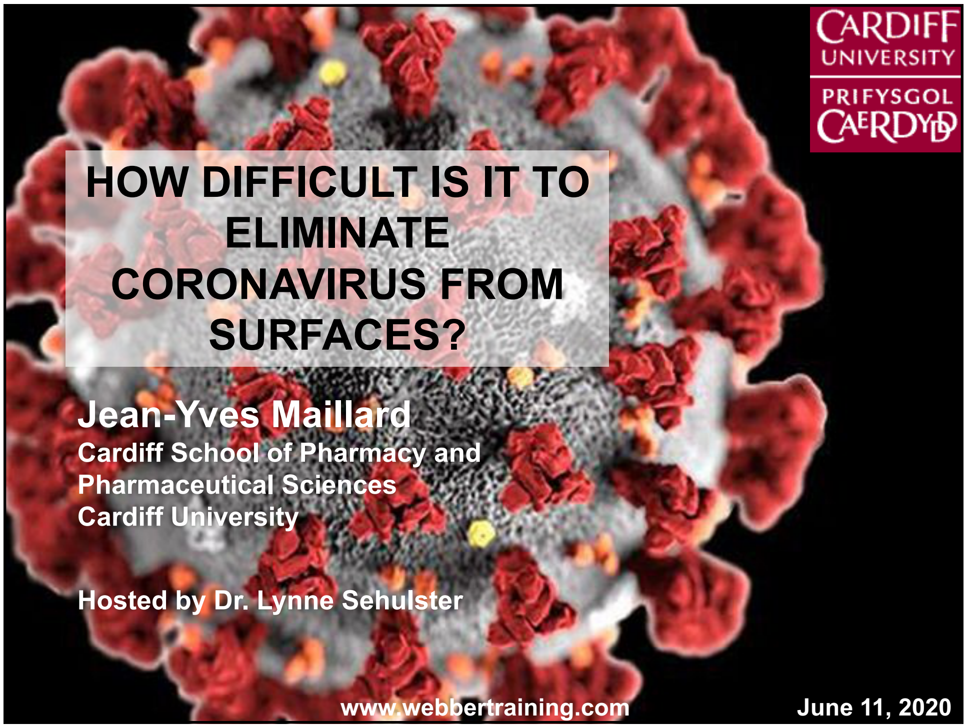

OVERVIEW

- Context
- Role of surfaces in pathogen transmission
- Virus structure & impact on susceptibility
- Virus susceptibility to chemical disinfection
- Conclusions

2

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CONTEXT

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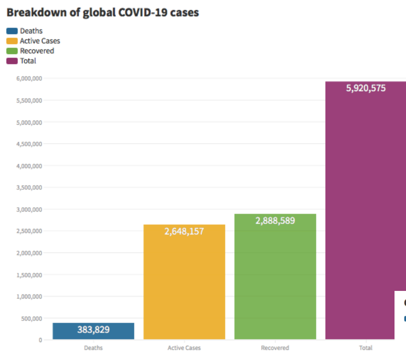

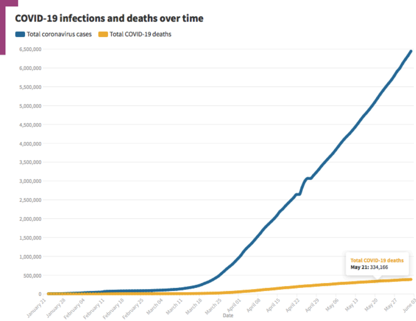

COVID-19
03 June 2020

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CONTEXT

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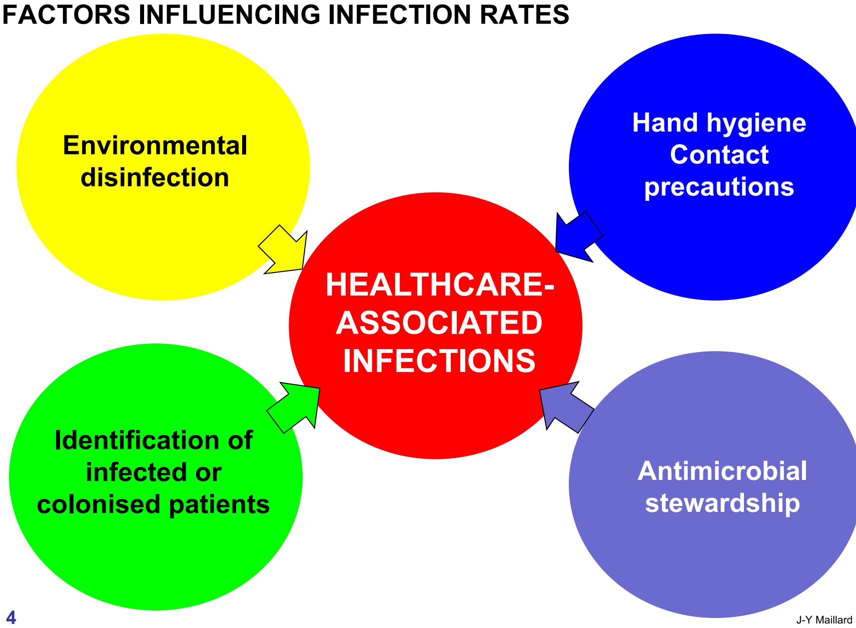
FACTORS INFLUENCING INFECTION RATES



