antimicrobial surfaces – healthcare settings

18

J-Y Maillard - Teleclass 2016

ANTIMICROBIAL & SURFACES

Antimicrobial surfaces – healthcare settings

- ✓ Many healthcare facilities around the world have installed copper/copper alloy fittings
- ✓ Clinical trial in an acute medical ward in UK – copper alloys presented a 90% microbial reduction vs. standard fittings

  Casey *et al. J Hops Infect* 201;74:72-77.
- ✓ One study claimed copper surfaces can reduce HCAIs by >50 %

  Salgado *et al. Infect Control hopsi Epidemiol* 2013; 34:479-486

Copper fittings in an ICU £105,000 *vs.* standard fittings £74,400

19

J-Y Maillard - Teleclass 2016

ANTIMICROBIAL & SURFACES

Antimicrobial surfaces – healthcare settings

- Metallic
  Copper alloys, silver – not a coating – no issues with duration
- Coating
  Metallic and other biocides
  Duration, scratches, robustness?
- Spray to deposit some coating
  Uniformity?
  Biocides?
  Duration?
  Robustness?
- Embedded in materials
  Bio-availability? – type of biocides
  Preservative effect i.e. protect the material from degradation?

20

J-Y Maillard - Teleclass 2016

ANTIMICROBIAL & SURFACES

Antimicrobial surfaces – healthcare settings

- **Role**
  - ✓ Decrease microbial bioburden on surfaces
  - ✓ Decrease the transfer of pathogens form surface to healthcare staff, patients and visitors
  - ✓ Decrease the transfer of pathogens between objects
- **Challenges**
  - ✓ Contact time – how fast do they work?
  - ✓ Duration
  - ✓ Compatibility with cleaning products
  - ✓ Aesthetic
  - ✓ Costs
- **Claims**
  - ✓ Decrease HAIs - kill all pathogens on surface
  - ✓ Stop all microbial transfer
  - ✓ Kill all pathogens in seconds
  - ✓ No need for additional cleaning

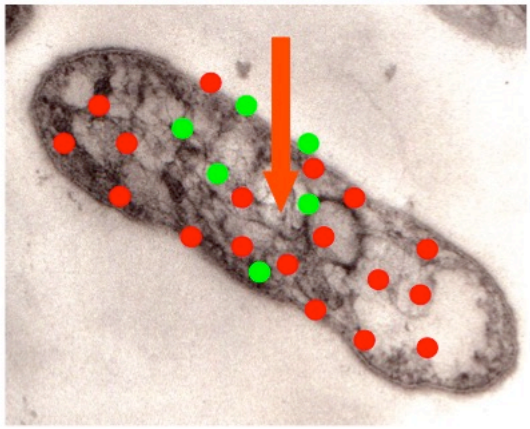
21

PRINCIPLES FOR ACTIVITY

22

PRINCIPLES FOR ACTIVITY
General considerations

- Contact
- Penetration
- Accumulation



23

J-Y Maillard - Teleclass 2016

PRINCIPLES FOR ACTIVITY
Factors affecting antimicrobial efficacy

Factors inherent to the product
- ✓concentration
- ✓formulation
- ✓water activity
- ✓pH*

Factors inherent to the application
- ✓surface
- ✓organic load (soiling)
- ✓temperature
- ✓contact time
- ✓humidity

Factors inherent to the micro-organism
- ✓type
- ✓number
- ✓phenotype
- ✓pH*

24

J-Y Maillard - Teleclass 2016

PRINCIPLES FOR ACTIVITY

Factors affecting antimicrobial efficacy

Factors inherent to the product
- ✓**concentration**
- ✓formulation
- ✓water activity
- ✓pH*

Factors inherent to the application
- ✓**surface**
- ✓**organic load (soiling)**
- ✓**temperature**
- ✓**contact time**
- ✓**humidity**

