Surface Textures and Implications for Needed Standards

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Dimer
UVC INNOVATIONS

Certified WBENC Women's Business Enterprise

NIST UV Workshop
14 January 2020

UV HAMMER

HIGHEST POSSIBLE STANDARDS

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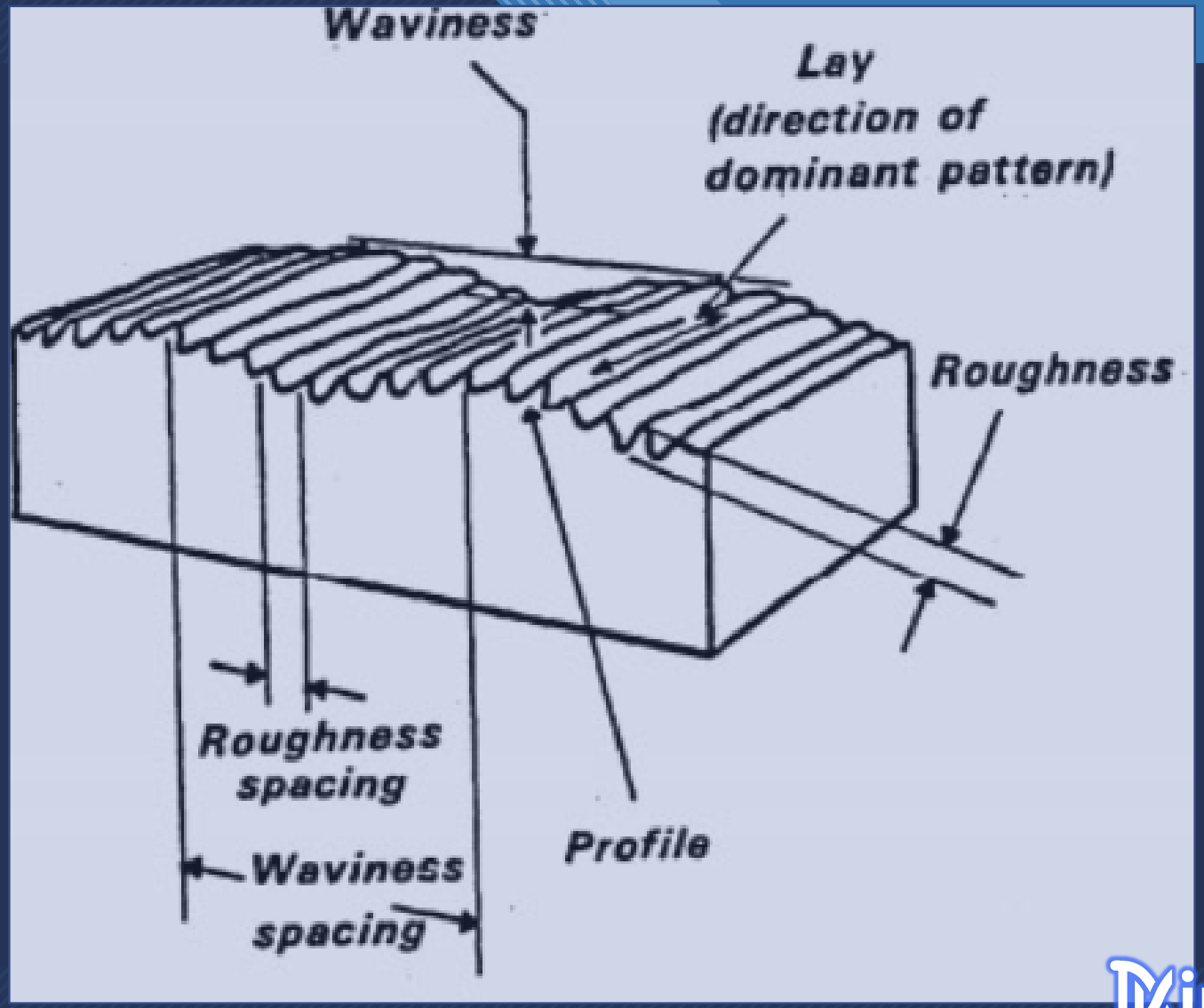
QUANTIFYING “TEXTURE”



ORIGINAL RESEARCH

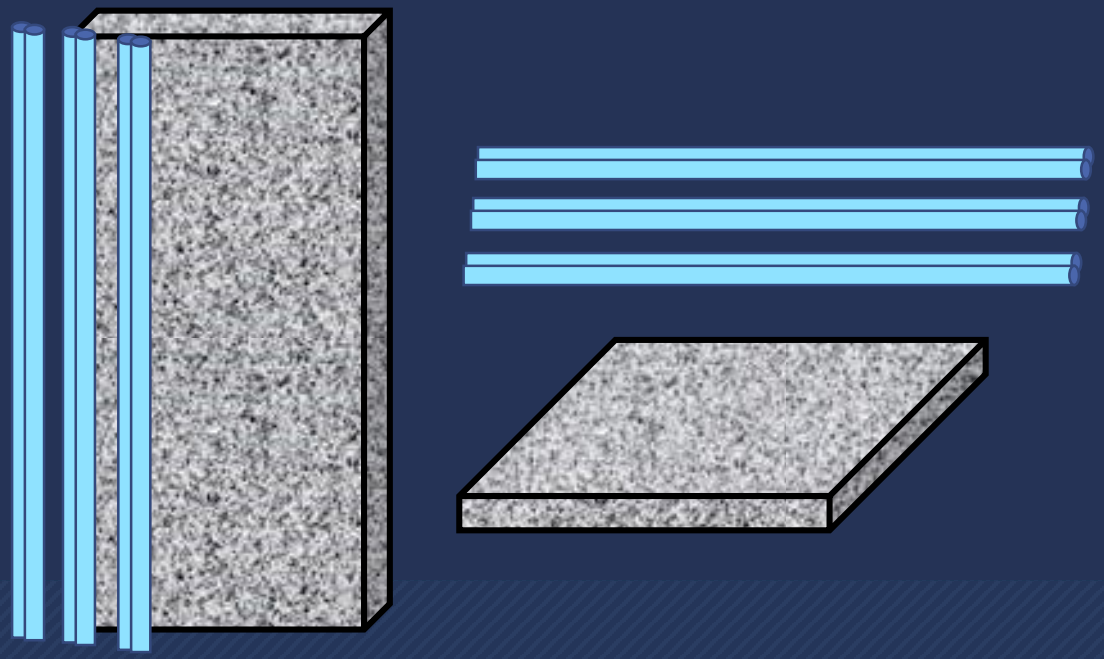
Objective

To assess germicidal effectiveness of UVC applied parallel vs perpendicular to textured vs smooth surfaces.