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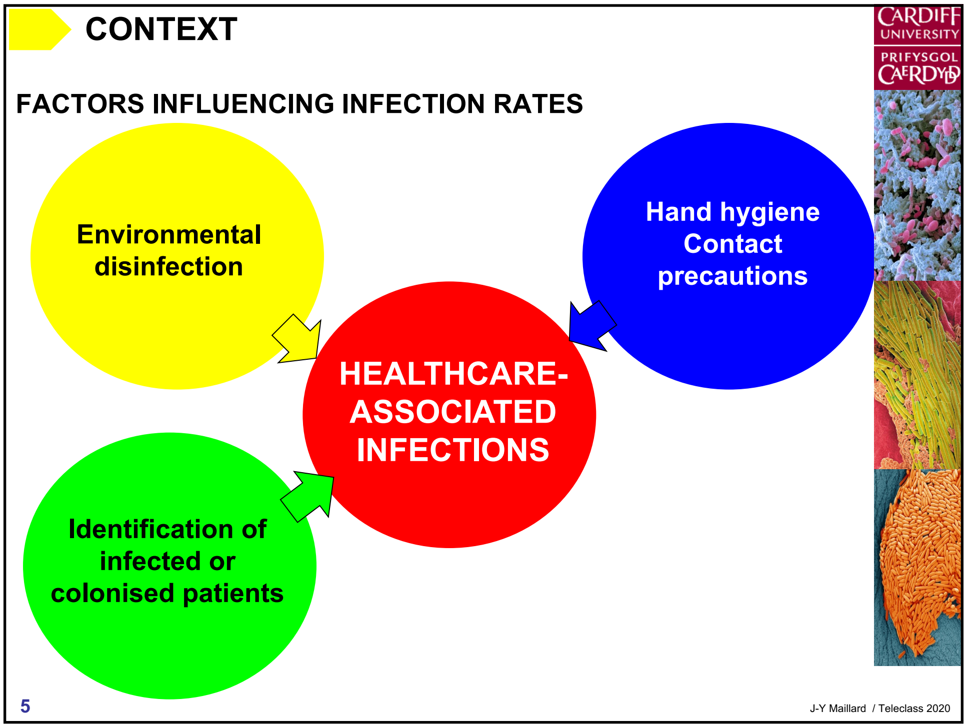
CONTEXT
CARDIFF UNIVERSITY
PRIFYSGOL CAERDYD
FACTORS INFLUENCING INFECTION RATES
Environmental disinfection
Hand hygiene Contact precautions
HEALTHCARE-ASSOCIATED INFECTIONS
Identification of infected or colonised patients
5
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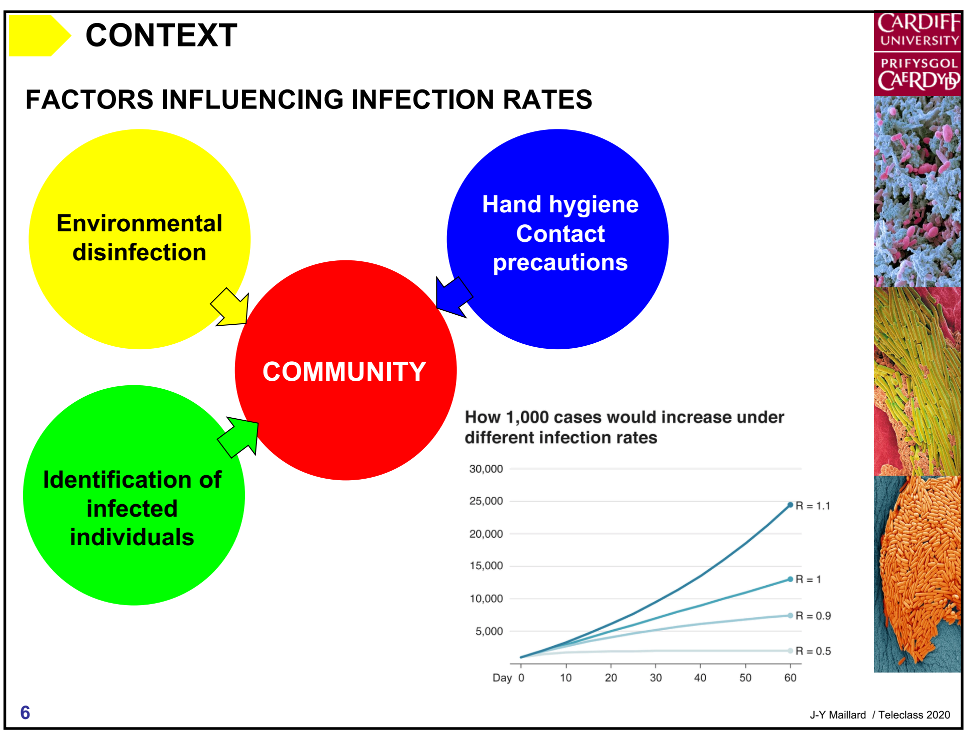
CONTEXT
CARDIFF UNIVERSITY
PRIFYSGOL CAERDYD
FACTORS INFLUENCING INFECTION RATES
Environmental disinfection
Hand hygiene Contact precautions
COMMUNITY
Identification of infected individuals
How 1,000 cases would increase under different infection rates
30,000
25,000
20,000
15,000
10,000
5,000
Day 0
10
20
30
40
50
60
R = 1.1
R = 1
R = 0.9
R = 0.5
6
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CONTEXT

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Pathogen transmission

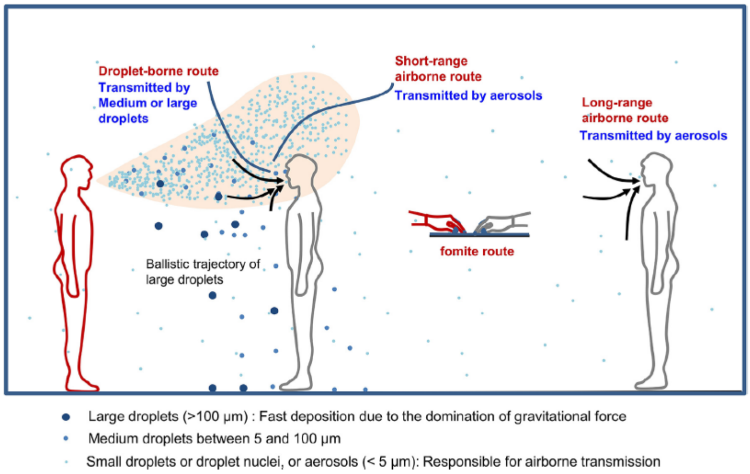

Fig 4. Illustration of different transmission routes. Small droplets (<5 µm), sometimes called aerosols, are responsible for the short-range airborne route, long-range airborne route, and indirect contact route; large droplets are responsible for the direct spray route and indirect contact route.

Wei & Li. Am J Infect Control, 2016; 44: S102-S108.

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CONTEXT

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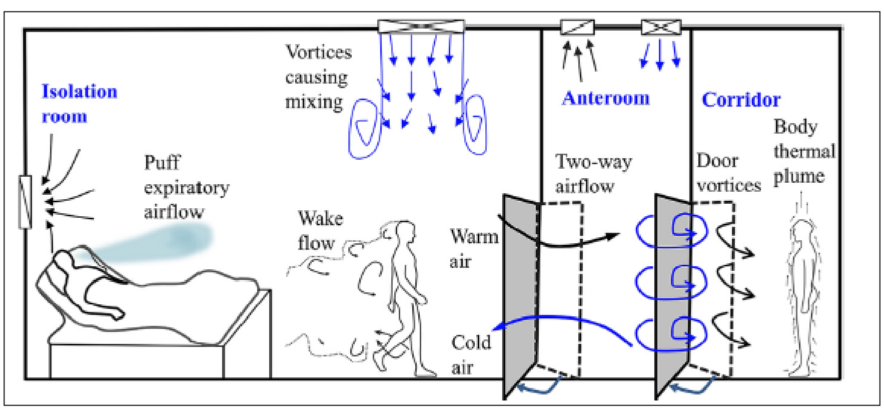
Pathogen transmission in hospital



Wei & Li. Am J Infect Control, 2016; 44: S102-S108.

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CONTEXT

Pathogen transmission in hospital

- Coughing: 24-23,600 droplets / 1L exhaled air
- Talking: 4-600 droplets / 1L exhaled air
- Breathing by mouth: 1-320 droplets / 1L exhaled air

- People in close contact can contaminate each other by direct spray from large droplets or by inhalation of smaller droplets.

- Contamination of the other person's skin or clothing can lead to self-inoculation through indirect contact transmission.

Wei & Li. Am J Infect Control, 2016; 44: S102-S108.

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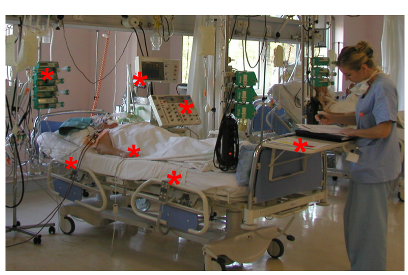
ROLE OF SURFACES IN MICROBIAL TRANSMISSION



High touch surfaces

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ROLE OF SURFACES IN MICROBIAL TRANSMISSION

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 OF SURFACE CONTAMINANTS!

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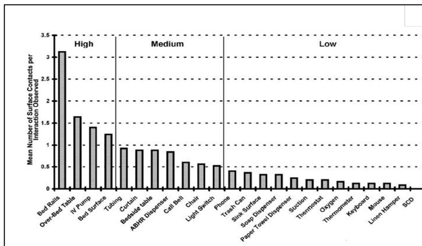
ROLE OF SURFACES IN MICROBIAL TRANSMISSION

Surfaces touched by staff

Med-Surg unit (touches per visit)

- Bedrails = 3.1
- Over-bed table = 1.6
- IV pump = 1.4
- Bed surface = 1.3



Mean frequency of healthcare worker contact for 24 surfaces on a general medical-surgical floor. ABHR, alcohol-based hand ravenous; SCD, sequential compression device.

- Average surfaces per interaction
  - ICU = 44, Med-Surg = 15
- Combining the data:
  - 82 people per day visit a typical patient room
  - 2/3 are clinical staff. 1/3 are not.
  - Bedrails get touched up to 256 times per day

Huslage et al. Infect Cont and Hosp Epidemiol, 2010;31: 850-3.