Factors inherent to the micro-organism
- ✓type
- ✓number
- ✓phenotype
- ✓pH*

25

J-Y Maillard - Teleclass 2016

PRINCIPLES FOR ACTIVITY

Factors affecting antimicrobial efficacy

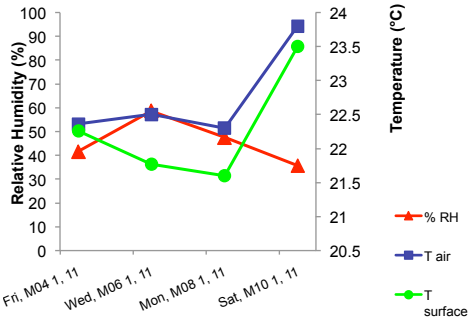
Factors inherent to the product
- ✓concentration
- ✓formulation
- ✓water activity
- ✓pH*

Factors inherent to the application
- ✓surface
- ✓organic load (soiling)
- ✓**temperature**
- ✓contact time
- ✓**humidity**

Factors inherent to the micro-organism
- ✓type
- ✓number
- ✓phenotype
- ✓pH*

JIS-Z-2801 standard efficacy test
- •Temperature: 35°C
- •Humidity: 100% humidity
- •Contact time: 24 hours

Surface Temperature and Relative Humidity, UHW



26

J-Y Maillard - Teleclass 2016

TESTS FOR ANTIMICROBIAL SURFACES

27

TESTS FOR ANTIMICROBIAL SURFACES

Parameters to consider

Physical conditions in healthcare settings

- ✓Temperature
- ✓Relative humidity
- ✓Duration – high touch surfaces

What is the contact time between individuals touching a high touch surface?

Microorganisms

How are micro-organisms deposited on surface?

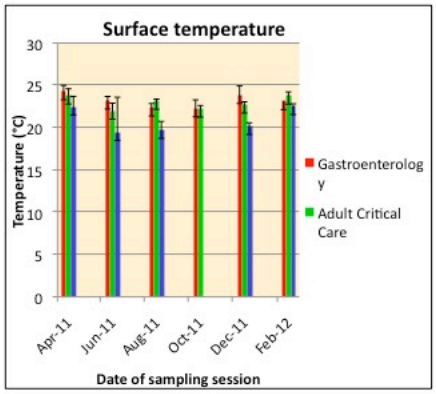
- ✓Contamination from hands – some RH
- ✓Contamination from the atmosphere – dry, on fomites
- ✓Contamination from objects – low RH

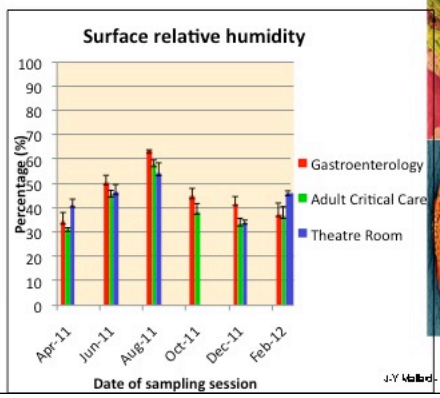
28

TESTS FOR ANTIMICROBIAL SURFACES

Parameters to consider

- Over a one year period high-touch surfaces were sampled for temperature and humidity to help set parameters *in vitro*.
- Gastroenterology, ICU and Theatre at University Hospital Wales





29

J-Y Maillard - Teleclass 2016

TESTS FOR ANTIMICROBIAL SURFACES

Current standard tests

ISO22196 / JIS Z 2801
Plastics. Measurement of antibacterial activity on plastics surfaces

ASTM E2180-01
Standard Test Method for Determining the Activity of Incorporated Antimicrobial Agent(s) In Polymeric or Hydrophobic Materials

ASTM E2149-01
Standard Test Method for Determining the Antimicrobial Activity of Immobilized Antimicrobial Agents Under Dynamic Contact Conditions

XP G 39-010
Propriétés des étoffes bioétoffes à propriétés antibactérienne par contact

30

J-Y Maillard - Teleclass 2016

TESTS FOR ANTIMICROBIAL SURFACES

Current standard tests - ISO22196 / JIS Z 2801

- Test surfaces inoculated with bacterial suspension, covered with a film, incubated at 35°C, 100% RH for 24 h, viable bacteria determined

Problems?