ORIGINAL RESEARCH

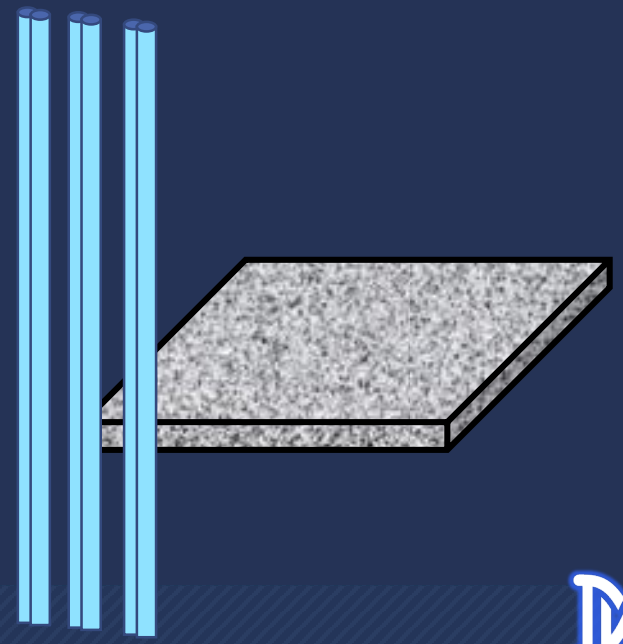
Parallel

UVC sources coplanar with surface: vertical lamps to vertical surface, horizontal lamps to horizontal surface



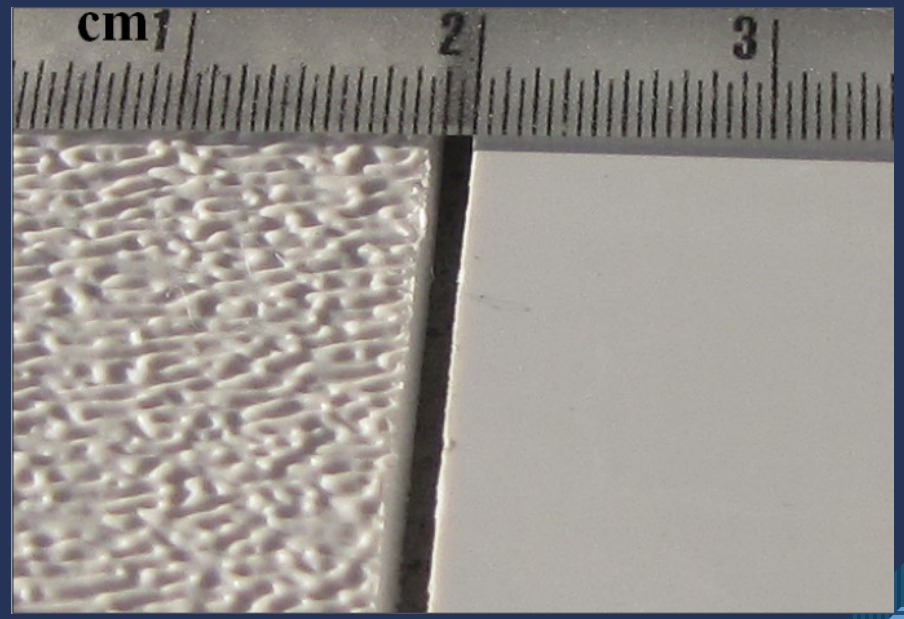
Perpendicular

UVC sources in plane 90 degrees to surface: vertical lamps to horizontal surface



MATERIALS & METHODS

- Disinfected ABS 8cm x 8cm smooth & textured tiles
- Inoculated with a Staph *aureus* solution & allowed to dry
- Tiles (n=9) arranged horizontally around a UVC meter (Intl Light Technologies)
- Set UVC dosing of 5, 10, or 20 mJ/cm^2
- Quantitative Baird Parker contact plates
- Plates incubated 36 hours then photographed
- CFUs enumerated and results in spread sheet



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MATERIALS & METHODS
UVHAMMER