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ROLE OF SURFACES IN MICROBIAL TRANSMISSION

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Surfaces touched by visitors

Visitors contact a range of surfaces/objects

- 33.5% = contact with the environment only (Most common level of touch)
- 27.1% = patient's intact skin
- 17.8% = blood or body fluids
- 16.0% = the person touched nothing in the room

- Nonclinical visitors and personal visitors were exposed to blood or body fluids 19% of the time
- 75% of the time, nonclinical visitors touch environmental surfaces only.

Percentage of Visits Achieving Each Maximum Level of Touch by Care Role

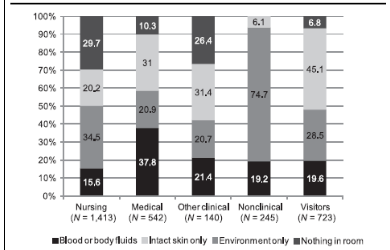

Figure 1. *Contact with patient environment only was the most common level of touch (33.5% of visits), followed by patient's intact skin (27.1%) and patient's blood or body fluids (17.8%).*

Cohen et al. J Comm J Qual Patient Safety, 2012;38:560-5.

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ROLE OF SURFACES IN MICROBIAL TRANSMISSION

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Observations	Hospital 1	Hospital 2
% observations where staff washed hands	28	20
% observations where staff used alcoholic hand rub	30	9
Of those incidences where no gloves worn, % incidences where staff used alcoholic hand rub	41	14
% staff wearing no gloves and used no AHR, but washed hands	17	19
% staff using no protection/skin sanitisation	19	46
% potential staff to object cross- contamination	**30**	**59**
% potential staff to patient cross-contamination	**4**	**0**
% potential object to object cross- contamination	**70**	**88**
% potential object to patient cross-contamination	**20**	**9**
% potential patient to object cross-contamination	**17**	**9**

Low frequency of hand sanitisation, particularly with use of AHR lead to high incidence of potential cross contamination

Cheeseman et al. J Hosp Infect, 2009; 72: 319-25.

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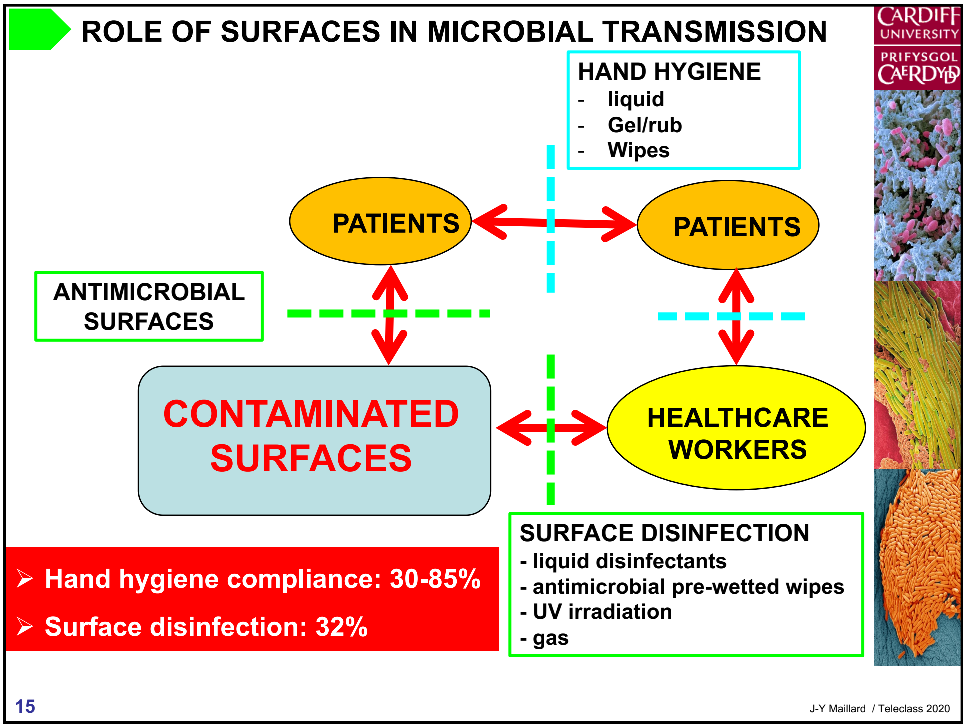
ROLE OF SURFACES IN MICROBIAL TRANSMISSION
CARDIFF UNIVERSITY PRIFYSGOL CAERDYDD
HAND HYGIENE
- liquid
- Gel/rub
- Wipes
PATIENTS
PATIENTS
ANTIMICROBIAL SURFACES
CONTAMINATED SURFACES
HEALTHCARE WORKERS
Hand hygiene compliance: 30-85%
Surface disinfection: 32%
SURFACE DISINFECTION
- liquid disinfectants
- antimicrobial pre-wetted wipes
- UV irradiation
- gas
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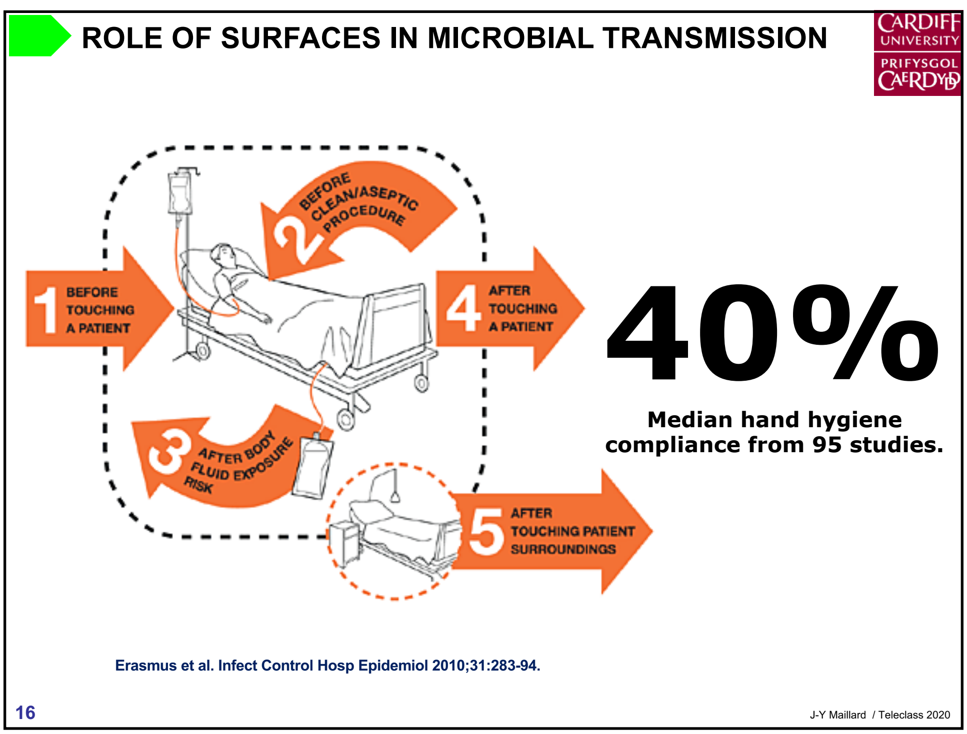
ROLE OF SURFACES IN MICROBIAL TRANSMISSION
CARDIFF UNIVERSITY PRIFYSGOL CAERDYDD
1 BEFORE TOUCHING A PATIENT
2 BEFORE CLEAN/ASEPTIC PROCEDURE
3 AFTER BODY FLUID EXPOSURE RISK
4 AFTER TOUCHING A PATIENT
5 AFTER TOUCHING PATIENT SURROUNDINGS
40%
Median hand hygiene compliance from 95 studies.
Erasmus et al. Infect Control Hosp Epidemiol 2010;31:283-94.
16
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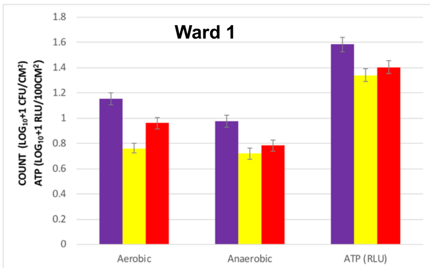
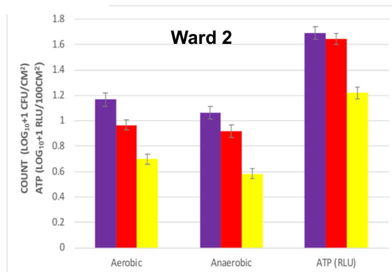
ROLE OF SURFACES IN MICROBIAL TRANSMISSION



- Pre-impregnated wipe first followed by cleaning + hypochlorite



- Baseline.
- Cleaning and use of chlorine 1,000 ppm
- Sporicidal wipe

- Cleaning + hypochlorite first followed by pre-impregnated wipe

Siani et al. Am J Infec Control 2018;46:1180-7.