- 37°C and 100 % RH – too high, not realistic
- 24 h contact – too long
- Liquid interface

31

J-Y Maillard - Teleclass 2016

TESTS FOR ANTIMICROBIAL SURFACES

Current standard tests - ASTM E2180-01 / ASTM E2149-01

- Test for fabrics not hard surface – high volume to sample ratio hydrophobic textiles, plastics
- Material in contact with an nutrient broth for 1- 24 h (ASTM E2180-01) or 0.3% agar slurry in saline for 24H (ASTM E2149-01) at 37°C.

Problems?

- Temperature and RH not controlled
- 1-24 h contact – too long
- Bacteria seeded in the broth or agar – wet inoculum
- Agar/broth – facilitate the diffusion of antimicrobial – e.g. ionic silver

32

J-Y Maillard - Teleclass 2016

TESTS FOR ANTIMICROBIAL SURFACES

Current standard tests - XP G 39-010

- Test for fabrics not hard surface – cell suspension intimate contact test
- Material in contact with an agar plate inoculated with test bacteria (*S. aureus* and *K. pneumoniae*) microorganisms for 1 min with 200 g weight
- Use of a neutralizer to quench the activity of the biocide

Problems?

- Not for hard surface
- Temperature and RH not controlled
- Bacteria seeded in the agar – wet inoculum
- Agar – facilitate the diffusion of antimicrobial – e.g. ionic silver

TESTS FOR ANTIMICROBIAL SURFACES

Current standard tests

- A surface may pass ISO22196 or ASTM E2149-0. However a lower incubation conditions (i.e. *in situ*) may not present the same antimicrobial activity – **false positive claims by manufacturers?**
- **No current 'dry inoculum' standard test exists**

TESTS FOR ANTIMICROBIAL SURFACES

Do antimicrobial surface work? – from the literature

In vitro testing

Researchers have utilised a low-volume, 'dry' inoculum that dries within 5 s

•Use of 1 µL ('dry') or 20 µL ('wet inoculum') on Cu surfaces

• Warnes and Keevil. *Appl Environ Microbiol* 2011;77:6049-6059.

•Staphylococci were inactivated by both moist (40 µL) and dry (1 µL) Cu surfaces

Mehtar et al. J *Hosp Infect* 2007;68-45-51
Espirito Santo et al. *Appl Environ Microbiol* 2010;76:1341-1348.

Field trials

•Cu resulted in diminishing bacterial surface-loads up to 90% as compared to controls

Casey *et al. J Hosp Infect* 2010;74:72-77.
Mikolay *et al. Appl Microbiol Biotechnol* 2010;7:1875-1879.

•Decrease rate of HAI and/or MRSA or VRE colonization in ICU rooms (0.071 vs. 0.123; *P*=0.020)
•Decrease rate of HAI from 0.081 to 0.034 (*P*=0.013)

Salgado *et al. Infect Control Hosp Epidemiol* 2013;34:479-486.

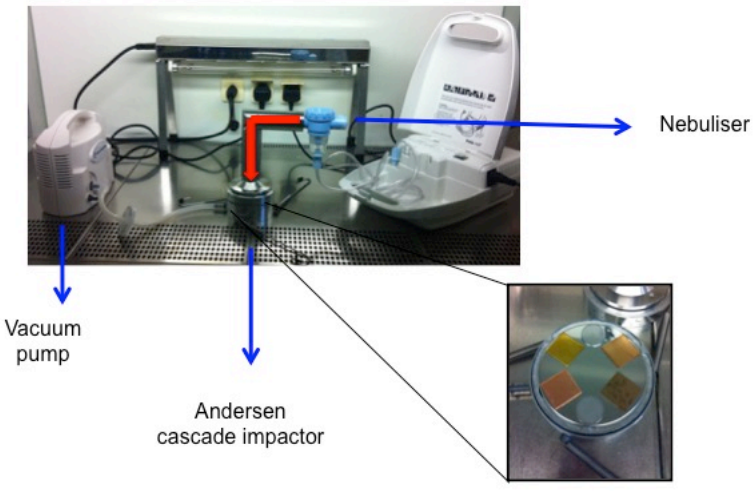
35

J-Y Maillard - Teleclass 2016

TESTS FOR ANTIMICROBIAL SURFACES

Do antimicrobial surface work? – Novel test

Wet inoculum test set-up – to mimic aerosol deposition on surfaces (e.g. coughing, sneezing)



O'Jeil *et al. Infect J Hosp Infect* 2013;85:274-281.