PARALLEL

Lamps 1.1m from surface & meter

Lamp length 505mm

PERPENDICULAR

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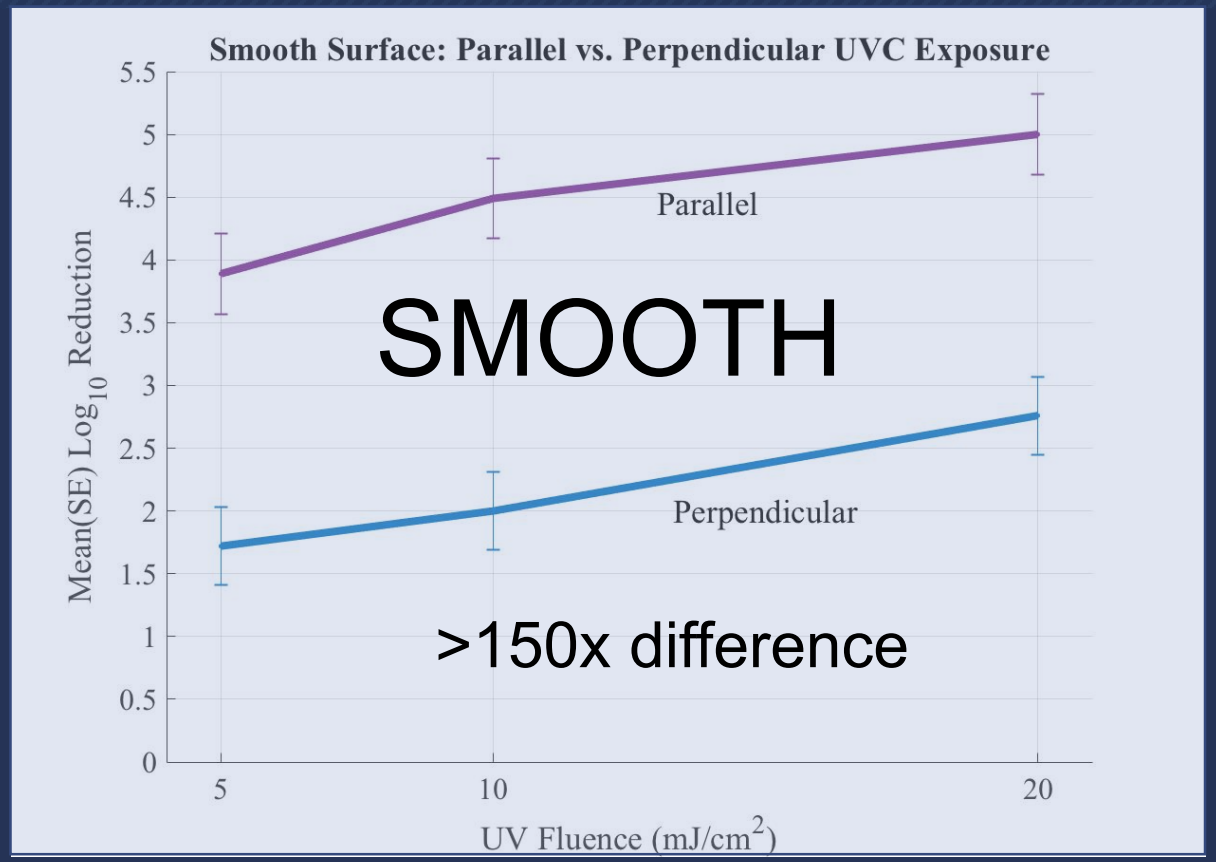
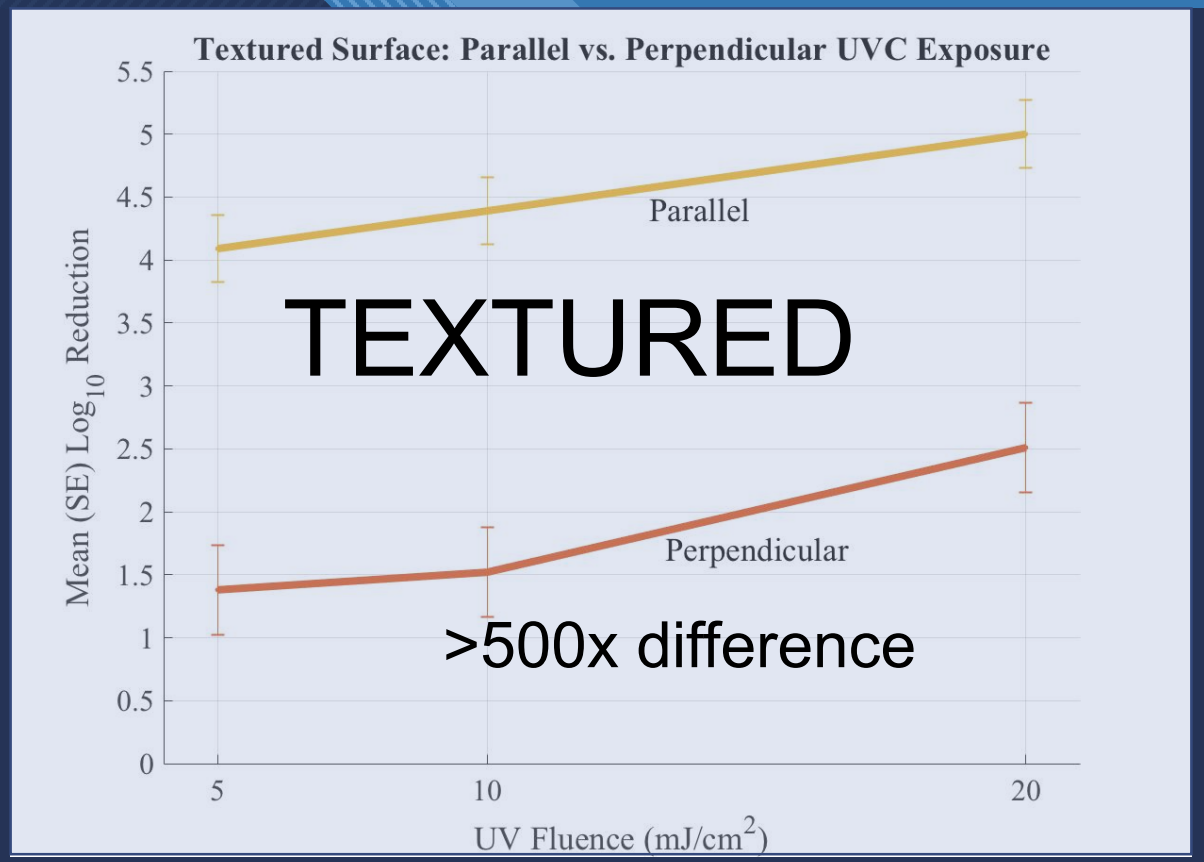
RESULTS