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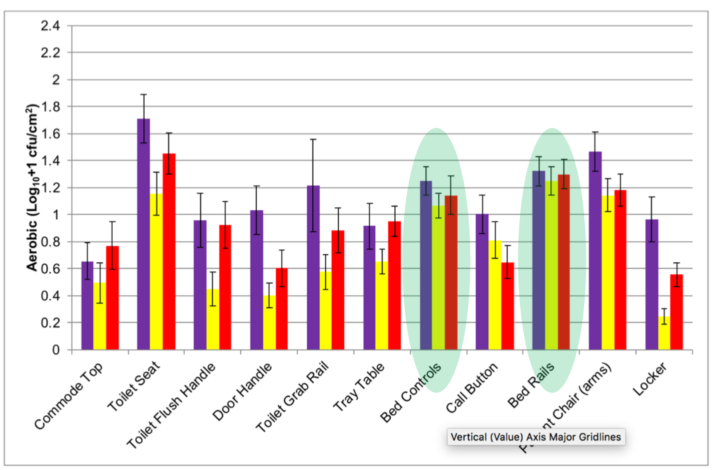
ROLE OF SURFACES IN MICROBIAL TRANSMISSION



- Baseline.
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- Sporicidal wipe

- Pre-impregnated wipe first followed by cleaning + hypochlorite

Siani et al. Am J Infec Control 2018;46:1180-7.

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ROLE OF SURFACES IN MICROBIAL TRANSMISSION

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Survival of pathogens on hospital surfaces

PATHOGEN	SURIVAL TIME
S. aureus (incl. MRSA)	7 days to >12 months
Enterococcus spp. (incl VRE)	5 days to >46 months
Acinetobacter spp.	3 days to 11 months
C. difficile (spores)	> 5 months
Norovirus (& feline calicivirus)	**8 h to > 2 weeks**
Ps. aeruginosa	6 h to 16 months
Klebsiella spp.	2h to 30 months

Hota *et al. Clin Infect Dis* 2004;39:1182-9
Kramer *et al. BMC Infect Dis* 2006;6:130

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ROLE OF SURFACES IN MICROBIAL TRANSMISSION

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Persistence of human coronavirus and coronavirus surrogates
Reviewed by Kampf et al. J Hosp Infect 2020;104:246-51.

Persistence of coronaviruses on different types of inanimate surfaces

Type of surface	Virus	Strain / isolate	Inoculum (viral titer)	Temperature	Persistence
Steel	MERS-CoV	Isolate HCoV-EMC/2012	10^5	20°C	48 h
				30°C	8–24 h
	TGEV	Unknown	10^6	4°C	≥ 28 d
				20°C	3–28 d
				40°C	4–96 h
	MHV	Unknown	10^6	4°C	≥ 28 d
				20°C	4–28 d
				40°C	4–96 h
	HCoV	Strain 229E	10^3	21°C	5 d
Aluminium	HCoV	Strains 229E and OC43	5×10^3	21°C	2–8 h
Metal	SARS-CoV	Strain P9	10^5	RT	5 d
Wood	SARS-CoV	Strain P9	10^5	RT	4 d
Paper	SARS-CoV	Strain P9	10^5	RT	4–5 d
	SARS-CoV	Strain GVU6109	10^6	RT	24 h
			10^5		3 h
			10^4		< 5 min
Glass	SARS-CoV	Strain P9	10^5	RT	4 d
	HCoV	Strain 229E	10^3	21°C	5 d
Plastic	SARS-CoV	Strain HKU39849	10^5	22°-25°C	≤ 5 d
	MERS-CoV	Isolate HCoV-EMC/2012	10^5	20°C	48 h
				30°C	8–24 h
	SARS-CoV	Strain P9	10^5	RT	4 d
	SARS-CoV	Strain FFM1	10^7	RT	6–9 d
	HCoV	Strain 229E	10^7	RT	2–6 d
PVC	HCoV	Strain 229E	10^3	21°C	5 d
Silicon rubber	HCoV	Strain 229E	10^3	21°C	5 d
Surgical glove (latex)	HCoV	Strains 229E and OC43	5×10^3	21°C	≤ 8 h
Disposable gown	SARS-CoV	Strain GVU6109	10^6	RT	2 d
			10^5		24 h
			10^4		1 h
Ceramic	HCoV	Strain 229E	10^3	21°C	5 d
Teflon	HCoV	Strain 229E	10^3	21°C	5 d

MERS = Middle East Respiratory Syndrome; HCoV = human coronavirus; TGEV = transmissible gastroenteritis virus; MHV = mouse he
SARS = Severe Acute Respiratory Syndrome; RT = room temperature.

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ROLE OF SURFACES IN MICROBIAL TRANSMISSION

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Human coronavirus- SARS-CoV

Lai et al. Clin I nfect Dis 2005;41:e67

- Simulates a situation in which large respiratory droplets (volume, 5 mL; radius, ~1 mm) that contain the virus fall onto paper

	Time taken to inactivate SARS-CoV, by surface		
Inoculation, $TCID_{50}$/mL	Paper	Disposable gown	Cotton gown
10^6	24 h	2 days	24 h
10^5	3 h	24 h	1 h
10^4	<5 min	1 h	5 min

- "Even with a higher concentration of virus (10^4 TCID50/mL) than would normally occur in NPA samples ($10^{2.2}$ $TCID_{50}$/mL), no virus infectivity remained after the paper was dried."
- "Paper contaminated with a higher concentration of virus (equivalent to that of fecal excreta (i.e., 10^5 $TCID_{50}$/mL) was not infectious after 3 h, and no viral infectivity was shown after 24 h, even with a concentration of 10^6 $TCID_{50}$/mL."

ROLE OF SURFACES IN MICROBIAL TRANSMISSION

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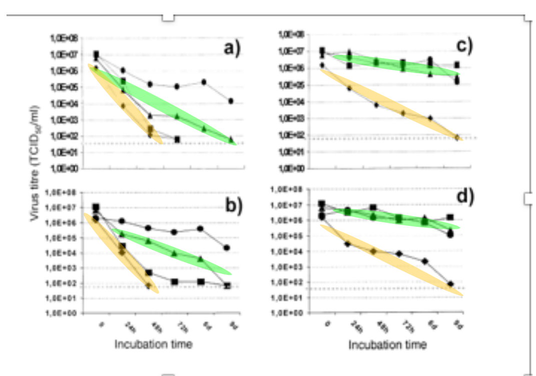
Stability of SARS-CoV

Rabenau et al. Med Microbiol Immunol 2005;194:1-6.

a,b: surface
c,d: suspension
b,d: organic load

● adenovirus type-3
▲ SARS-CoV
❖ h-CoV (229E)
■□ HSV-1



"Nevertheless, the agent's (SARS-CoV) tenacity is considerably higher than that of HCoV-229E, and should SARS re-emerge, increased efforts need to be devoted to questions of environmental hygiene."