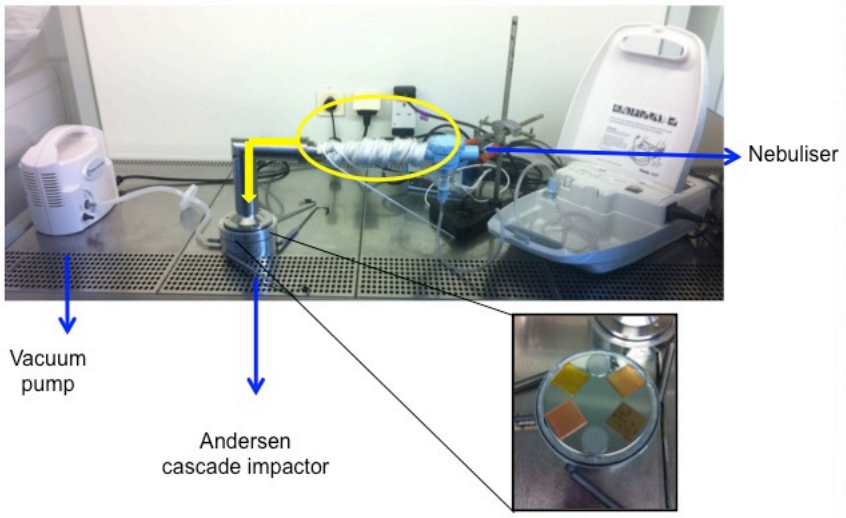
36

J-Y Maillard - Teleclass 2016

TESTS FOR ANTIMICROBIAL SURFACES

Do antimicrobial surface work? – Novel test

Dry inoculum test set-up – to mimic dry touch contamination



37

J-Y Maillard - Teleclass 2016

TESTS FOR ANTIMICROBIAL SURFACES

Do antimicrobial surface work? – Novel test

Deposition of dry/wet inoculum on surfaces

↓

Incubate surfaces for 30 min, 60 min and 24 h at:
- 37°C-100% RH
- 20°C-50% RH
- 20°C-40% RH

↓

Enumerate viable bacteria

38

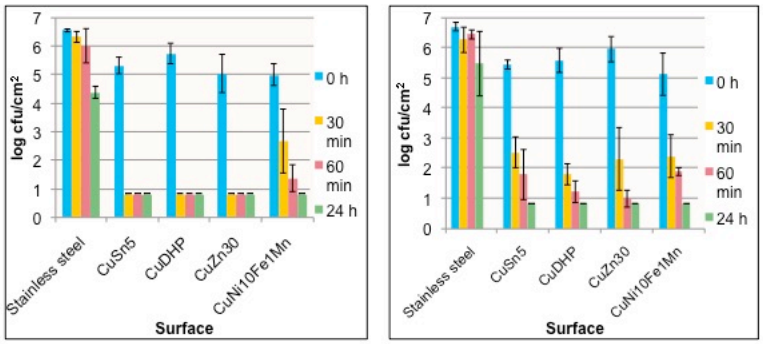
J-Y Maillard - Teleclass 2016

TESTS FOR ANTIMICROBIAL SURFACES

Do antimicrobial surface work? – Novel test

Wet inoculum (*S. aureus*) testing results- aerosol deposition

37°C-100% RH **20°C-40% RH**



- At 37°C-100% RH copper alloys displayed a >4 $\log_{10}$ reduction of viable *S. aureus* after 30 min
- At in-use conditions antimicrobial activity was slower; 60 min required for >4 $\log_{10}$ reduction

39

O'Jeil *et al. Infect J Hosp Infect* 2013;85:274-281.