For both smooth & textured parallel>>perpendicular

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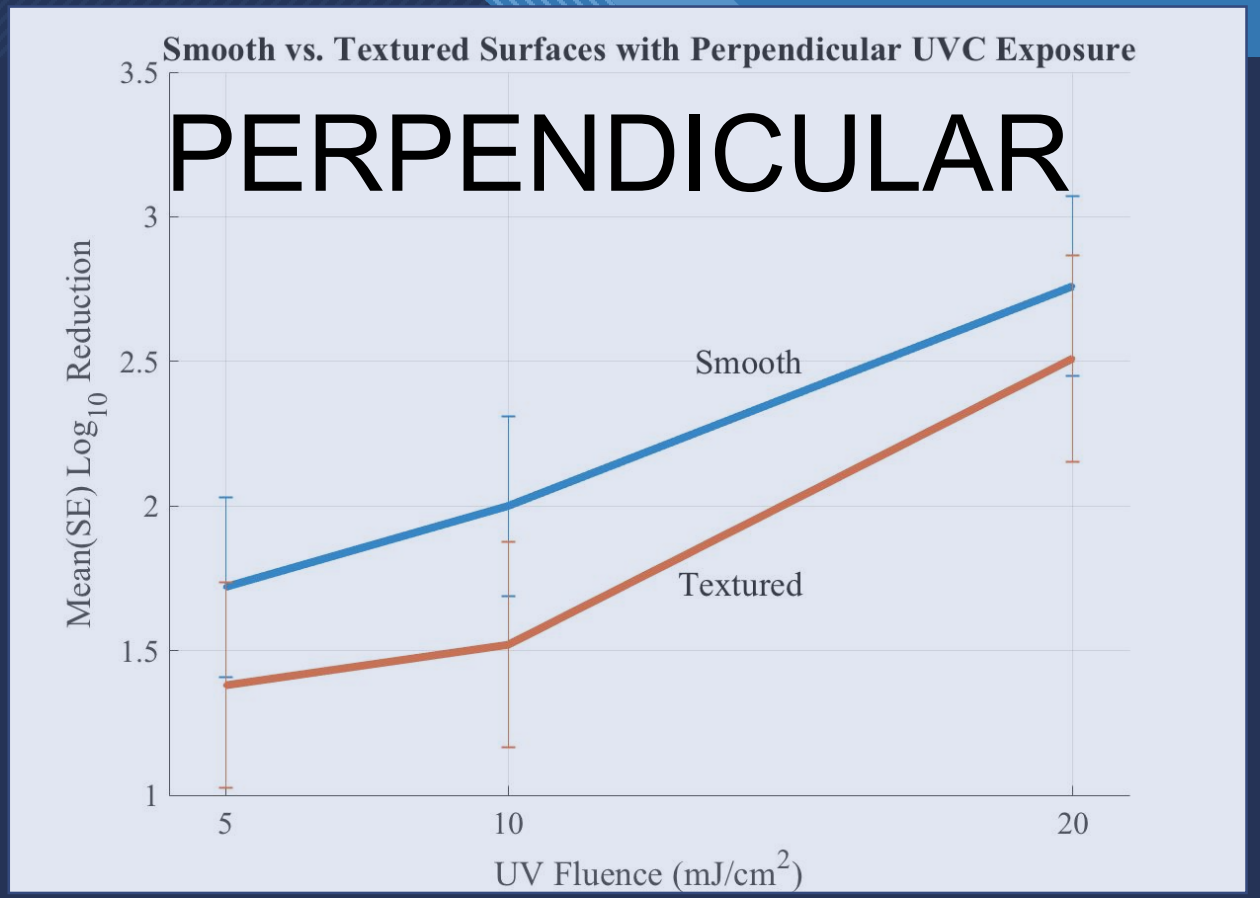
RESULTS



Smooth>>textured CFU reduction ($p<0.01$)

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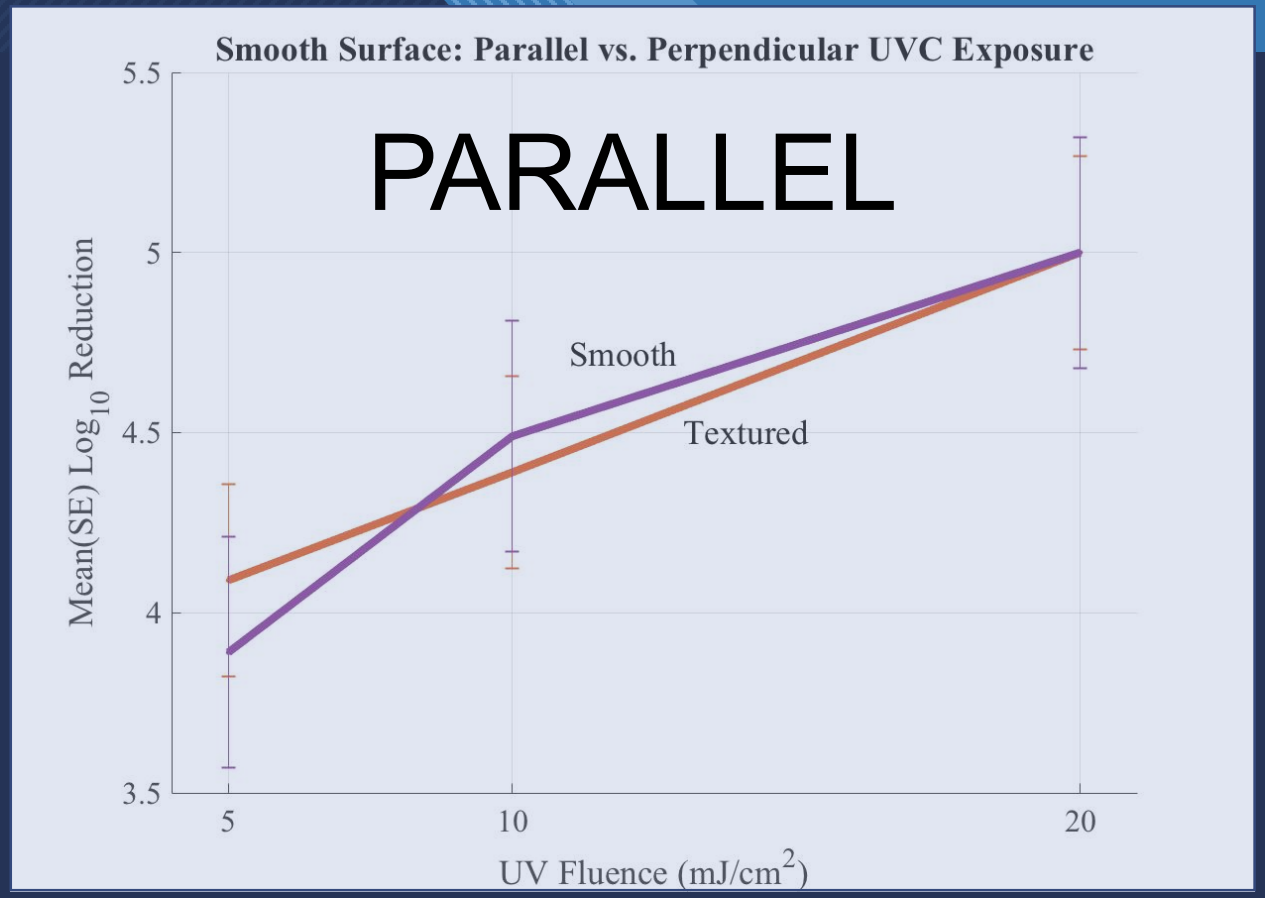
RESULTS



