



STOP

Surface Transfer of Pathogens

Project Vision and Progress

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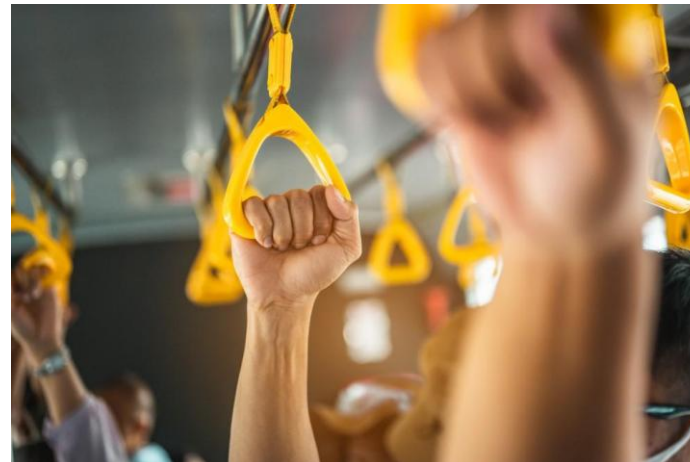
Next Generation Antimicrobial Nanocoating for High-Traffic Surfaces
Ghent 26-27 August 2026



Why STOP is needed

High-touch surfaces can transfer pathogens between cleaning cycles

Pathogens deposited by hands, droplets or contaminated objects may remain on frequently **touched surfaces**. **Conventional disinfectants act at the time of cleaning but do not provide** continuous protection. Hospitals, nursing homes, public transport and other shared spaces therefore need surface technologies that remain active during normal use, repeated cleaning and wear.





STOP aims to interrupt surface-mediated pathogen transfer

- 1. Provide continuous antibacterial and antiviral activity on high-touch surfaces.
- 2. Complement routine cleaning rather than replace it.
- 3. Reduce infection risk while limiting reliance on repeated chemical disinfection.
- 4. Create technologies suitable for permanent treatment or flexible spray application.



The STOP project combines four routes to active surfaces



1. Antimicrobial and photocatalytic nanomaterials, including metal oxides and metal nanoparticles.
2. Antimicrobial peptides and peptide-based carriers with broad activity and low antimicrobial resistance risk.
3. Laser-generated micro- and nanoscale surface structures, alone or combined with Ag and Cu.
4. Water-based formulations that support spray coating, adhesion and long-term stability.



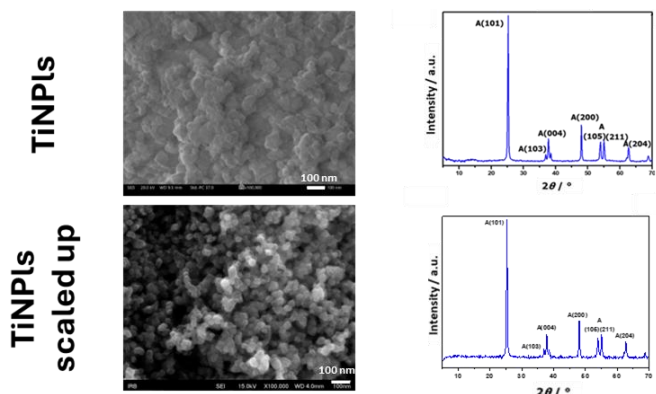
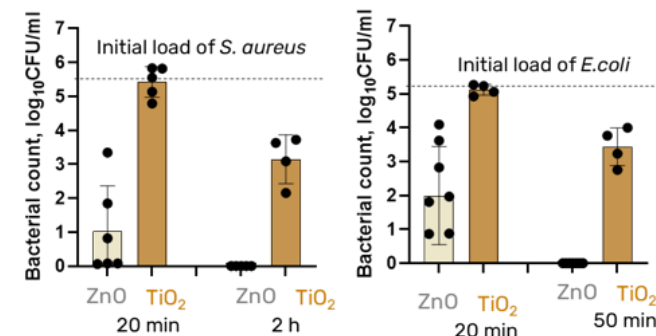
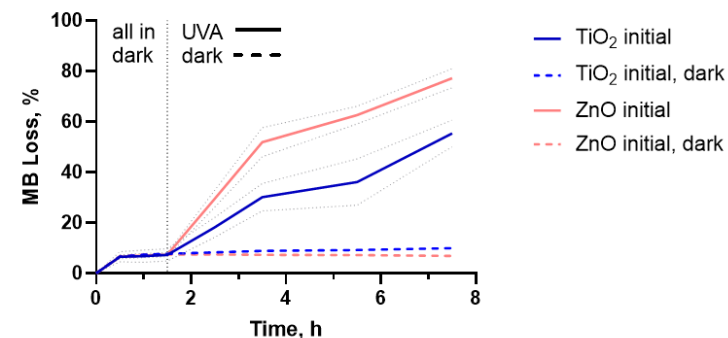
STOP objectives cover development, safety and real-world use