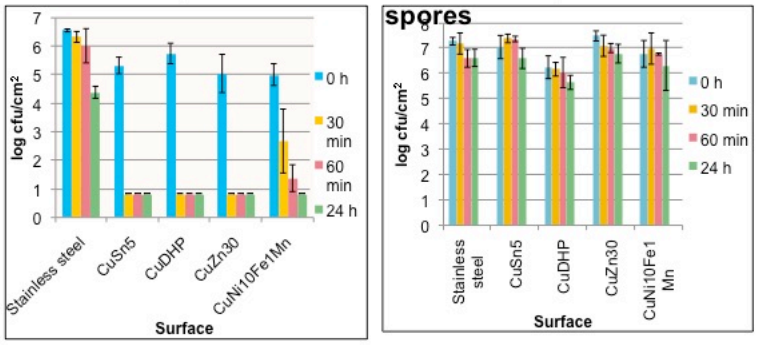
J-Y Maillard - Teleclass 2016

TESTS FOR ANTIMICROBIAL SURFACES

Do antimicrobial surface work? – Novel test

Wet inoculum testing results- aerosol deposition

20°C-40% RH; *A. baumannii* **20°C-40% RH; *B. subtilis* spores**



- >4 $\log_{10}$ reduction of viable *A. baumannii* after 30 min at in-use conditions
- Copper not sporicidal – <1 $\log_{10}$ reduction after 24 h and no significant differences between stainless steel and copper (P>0.05)

40

O'Jeil *et al. Infect J Hosp Infect* 2013;85:274-281.

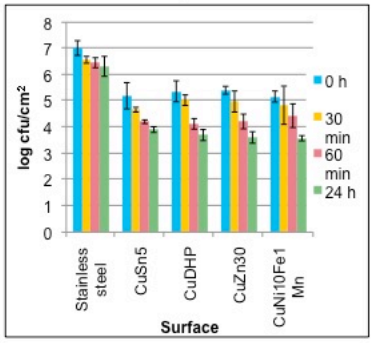
J-Y Maillard - Teleclass 2016

TESTS FOR ANTIMICROBIAL SURFACES

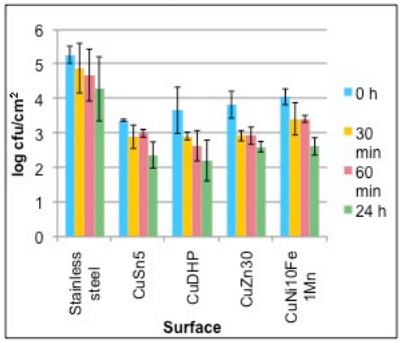
Do antimicrobial surface work? – Novel test

Dry inoculum testing results- dry aerosol deposition

20°C-40% RH; *S. aureus*



20°C-40% RH; *A. baumannii*



- Some copper alloys presented a >1 $\log_{10}$ reduction after 60 min
- After 24 h all copper alloys presented a >1_{10} but <2 $\log_{10}$ reduction in viable *S. aureus* and *A. baumannii*

41

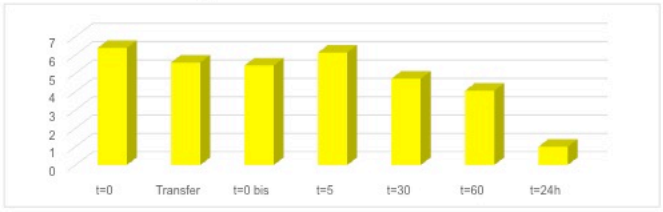
J-Y Maillard - Teleclass 2016

TESTS FOR ANTIMICROBIAL SURFACES

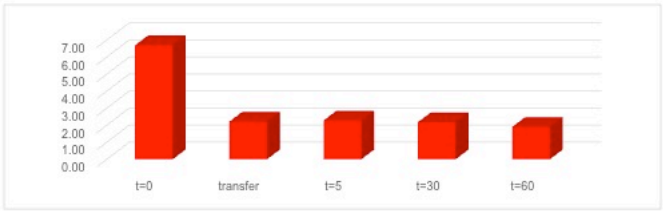
Do antimicrobial surface work? – Novel test