CFU reductions excellent with both textured & smooth surfaces (parallel lamps make texture irrelevant)

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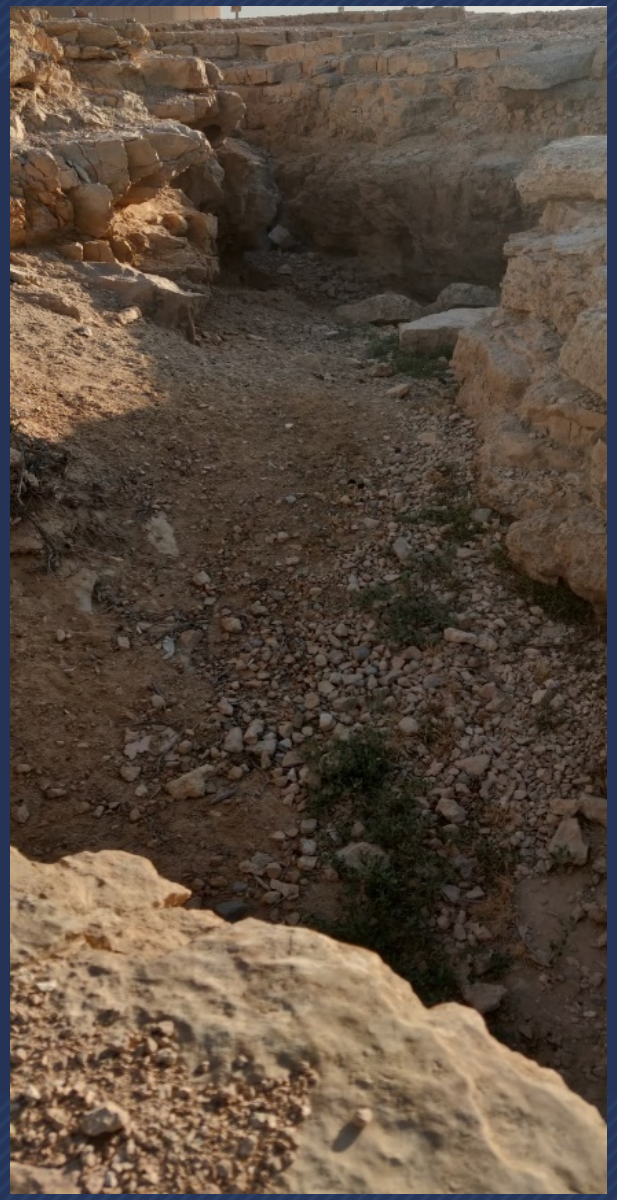
“CANYON WALL” EFFECT

9am



NOON

2m deep

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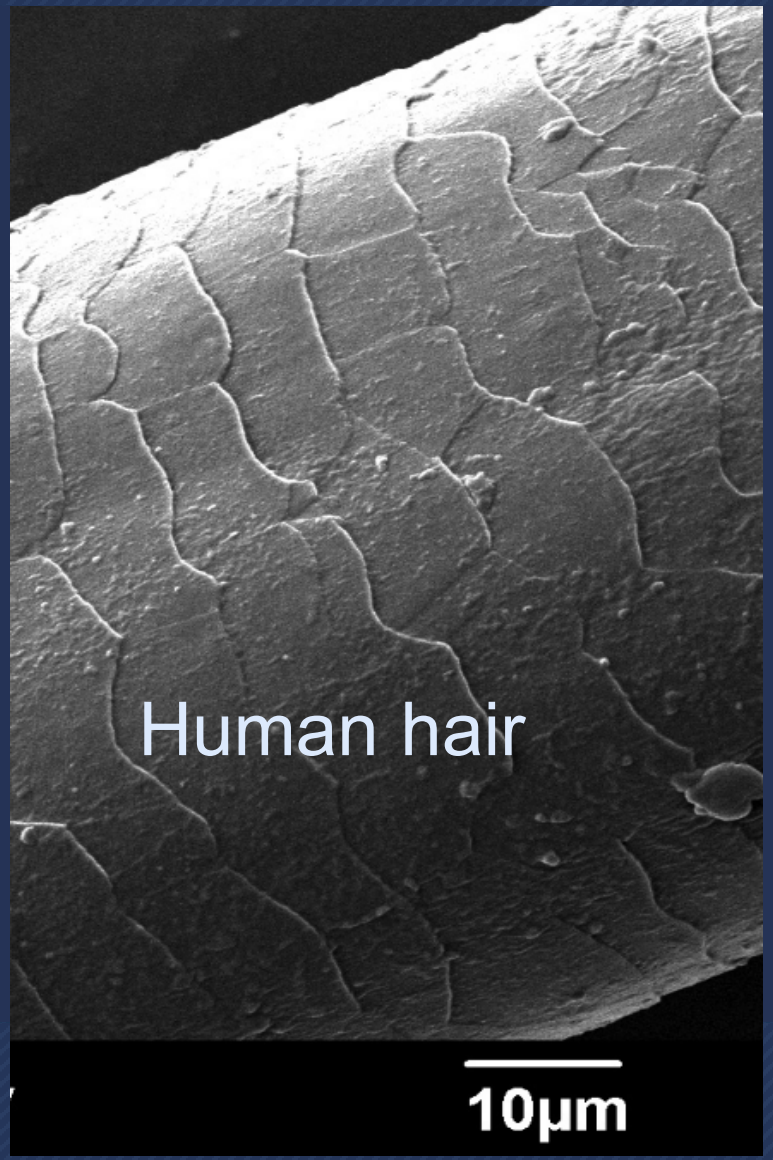
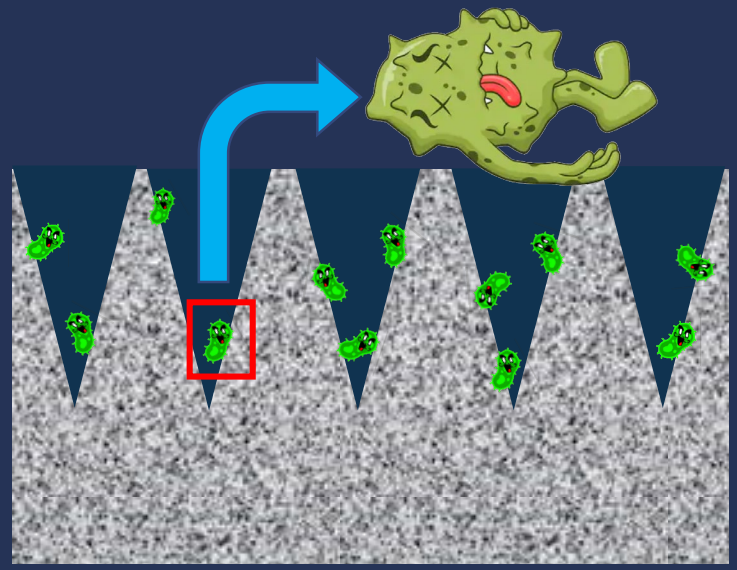
SUBMILLIMETER SCALE