ROLE OF SURFACES IN MICROBIAL TRANSMISSION

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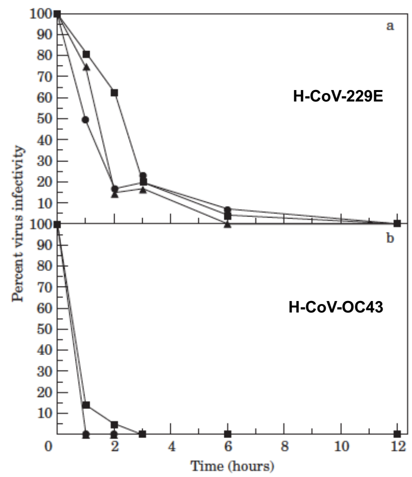
Human coronavirus; H-CoV-229E and H-CoV-OC43

Dry in a laminar flow hood for 15–45 min the incubated at 21ºC and humidity between 55 and 70%

Surfaces
■□ aluminium
● sterile sponges
▲ latex surgical gloves



Sizun et al J Hosp Infec 2000;46:55-60.

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ROLE OF SURFACES IN MICROBIAL TRANSMISSION

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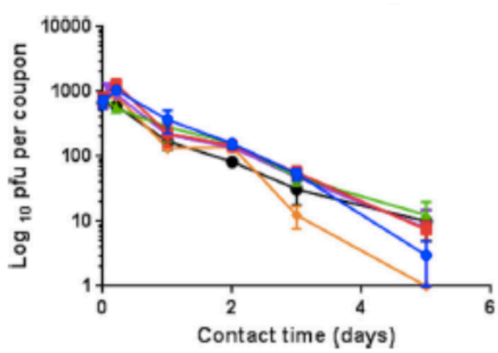
Human coronavirus; H-CoV-229E

H-CoV-229e 10^3 PFU in lysate incubated at 21ºC and humidity between 30 and 40%



Warnes et al mBio 2015;6: e01697-15

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VIRUS STRUCTURE AND SUSCEPTIBILITY

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Viruses differ greatly in size and morphology

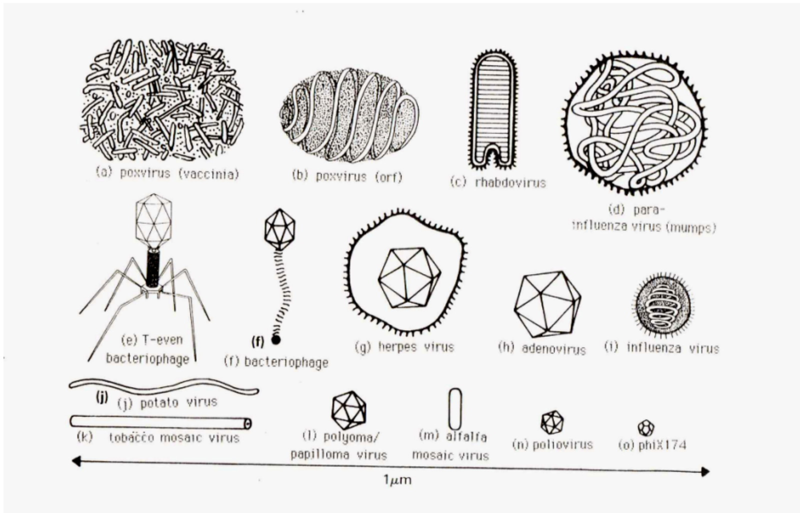

Diagram showing the approximate size and shapes of different viruses.
(From Horne, 1978)

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VIRUS STRUCTURE AND SUSCEPTIBILITY

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Levels of 'germicidal' action
Spaulding classification, 1972

High-level	**Prions**	Creutzfeld-Jakob disease
	Bacterial spores	*Bacillus* spp, *Geobacillus* spp., Clostridia
Intermediate-level	**Protozoal cysts and oocysts**	*Cryptosporidium* spp., *Ancanthamoeba.* spp, *Entamoeba* spp.
	Mycobacteria	*Mycobacterium tuberculosis*, *M. avium intracellulare*
	Non-enveloped viruses	Poliovirus, parvovirus, papilloma virus, norovirus
	Fungi	*Aspergillus* spp., *Candida* spp.
	Vegetative Gram- negative	*Pseudomonas* spp., *Klebsiella* spp.
Low-level	**Protozoa**	*Cryptosporidium* spp., *Acanthamoeba* spp.
	Vegetative Gram-positive	Staphylococci, streptococci
	Enveloped viruses	Hepatitis B virus, HIC, HSV, SARS

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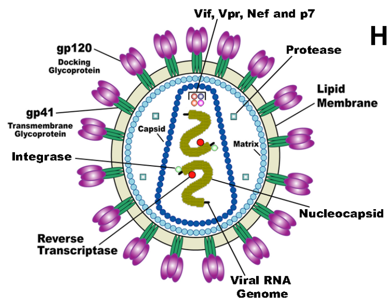
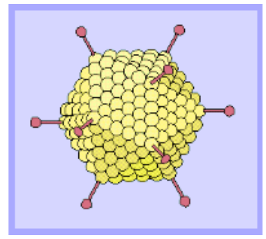
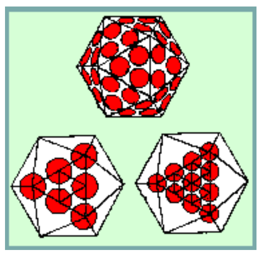
VIRUS STRUCTURE AND SUSCEPTIBILITY

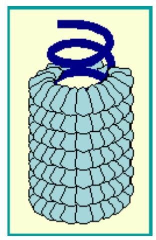
HIV







Icosahedral symmetry



Helical symmetry

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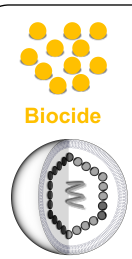
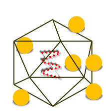
VIRUS STRUCTURE AND SUSCEPTIBILITY