Transfer of *S. aureus* from a dry inoculum - dry aerosol deposition

- Transfer from latex glove from Cu surface incubated at 20°C-40% RH



- Transfer from latex glove to Cu surface and then incubation at 20°C-40% RH

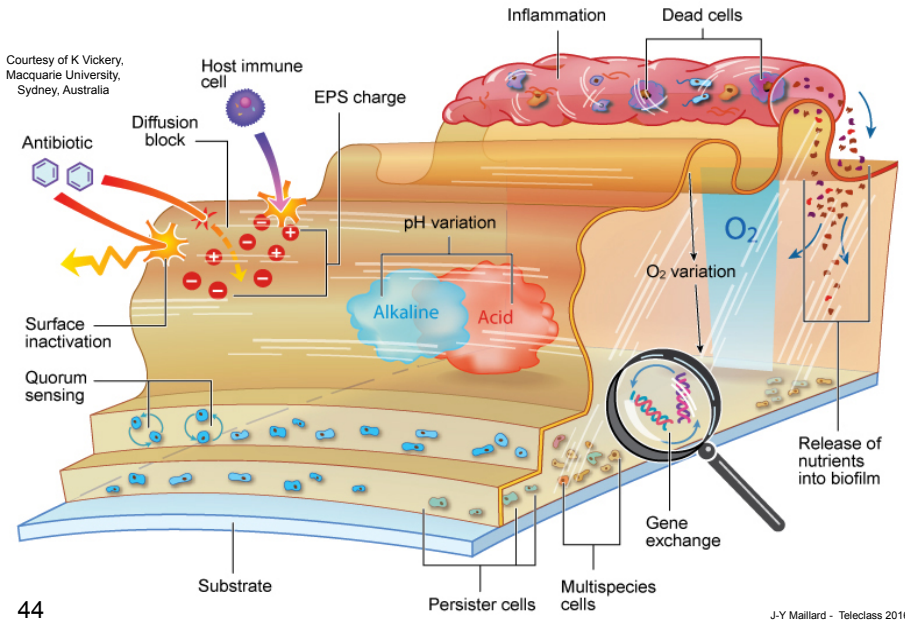


42

J-Y Maillard - Teleclass 2016

DRY BIOFILMS?

MICROBIAL BIOFILMS



MICROBIAL BIOFILMS

CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

Biofilm resistance mechanisms	Observation
Establishing a reduced local biocide concentration	Diffusion gradient
	Non-specific neutralising interaction with cell constituents
	Lysed bacterial community offering mechanistic inactivation as a result of increased organic load
Enhanced bacterial insusceptibility	Degradation of antimicrobial
	Efflux (more effective against lower concentrations)
	Early stress-response
Slow growth/metabolism	A local chemical gradient (reduced nutrients / O_2) can retard growth rate, mitigating against biocide injury
Selection for increased resistance	Formation of pockets of surviving bacteria
	Dormant cells (which re-grow rapidly in the presence of exudates released from lysed community)
Acquisition of new resistance determinants	Increased genetic exchange
Intrinsic resistance	Nature of micro-organisms (i.e. some being more resistant than others)

Maillard & Denyer. *Chemica Oggi 2009*; 27:26-8.

MICROBIAL BIOFILMS

"Dry" biofilm - a new challenge

CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

Journal of Hospital Infection 80 (2012) 52–55

Available online at www.sciencedirect.com

Journal of Hospital Infection

journal homepage: www.elsevierhealth.com/journals/jhin

Presence of biofilm containing viable multiresistant organisms despite terminal cleaning on clinical surfaces in an intensive care unit

K. Vickery[a,*], A. Deva[a], A. Jacombs[a], J. Allan[a], P. Valente[a], I.B. Gosbell[b,c]

[a] Surgical Infection Research Group, Australian School of Advanced Medicine, Macquarie University, New South Wales, Australia
[b] Antibiotic Resistance and Mobile Elements Group (ARMEG), Microbiology and Infectious Diseases Unit, School of Medicine, University of Western Sydney, New South Wales, Australia
[c] Department of Microbiology and Infectious Diseases, Sydney South West Pathology Service – Liverpool, New South Wales, Australia

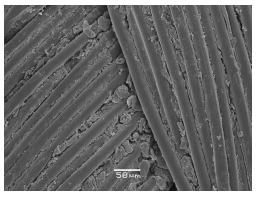
ARTICLE INFO

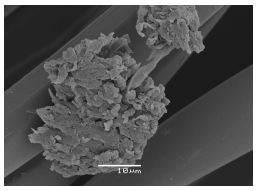
Article history:
Received 15 March 2011
Accepted 3 July 2011
by J.A. Child
Available online 6 September 2011