Parallel UVC Exposure

UVC kill values determined by parallel exposures



Valley depth ≈ 10 microns (1/10 hair)

Bacteria ≈ 1 micron
Viruses ≈ 0.1 micron

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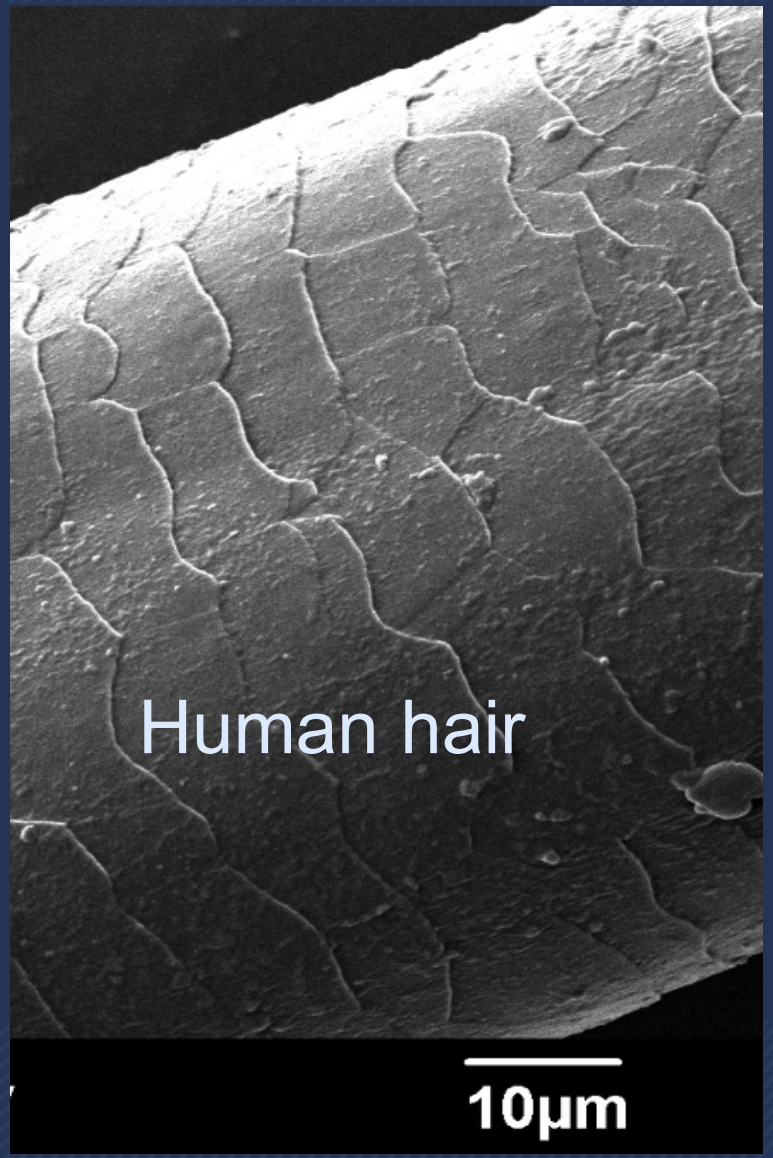
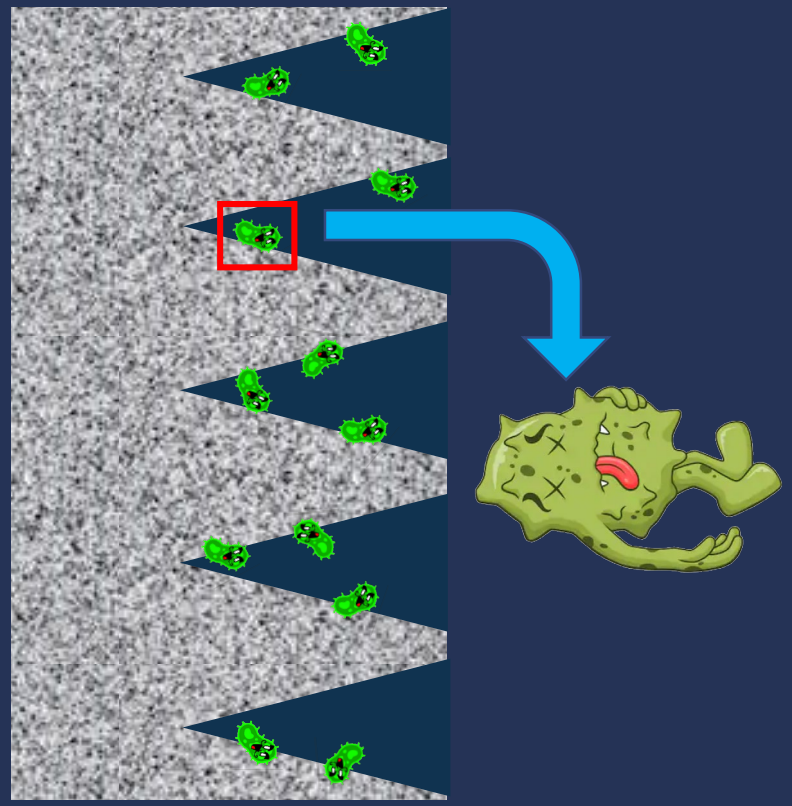
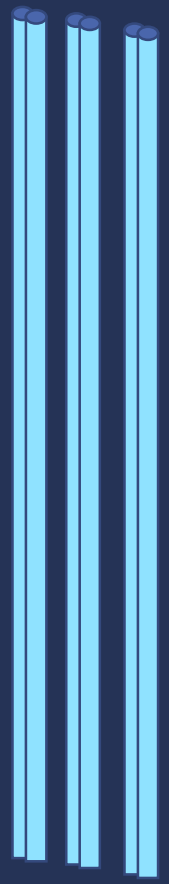
SUBMILLIMETER SCALE