CAPSID PERMEABILITY

Penetration of the biocides inside the capsid and destruction of nucleic acid



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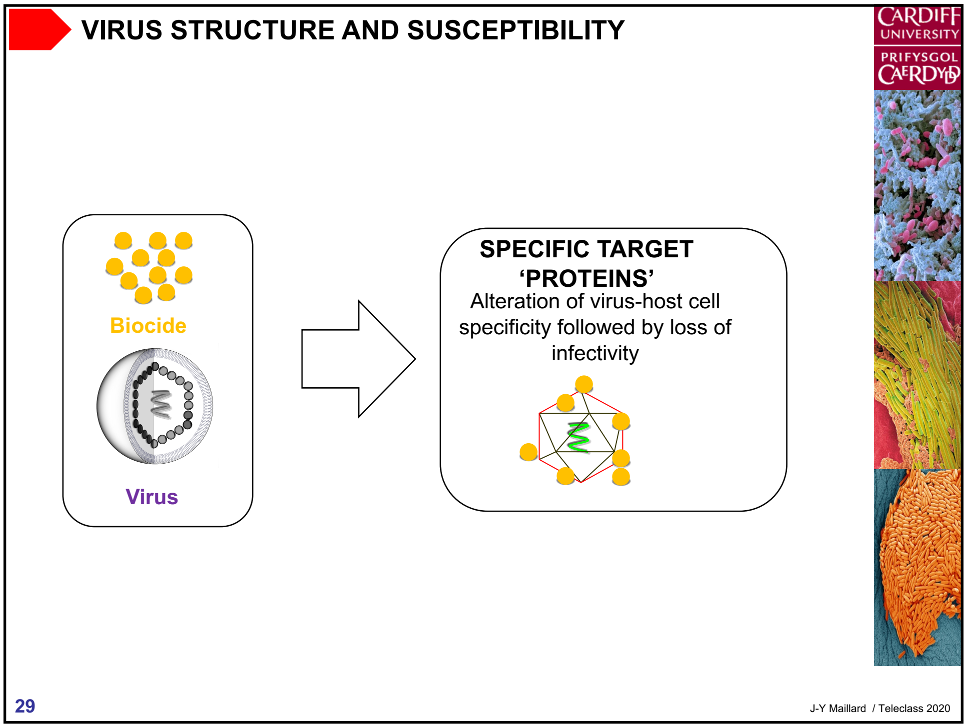
VIRUS STRUCTURE AND SUSCEPTIBILITY
CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD
Biocide
Virus
SPECIFIC TARGET 'PROTEINS'
Alteration of virus-host cell specificity followed by loss of infectivity
29
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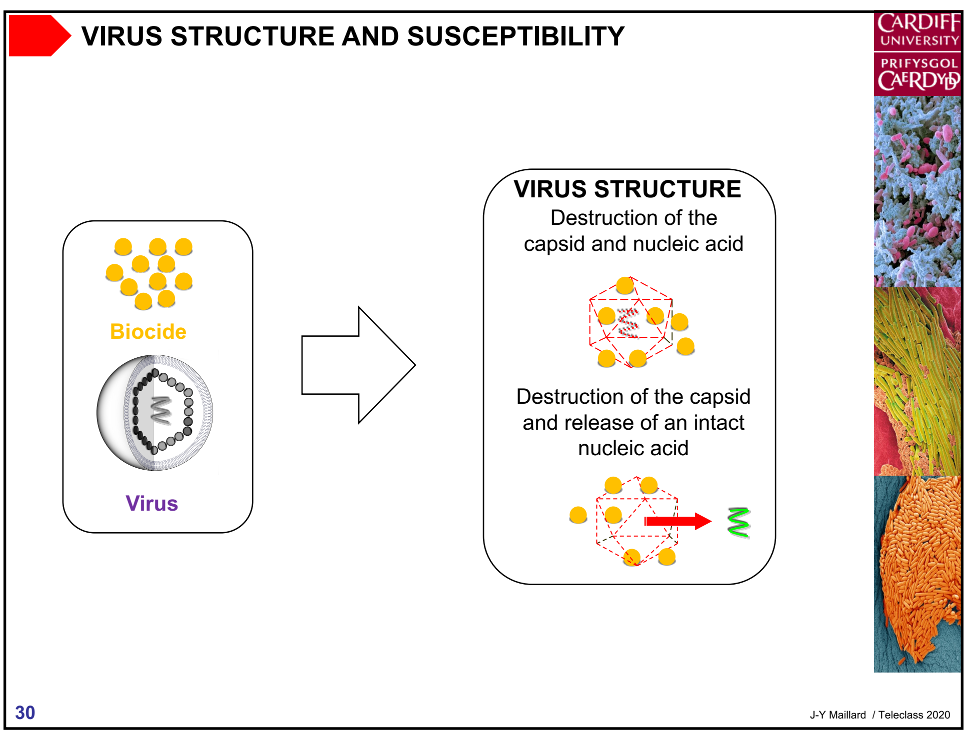
VIRUS STRUCTURE AND SUSCEPTIBILITY
CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD
Biocide
Virus
VIRUS STRUCTURE
Destruction of the capsid and nucleic acid
Destruction of the capsid and release of an intact nucleic acid
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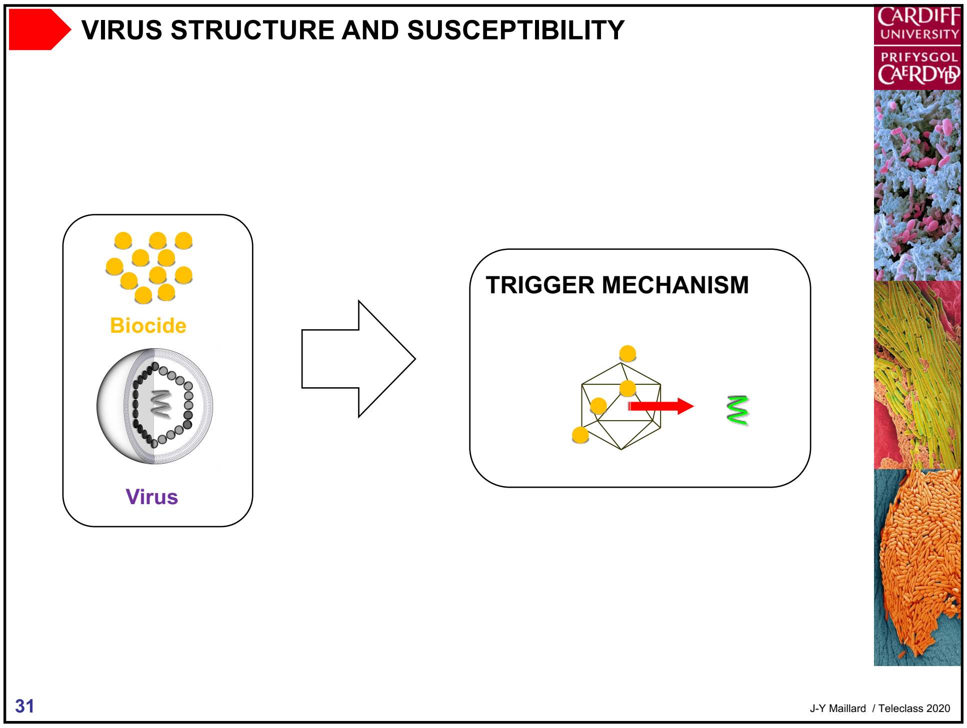
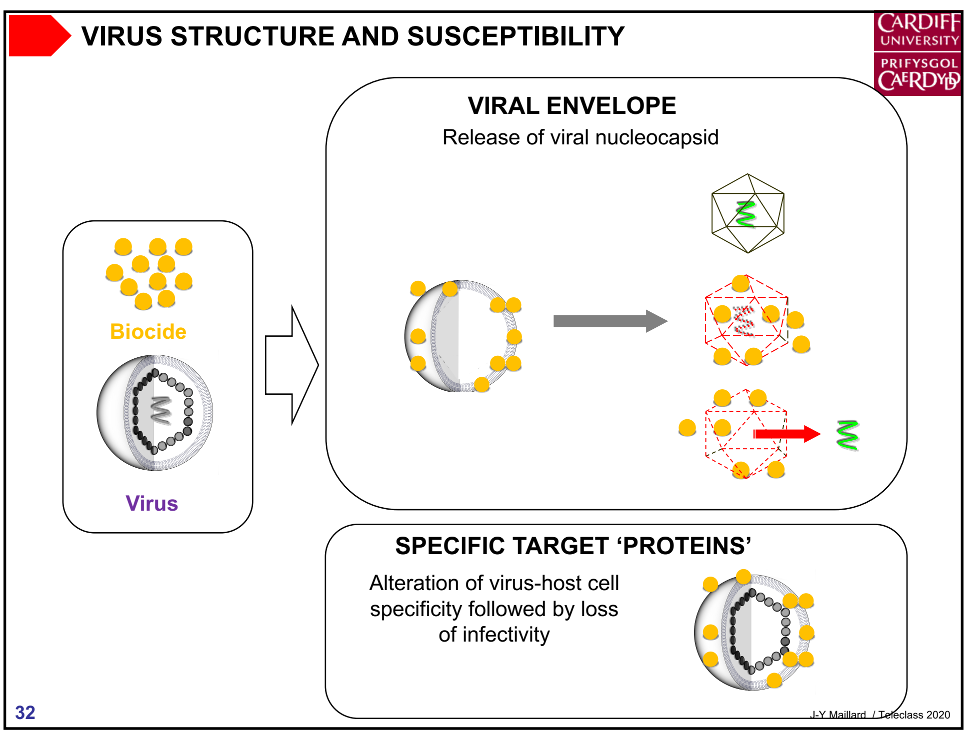
How Difficult is it to Eliminate Coronavirus From Surfaces?
Prof. Jean-Yves Maillard, Cardiff University, Wales
A Webber Training Teleclass





Hosted by Dr. Lynne Sehulster
www.webbertraining.com

VIRUS STRUCTURE AND SUSCEPTIBILITY

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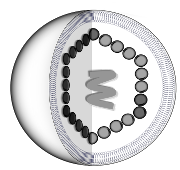
ENVELOPE

- Alkylating agents: interaction with viral proteins
- Membrane active agents (chlorhexidine, QAC, alcohols, surfactants, phenolics)

STRUCTURAL ALTERATION

- chlorine compounds (f2, rotavirus, poliovirus; HBV)
- bromine (reovirus type-3, f2, poliovirus)
- cetylpyridinium chloride (F116)
- cetrimide (rotavirus)
- alcohols (F116, rotavirus)
- phenols (F116)
- peracetic acid (F116, adenovirus)
- aldehydes (poliovirus, HBV)
- metallic salts (e.g. silver?)
- iodine (poliovirus, f2): tyrosine amino acid
- ozone (poliovirus type-2, ΦX174, T4, f2): cysteine, tryptophane, methionone (?)
- copper salts: thiol and other group of protein molecules
- GTA (F116, HBV, poliovirus): ε-amino acid of lysine residues



Maillard and Russell. Sci Prog 1997; 80: 287-315.
Maillard. Rev Med Microbiol 2001; 12: 63-74.