Keywords:
Biofilm
Enterococci
Environmental contamination
Healthcare-associated infections
Intensive care unit
Multiresistant organisms
Staphylococcus aureus

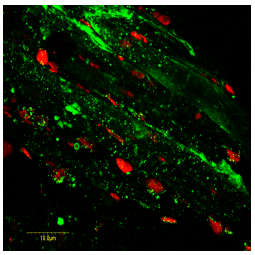
SUMMARY

Background: Despite recent attention to surface cleaning and hand hygiene programmes, multiresistant organisms (MROs) continue to be isolated from the hospital environment. Biofilms, consisting of bacteria embedded in exopolymeric substances (EPS) are difficult to remove due to their increased resistance to detergents and disinfectants, and periodically release free-swimming planktonic bacteria back into the environment which may may act as an infection source.
Aim: To establish whether reservoirs of MROs exist in the environment as biofilms.
Methods: Following terminal cleaning, equipment and furnishings were removed aseptically from an intensive care unit (ICU) and subjected to culture and scanning electron microscopy (SEM). Samples were placed in 5 mL of tryptone soya broth, sonicated for 5 min before plate culture on horse blood agar, Brilliance MRSA and Brilliance VRE agar plates. Samples for SEM were fixed in 3% glutaraldehyde and hexamethyldisilizane (HMDS) prior to sputter-coating with gold and examination in an electron microscope.
Findings: Biofilm was demonstrated visually on the sterile supply bucket, the opaque plastic door, the venetian blind cord, and the sink rubber, whereas EPS alone was seen on the curtain. Viable bacteria were grown from three samples, including MRSA from the venetian blind cord and the curtain.
Conclusion: Biofilm containing MROs persist on clinical surfaces from an ICU despite terminal cleaning, suggesting that current cleaning practices are inadequate to control biofilm development. The presence of MROs being protected within these biofilms may be the mechanism by which MROs persist within the hospital environment.





Venetian blind cord MRSA +ve



Curtain – MRSA +ve

Desiccation resistance

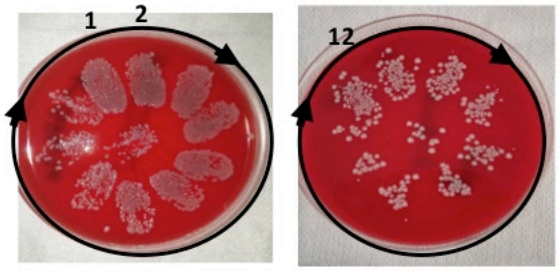
Courtesy of K Vickery,
Macquarie University
Sydney, Australia

MICROBIAL BIOFILMS

"Dry" biofilm - a new challenge

Effect of chlorine on dry biofilm

- 1000 and 5000ppm – recovered 1 day
- 10,000ppm – Recovered after 8 days
- 20,000ppm – Recovered after 12 days



Courtesy of C Vickery Macquarie University Sydney Australia

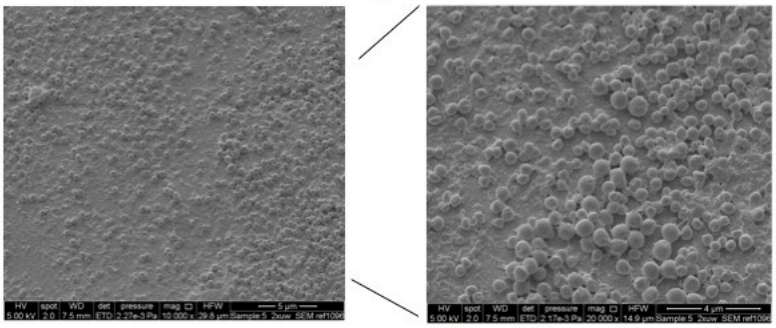
Transmission following touching a dry biofilm