- **Develop** and optimise antimicrobial agents, peptides and structured surfaces.
- **Integrate** active components into stable, scalable and durable coating systems.
- **Measure** antibacterial and antiviral efficacy using standard and improved transfer tests.
- **Assess** wear, repeated cleaning, cytotoxicity, environmental safety and antimicrobial resistance selection.
- **Validate** selected technologies in realistic high-touch environments.
- **Support** standardisation, scale-up, end-user acceptance and future commercial use.



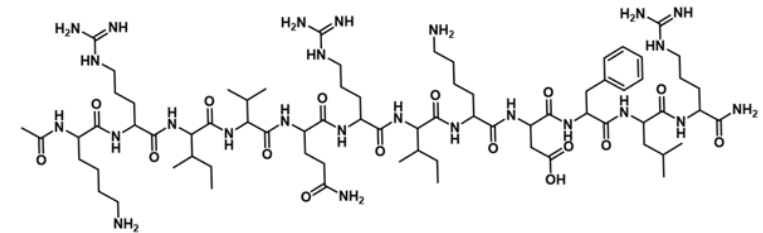
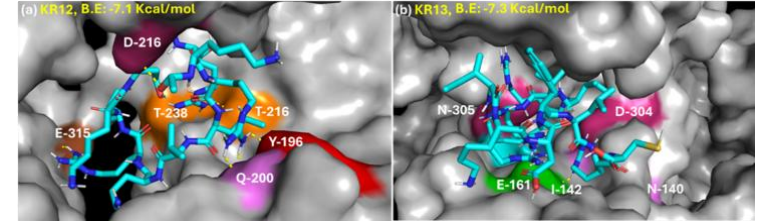
Nanomaterials progressed from comparison to scale-up

- **TiO₂** nanoplates gave the strongest combined photocatalytic and antimicrobial performance among the tested TiO₂ morphologies. Production increased from 1–3 g to about 20 g per batch while retaining morphology, particle size and surface area.
- **ZnO** showed rapid antibacterial action, and doping routes were started to extend activity
- under indoor light.



Peptide systems reached gram-scale production

- Antimicrobial peptide constructs and elastin-like peptide carriers showed **antimicrobial and antibiofilm activity**.
- Recombinant constructs became active after enzymatic cleavage**.
- Fermentation** produced gram-scale material for field trials, and discussions began with industrial partners on pilot-scale production.



UNITS 006 - UELP4



UNITS 007 - U4In (UEL4-Indolicidin)



UNITS 008 - UELP(8)



UNITS 009 - H1FK16 (HELP - 1FK16)



UNITS 010 - H2FK16 (HELP - 2FK16)