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VIRUS STRUCTURE AND SUSCEPTIBILITY

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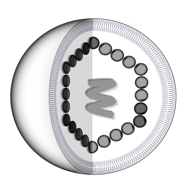
VIRAL MARKERS

- metallic salts: phage adsorption, DNA ejection
- alcohols: HbcAg, HBV DNA polymerase
- GTA: HbsAg & HbcAg, HBV DNA polymerase
- Chlorine compounds: HbsAg & HbcAg

ALTERATION OF VIRAL GENOME

- chlorine compounds (f2 RNA, poliovirus RNA)
- peracetic acid (F116 DNA)
- metallic salts (R17 RNA, ΦX174 DNA, poliovirus RNA)
- ozone (f2 RNA, ΦX174 DNA, T4 DNA): purines and pyrimidines
- GTA: HBV DNA (detection of HBV DNA residues)



Maillard and Russell. Sci Prog 1997; 80: 287-315.
Maillard. Rev Med Microbiol 2001; 12: 63-74.

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VIRUS SUSCEPTIBILITY TO CHEMICAL DISINFECTION

Definitions

Cleaning

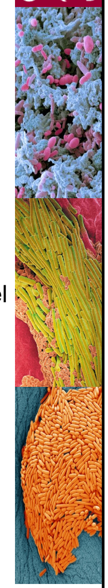
- Removal of contamination from a surface to the extent necessary for further processing or for intended use.

Disinfection

- Process of reduction of the number of viable microorganisms to a level previously specified
- Three levels of disinfection (high, intermediate and low)

Sterilization

- Validated process used to render a product/surface free from viable microorganisms, **including bacterial spores**.



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VIRUS SUSCEPTIBILITY TO CHEMICAL DISINFECTION

What level of efficacy is necessary?

High level of shedding **Low infectious dose**	**High level of shedding** **High infectious dose**
Low level of shedding **Low infectious dose**	**Low level of shedding** **High infectious dose**

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VIRUS SUSCEPTIBILITY TO CHEMICAL DISINFECTION

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What level of efficacy is necessary?

High level of shedding

Low infectious dose

e.g. norovirus

Shedding: 1 x 10^8 virus/ml or /g ($8 \log_{10}$)

ID: 10^2 virus ($2 \log_{10}$)

>6 $\log_{10}$ reduction of 99.9999%

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VIRUS SUSCEPTIBILITY TO CHEMICAL DISINFECTION

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What level of efficacy is necessary?

Shedding: 1 x 10^8 virus/ml or /g ($8 \log_{10}$)

ID: 10^4 virus ($4 \log_{10}$)

>4 $\log_{10}$ reduction of 99.99%

High level of shedding

High infectious dose

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VIRUS SUSCEPTIBILITY TO CHEMICAL DISINFECTION

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What level of efficacy is necessary?

Shedding: 1 x 10^5 virus/ml or /g
(5 $\log_{10}$)

ID: 10^4 virus (4 $\log_{10}$)

>1 $\log_{10}$ reduction of 90%

Low level of shedding

High infectious dose

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VIRUS SUSCEPTIBILITY TO CHEMICAL DISINFECTION

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What level of efficacy is necessary?

Shedding: 1 x 10^5 virus/ml or /g
(5 $\log_{10}$)

ID: 10^2 virus (2 $\log_{10}$)

>3 $\log_{10}$ reduction of 99.9%

Low level of shedding

Low infectious dose

e.g. SARS?

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VIRUS SUSCEPTIBILITY TO CHEMICAL DISINFECTION

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Disinfectant	Contact Time	Log_{10} Reduction			
		Parvoviruses	Poliovirus	Adenovirus	Vaccinia
Alcohol (70%)	10 min	<1	2	>4	>4
QUAT (0.05%)	10 min	<1	<1	1	3
Bleach (1/10)	10 min	0.6 to 3	3	>4	>4
2% Glutaraldehyde	20 min	3 to 4	>4	>4	>4
0.55% OPA	10 min	3 to 4	>4	>4	>4
0.2% PAA (at 20°C)	10 min	>4	>4	>4	>4

Eterpi et al. J Hosp Infect 2009;73:64-70.

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VIRUS SUSCEPTIBILITY TO CHEMICAL DISINFECTION

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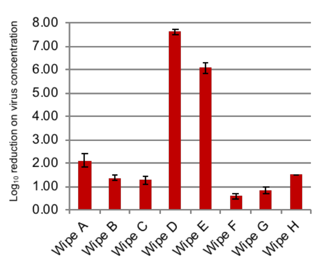
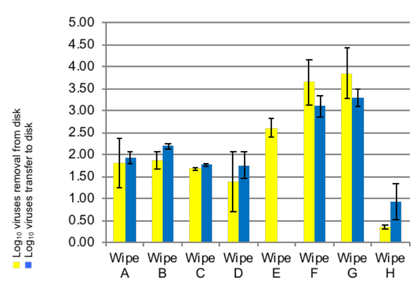
EFFICACY OF ANTIMICROBIAL WIPES AGAINST VIRUSES

Virucidal activity of expressed wipe solutions (n=3)



Virus removal from disks and virus transfer from wipes to disks. (n=3)



	Mean removal	Range
'Universal' wipes	1.68 log_{10}	1.37-1.87 log_{10}
Sporicidal wipes	3.13 log_{10}	2.61- 3.65 log_{10}
Detergent wipes	2.11 log_{10}	0.36- 3.85 log_{10}

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VIRUS SUSCEPTIBILITY TO CHEMICAL DISINFECTION

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Number of wipes	Surface initially wiped	Time applied (sec)	Number of consecutive surfaces wiped (other surfaces)
1	Bed Rail	4	5 (bedside table, monitor X2, monitor stand)
2	Steel Trolley	6	2 (both shelves on the trolley wiped)
1	Monitor	4	5 (monitors, two keypads, monitor stand)
2	Bed rail	7	4 (table, monitor, keypad)
3	Bedside table	10	4 (folder, two bed rails)

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VIRUS SUSCEPTIBILITY TO CHEMICAL DISINFECTION

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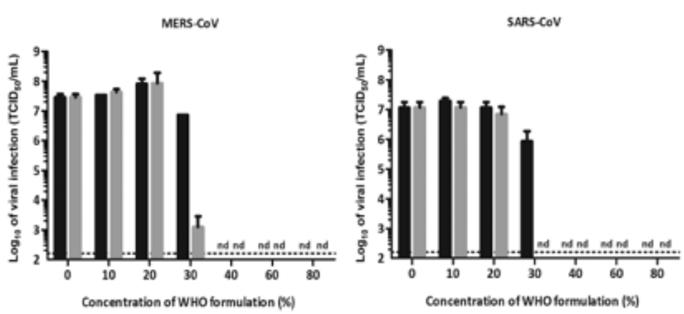
SARS-CoV and MERS-CoV
Suspension test

30 seconds contact time
WHO ethanol-based formulations



Siddharta et al. J Infect Dis 2017;215:902–6

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VIRUS SUSCEPTIBILITY TO CHEMICAL DISINFECTION

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Coronavirus SARS-CoV and PVP-I
Suspension test

Table 1. Efficacy of PVP-I products to SARS-CoV

Reagent or treatment	Final PVP-I concentration, %	Virus titer after treatment, $TCID_{50}$/ml	
		60 s	120 s
Control	0	1.17×10^6	n.d.
Isodine	1	95.1	u.d.
Isodine Gargle	0.47	190	u.d.
Isodine Scrub	1	u.d.	n.d.
Isodine Palm	0.25	u.d.	n.d.
Isodine Nodo Fresh	0.23	u.d.	n.d.
Ethanol (final 35%)	–	u.d.	n.d.

n.d. = Not done; u.d. = under the detectable level.