47

J-Y Maillard - Teleclass 2016

MICROBIAL BIOFILMS

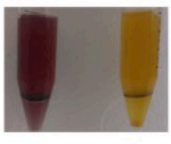
"Dry" biofilm - a new challenge



Removed

Killed

Regrowth

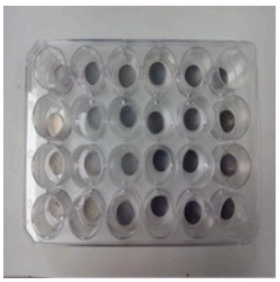


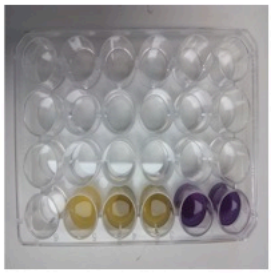
48

J-Y Maillard - Teleclass 2016

MICROBIAL BIOFILMS

"Dry" biofilm - a new challenge





	CT	Log_{10} reduction	Growth-Re-growth	
GTA 2% w/v	5	1.33 ± 0.35	24 h	0/3
			48 h	0/3
	60	4.19 ± 0.00	24 h	0/3
			48 h	0/3
PAA 3% v/v	5	0.93 ± 0.34	24 h	0/3
			48 h	0/3
	60	0.13 ± 0.30	24 h	0/3
			48 h	0/3
Chlorine 1000 ppm	5	0.80 ± 0.71	24 h	0/3
			48 h	0/3
	60	2.29 ± 0.02	24 h	1/3
			48 h	-

49

J-Y Maillard - Teleclass 2016

MICROBIAL BIOFILMS

"Dry" biofilm - a new challenge

- ✓ **Dry biofilms are present on dry surfaces of the ICU**
- ✓ Multi-species and contain organisms from the skin, gut and environment
- ✓ Can be associated with organic matter, soiling, food…
- ✓ **Can contain and protect pathogens including MDR**
- ✓ **Dry biofilms have increased resistance to disinfectants.**
- ✓ This may be one of the mechanisms by which MDR persist within the hospital environment and contribute to HAI

- What about antimicrobial surfaces?

50

J-Y Maillard - Teleclass 2016

CONSIDERATIONS

51

CONSIDERATIONS

Antimicrobial surfaces yes or no?

✓Studies in ICU shows a decrease in microbial bioburden (90%)

•Claimed decrease in HAI needs further evidence – too few studies

•Efficacy in vitro (product claim and product development) – Urgently need a standard to avoid inappropriate claims

✓Costs – is it worth it?

•Beneficial for high touch surfaces?

✓Other usages: light fitting, high surfaces, air conditioning

DOES NOT REPLACE APPROPRIATE HYGIENE & CLEANING

52

Antimicrobial Environment Surfaces in Healthcare Settings
Prof. Jean-Yves Maillard, Cardiff University, Wales
A Webber Training Teleclass

THANK YOU

53

J-Y Maillard - Teleclass 2016

November 10 **NOROVIRUS AND HEALTHCARE FACILITIES: HOW TO KEEP THE VIRUS OUT AND WHAT TO DO WHEN IT GETS IN**
Dr. Ben Lopman, CDC, Atlanta
Prof. Miren Iturriza-Gomara, University of Liverpool

November 23 **AIR TRAVEL AND INFECTION TRANSMISSION**
Dr. Paul Edelson, CDC JFK Airport Quarantine Station, New York
Sponsored by GOJO (www.gojo.com)

December 1 **2017 TELECLASS SCHEDULE RELEASED**

December 8 **VIABILITY OF BACTERIA ON FABRICS**
Prof. Jerry H. Kavouras, University of Illinois at Chicago

December 15 (FREE Teleclass)
INFECTION CONTROL IN ELDERLY CARE INSTITUTIONS – WHERE SHOULD WE GO?
Prof. Andreas Voss, Radboud University Medical Centre, The Netherlands

www.webbertraining.com/schedulep1.php

Hosted by Bruce Gamage
www.webbertraining.com

Antimicrobial Environment Surfaces in Healthcare Settings
Prof. Jean-Yves Maillard, Cardiff University, Wales
A Webber Training Teleclass

2001-2016
15 YEARS
TELECLASS EDUCATION

THANKS FOR YOUR SUPPORT

Thanks to Teleclass Education

PATRON SPONSORS

Sealed Air Diversey Care
www.sealedair.com

VIROX TECHNOLOGIES INC.
www.virox.com

World Health Organization
Infection Prevention and Control Global Unit
www.who.int/gpsc/en

Hosted by Bruce Gamage
www.webbertraining.com