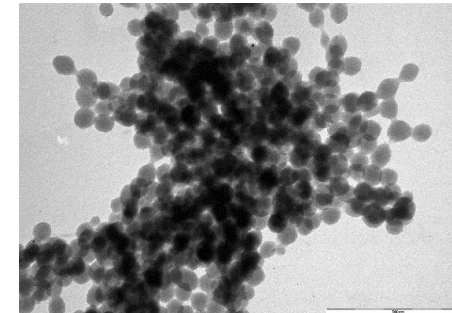
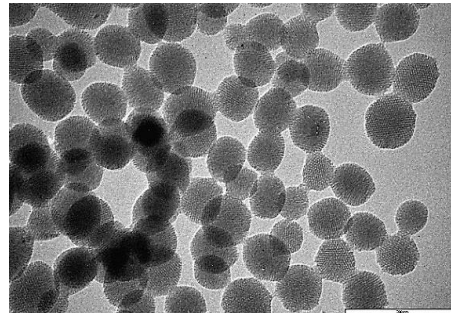
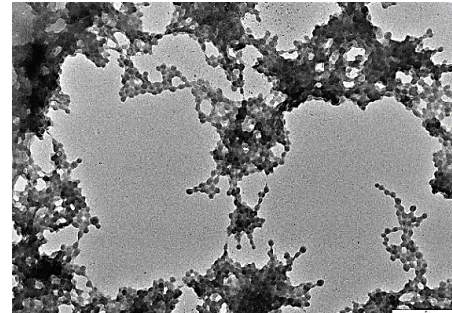
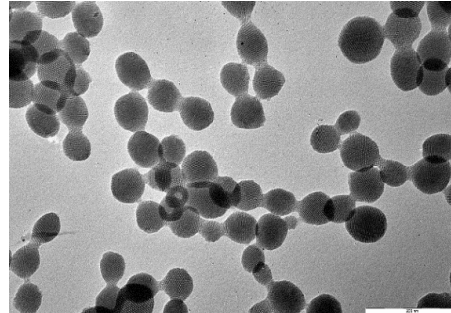


UNITS 033 - U4-2mod1R (UEL4-2xmod1R)



- *Silver-core/porous silica-shell nanoparticles*

- (a) SiO_2 NPs with NH_2 groups;
- (b) KR-12 functionalised SiO_2 NPs- NH_2 NPs;
- (c) SiO_2 NPs with COOH groups and
- (d) KR-12 functionalised SiO_2 - COOH NPs.

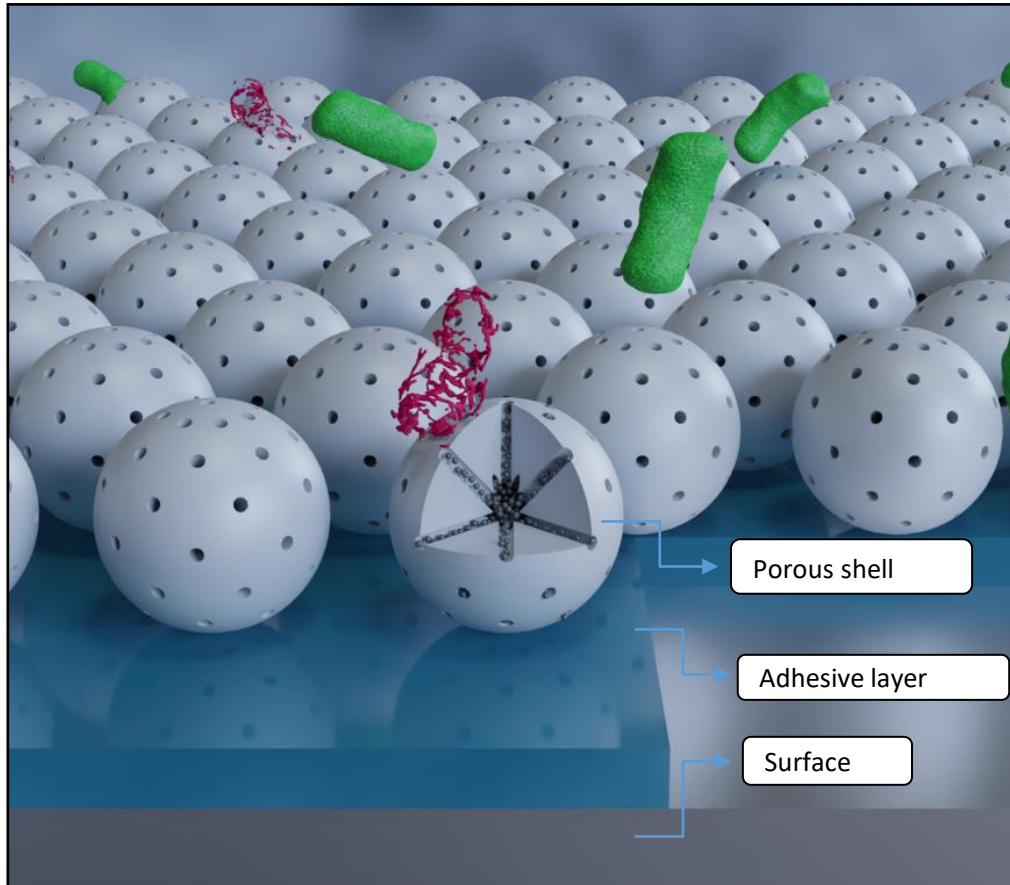


Successful synthesis of the different nanoparticle architectures and their functionalisation was confirmed using dynamic light scattering and Zeta potential measurements, transmission electron microscopy and Fourier transform infrared spectroscopy . The release of copper and silver ions from nanoparticles with different functional groups was followed using inductively coupled plasma optical emission spectroscopy.