Parallel UVC Exposure





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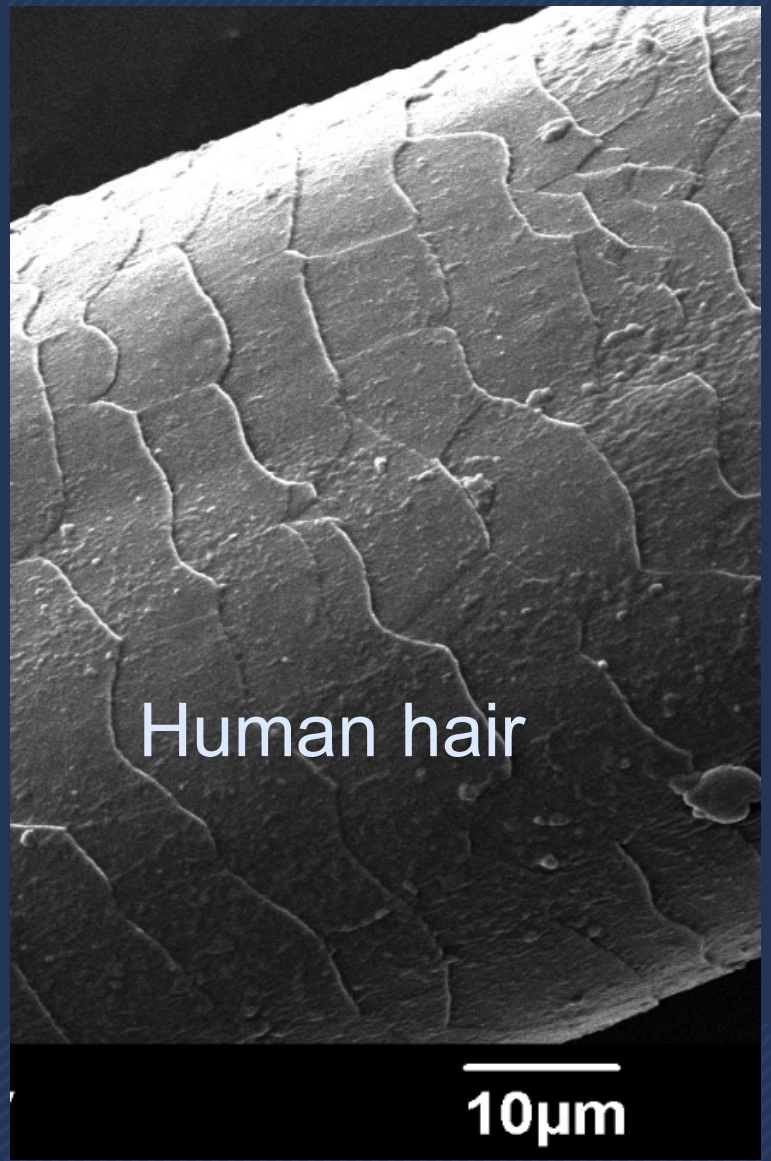
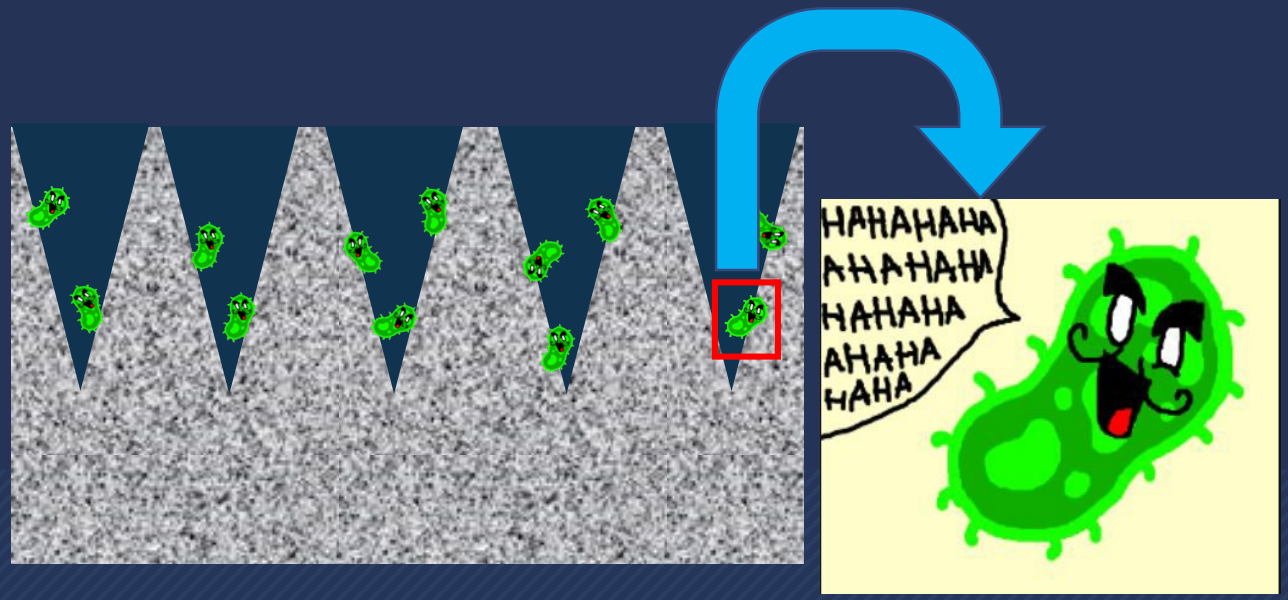
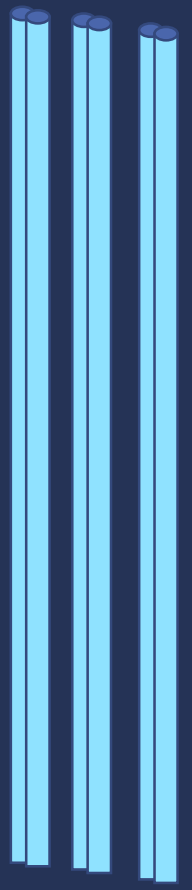
SUBMILLIMETER SCALE