Kariwa et al. Dermatology 2006;212:119-23

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VIRUS SUSCEPTIBILITY TO CHEMICAL DISINFECTION

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SARS-CoV
Suspension test

Table 2 Viricidal activity of different disinfectants against SARS-CoV

Treatment	Virus titre ($TCID_{50}$/ml [log10]) (after contact time of x s)	Minimal reduction factor (log10)
2-Propanol[a] (100%)	≤ 1.8 ± 0 (30 s)	≥3.31
2-Propanol[a] (70%)	≤ 1.8 ± 0 (30 s)	≥3.31
Desderman[b] (78% ethanol)	≤ 1.8 ± 0 (30 s)	≥5.01
Sterillium[c] (45% 2-propanol, 30% 1-propanol)	≤ 3.8 ± 0 (30 s)	≥2.78
Wine vinegar[d]	≤ 2.80 ± 0 (60 s)	≥ 3.0
Formaldehyde (0.7%) [b]	≤ 3.8 ± 0 (120 s)	≥3.01
Formaldehyde (1.0%) [b]	≤ 3.8 ± 0 (120 s)	≥3.01
Glutardialdehyde (0.5%) [b]	≤ 2.8 ± 0 (120 s)	≥4.01
Incidin plus[e] (2%) (26% glucoprotamin)	≤ 4.8 ± 0 (120 s)	≥1.68

[a]Input virus titre 5.55 ± 0.44
[b]Input virus titre 7.18 ± 0.37, tested by membrane filtration
[c]Input virus titre 6.95 ± 0.37, tested by membrane filtration
[d]Input virus titre 5.93 ± 0.13
[e]Input virus titre 6.48 ± 0.37, tested by membrane filtration

Rabenau et al. Med Microbiol Immunol 2005;194:1-6.

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VIRUS SUSCEPTIBILITY TO CHEMICAL DISINFECTION

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SARS-CoV
Suspension test

Rabenau et al. JHI 2005;61:107-11

Table I Efficacy of different types of disinfectant at various exposure times against SARS coronavirus, expressed as minimum reduction factors (RFs) of three parallel experiments: 0.3% serum albumin (BSA), 10% fetal calf serum (FCS), and 0.3% BSA with 0.3% sheep erythrocytes

Product	Type of area of application	Concen-tration	Exposure time	RF (and SD) 0.3% BSA	RF (and SD) 10% FCS	RF (and SD) 0.3% BSA and 0.3% sheep erythrocytes
Sterillium	Hand rub	Undiluted	30 s	≥4.25 (0.47)	≥4.25 (0.47)	≥4.25 (0.47)
Sterillium Rub	Hand rub	Undiluted	30 s	≥4.25 (0.47)	≥4.25 (0.47)	≥4.25 (0.47)
Sterillium Gel	Hand rub	Undiluted	30 s	≥5.5 (0.54)	≥5.5 (0.54)	≥5.5 (0.54)
Sterillium Virugard	Hand rub	Undiluted	30 s	≥5.5 (0.54)	≥5.5 (0.54)	≥5.5 (0.54)
Mikrobac forte	Surface disinfectant	0.5%	30 min	≥6.13 (0.35)	≥6.13 (0.35)	≥6.13 (0.35)
			60 min	≥6.13 (0.35)	≥6.13 (0.35)	≥6.13 (0.35)
Kohrsolin FF	Surface disinfectant	0.5%	30 min	≥3.75 (0.71)	≥3.75 (0.71)	≥3.75 (0.71)
			60 min	≥3.75 (0.71)	≥3.75 (0.71)	≥3.75 (0.71)
Dismozon pur	Surface disinfectant	0.5%	30 min	≥4.5 (0.54)	≥4.5 (0.54)	≥4.5 (0.54)
			60 min	≥4.5 (0.54)	≥4.5 (0.54)	≥4.5 (0.54)
Korsolex basic	Instrument disinfectant	4%	15 min	≥3.25 (0.47)	≥3.25 (0.47)	≥3.25 (0.47)
		3%	30 min	≥3.25 (0.47)	≥3.25 (0.47)	≥3.25 (0.47)
		2%	60 min	≥3.25 (0.47)	≥3.25 (0.47)	≥3.25 (0.47)

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VIRUS SUSCEPTIBILITY TO CHEMICAL DISINFECTION

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… Other studies

Sattar et al. Epidem Inf 1989;102:498-505

- H-CoV-229E compared to other viruses
- Virus on surfaces in mucin or faeces – 1 min exposure
- 3 log_{10} reduction after 1 min exposure time ■ yes ■ no

Chlorhexidine cetrimide	0.008% 0.08%
Chlorhexidine cetrimide + ethanol	0.008% 0.08% 70%

NaOCl	0.10% (pH 9.4)
	0.5% (pH 11.0)
Chloramine T	0.10% (pH 8.0)
	0.30% (pH 8.0)
PVP-I	1% iodine (pH 3.0)
Ethanol	70%
GTA	2% (pH 7.0)

BZC	0.04% (pH 6.0)
BZC + HCl	0.04% (pH 1.0) 7%
BZC + ethanol	0.04% (pH 5.0) 70%
BZC + sodium metasilicate	0.04% (pH 11.0) 0.5%

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CONCLUSIONS

- Enveloped viruses are really susceptible to chemical disinfectant

BUT

Some membrane agents need to be formulated with other excipients to have rapid efficacy against SARS-CoV

- Enveloped viruses are generally fragile but can persist on surfaces when mixed with organic load

SARS-CoV may persist better at low temperature and low RH

- Required efficacy for a chemical disinfectant depends on:

Virus type
Virus load on surface
Virus infectious dose

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THANK YOU

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June 17, 2020	*(South Pacific Teleclass)* SHARPS INJURIES - WHY AREN'T WE AT ZERO? Speaker: **Terry Grimmond**, Grimmond and Associates, New Zealand
July 9, 2020	INFECTION PREVENTION AND CONTROL IN HOME CARE AND HOSPICE: COMMON COMPLIANCE ISSUES Speaker: **Mary McGoldrick**, Home Health Systems, Inc.
July 16, 2020	*(FREE Teleclass)* THE BUZZ AROUND MOSQUITOES AND MOSQUITO-BORNE DISEASES Speaker: **Dr. Marcia Anderson**, Environmental Protection Agency
July 23, 2020	IMPROVEMENT OF HOSPITAL ENVIRONMENTAL CLEANING AND DISINFECTION PRACTICES FOLLOWING AN EIGHT-MONTH OUTBREAK Speaker: **Corey Weisgerber** and **Terrence Shaw**, Regina General Hospital, Saskatchewan
August 6, 2020	CLEANING AND DISINFECTION IN THE ERA OF SARS-COV-2 Speaker: **Dr. Curtis Donskey**, Louis Stokes VA Medical Center, Cleveland, Ohio
August 13, 2020	AHEAD - A CONSOLIDATED FRAMEWORK FOR BEHAVIOURAL INFECTIOUS RISKS IN ACUTE CARE - PART 2 Speaker: **Prof. Hugo Sax** and **Dr. Lauren Clack**, University of Zurich Hospitals, Switzerland

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