Mesoporous Silica Nanomaterials

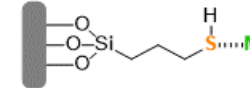
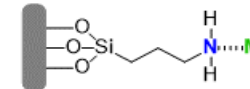
Synthesis and functionalization of NPs



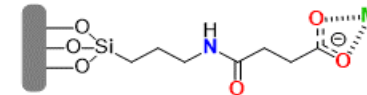
- Outer surface can be functionalized with various FG:
 - ✓ Enhance Performance (adhesion, hydrophobicity)
 - ✓ Biocompatibility
 - ✓ Antimicrobial Properties
 - ✓ Wear and corrosion resistance
 - ✓ Improve wettability or specific bindings affinities.

“Inner Surface”:

Control Metal Ion Loading & Release

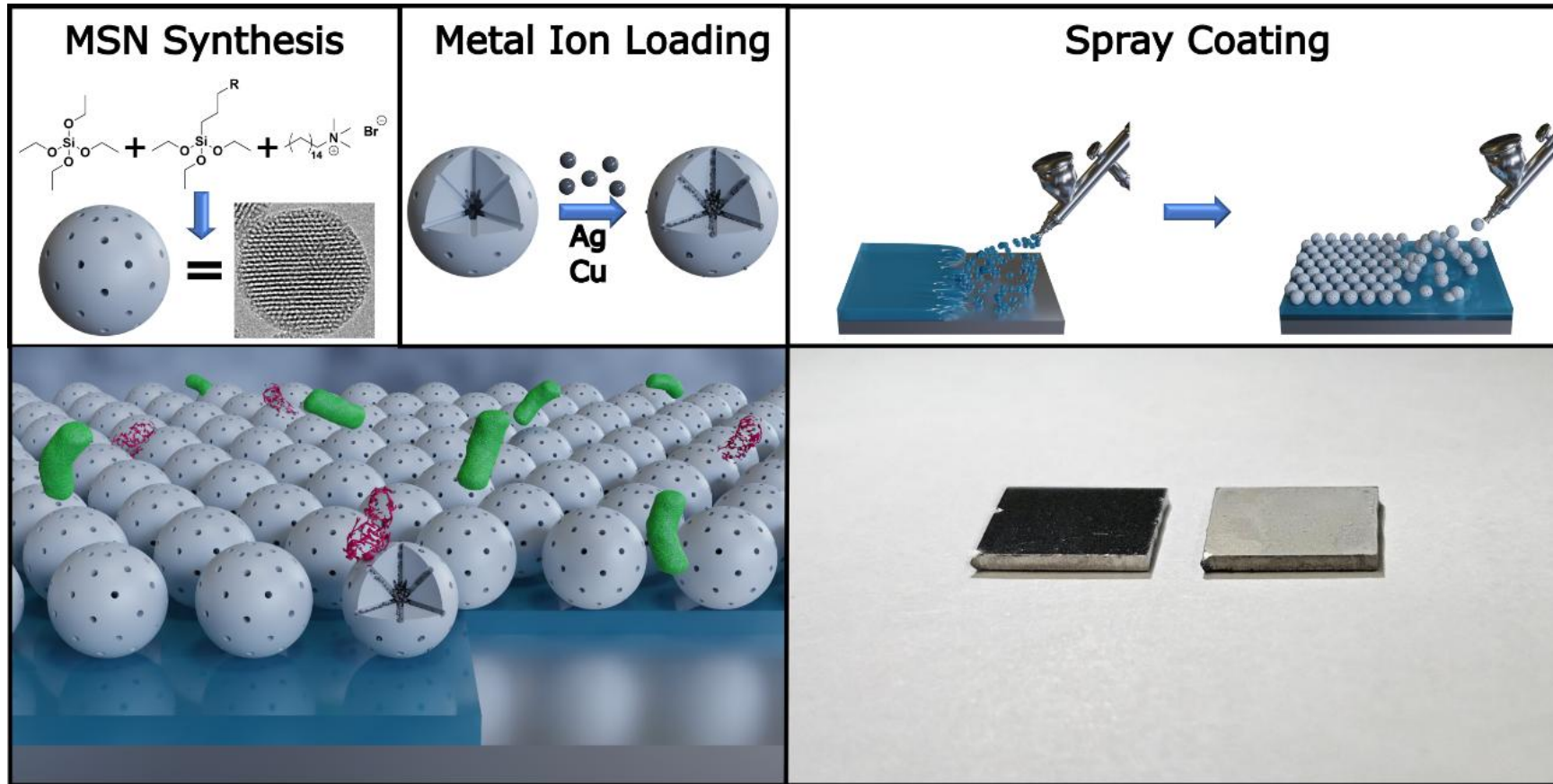


$M = Ag^+, Cu^{2+}$



Mesoporous Silica Nanomaterials

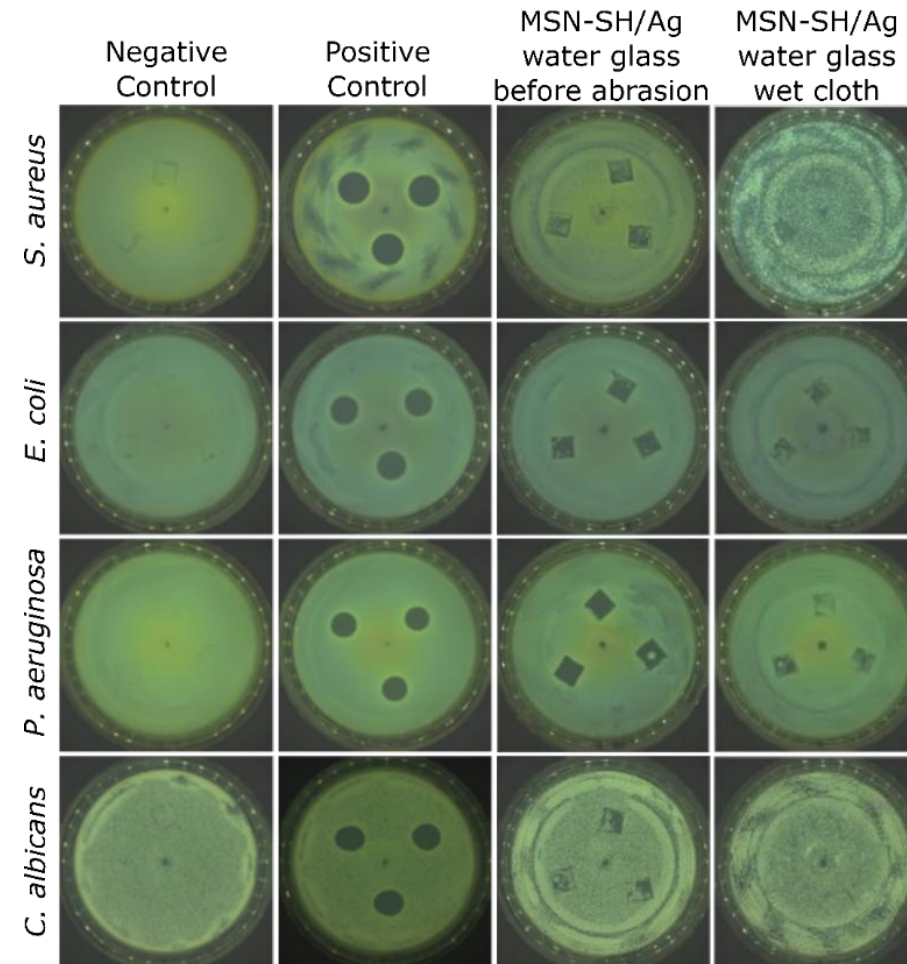
Synthesis and functionalization of NPs





Antibacterial screening

BAM-197 Water Glass + MSN-SH/Ag + Ac-KR13



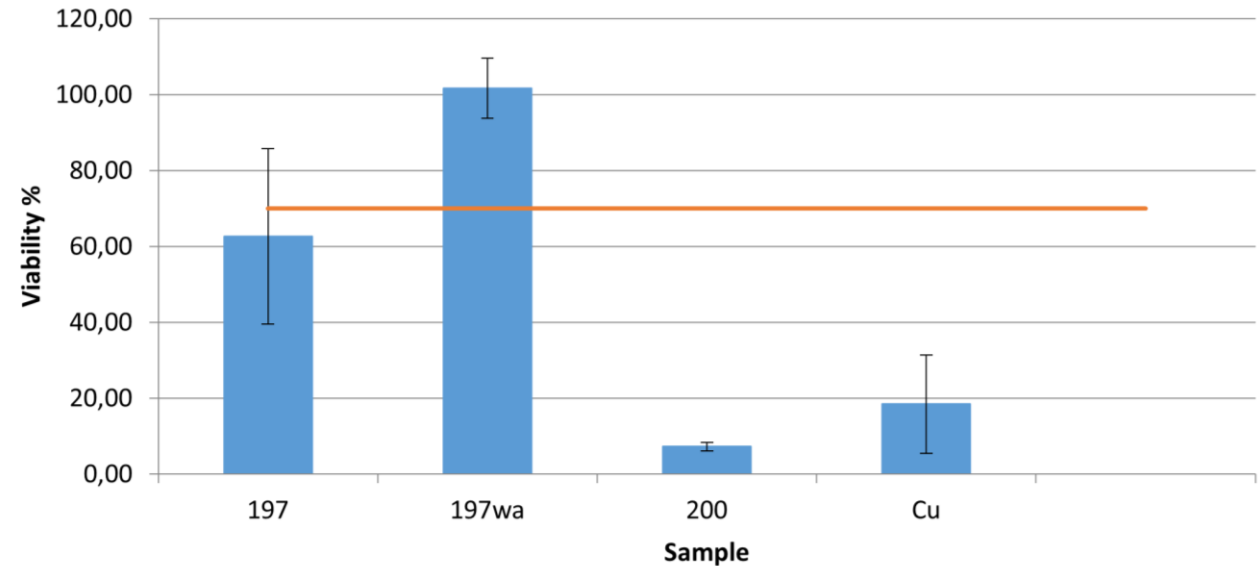
Cytotoxicity tests - UT

BAM-197 Water Glass + MSN-SH/Ag + Ac-KR13