Perpendicular UVC exposure





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STANDARD & TEXTURES

Ignore texture when writing a standard?

Require all surfaces to be smooth?

Require standards for multiple textures?

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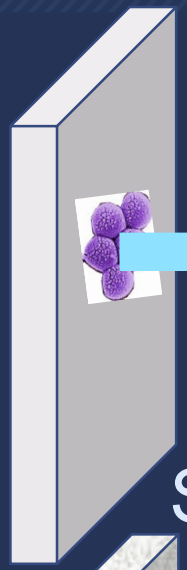
STANDARD & TEXTURES
EVIDENCE-BASED RECOMMENDATIONS



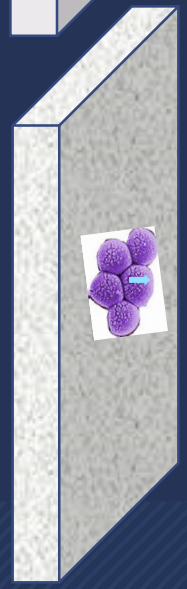
Reflected UV

Direct UV

Stainless steel
2B finish

20%

Stainless steel may falsely boost kill rate 20%



ABS plastic
textured

1.4%

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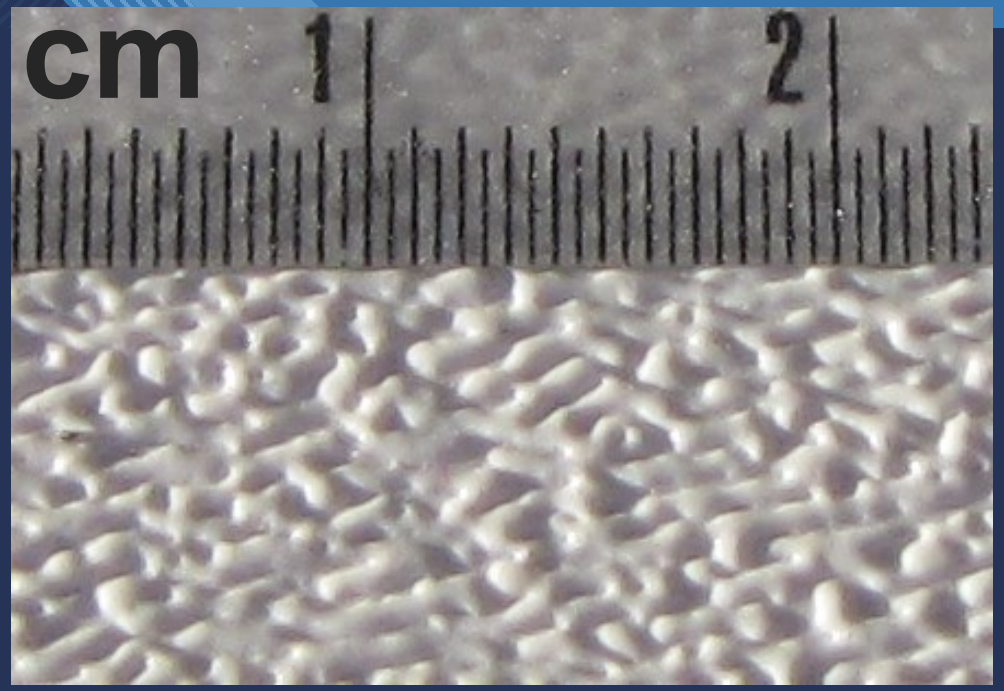
STANDARD & TEXTURES
EVIDENCE-BASED RECOMMENDATIONS



Carrier materials:

- Prevalent in the healthcare setting (Formica, vinyl, curtain, plastic, etc.)
- Low (< 5%) UVC reflectivity
- Textured with ≈ 1mm peak-valley height
- Uniform & random ≈ 1mm pattern/spacing

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STANDARD & TEXTURES
EVIDENCE-BASED RECOMMENDATIONS

Privacy curtains should be part of the Standard:

- Ubiquitous & literature-documented primary fomite
- When folded, 75% not exposed
- When unfolded, UV blocked from other side
- Textured & absorptive

STANDARD & TEXTURES
EVIDENCE-BASED RECOMMENDATIONS

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STANDARD & TEXTURES
EVIDENCE-BASED RECOMMENDATIONS

Dosimetry is a fast & cheap screening tool

- Data show >500x over-estimation of actual germ kill
- Can also under-estimate actual germ kill

Germ-killing device standards must specify germ-kill

Thank You

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