- ✓ Easy deployable coating
- ✓ Effective against the pathogens
- ✓ No brown spots formation
- ✓ Wear Resistant (improved adhesion)
- ✓ Non-Toxic towards human cells (after wet abrasion)

Cell viability to stainless steel



- The wet abraded (25 cycles) coating is not cytotoxic under the conditions tested towards the HaCaT cells (Keratinocytes).

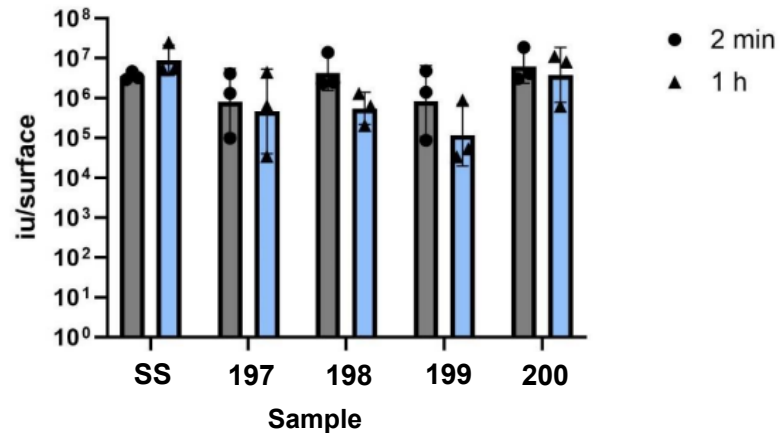
Antiviral Properties

Peptide conjugation (from UoB)

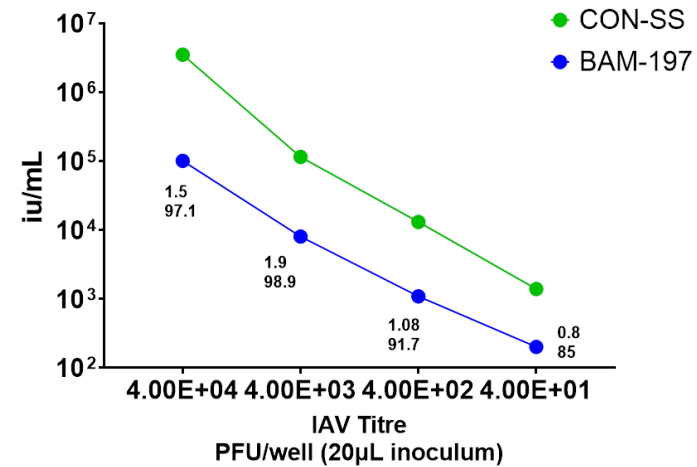


- Effective against Influenza A virus and SARS-CoV-2
- Ineffective against Adenovirus

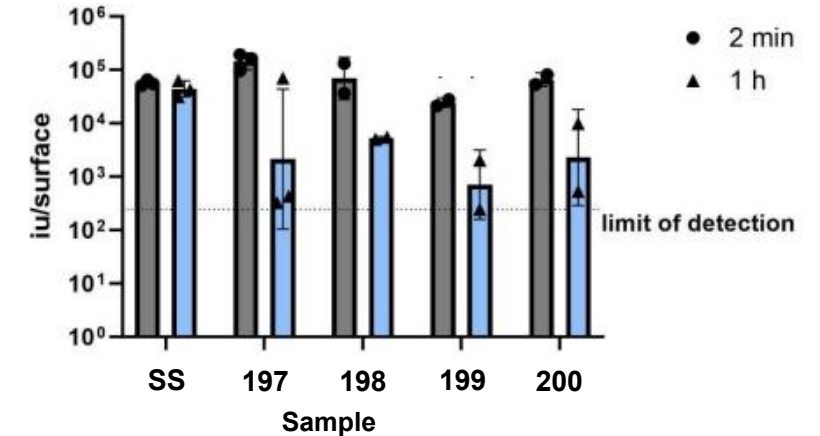
Adenovirus



Influenza A virus



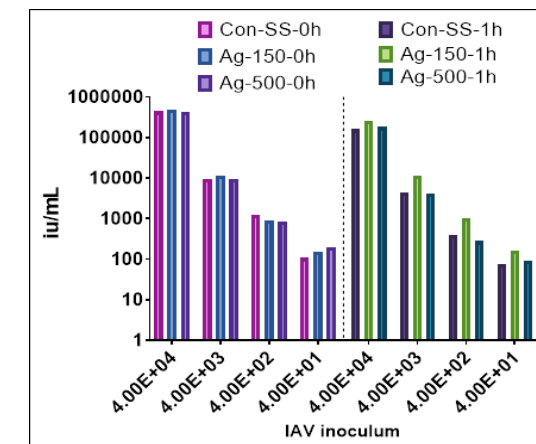
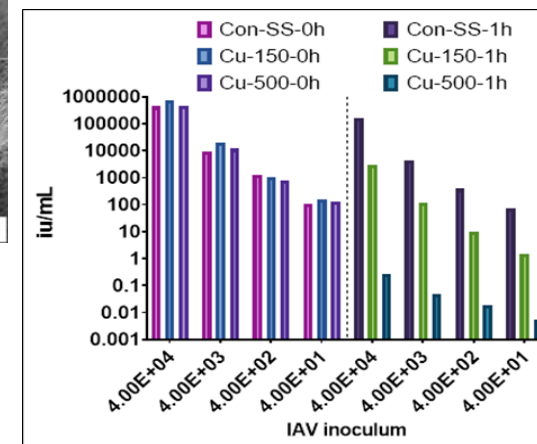
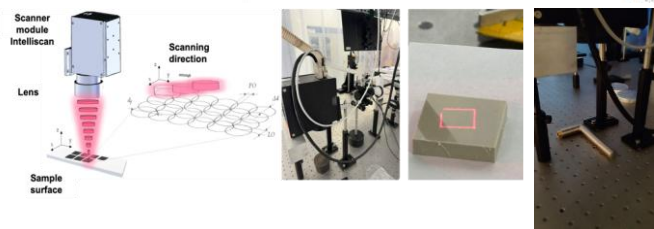
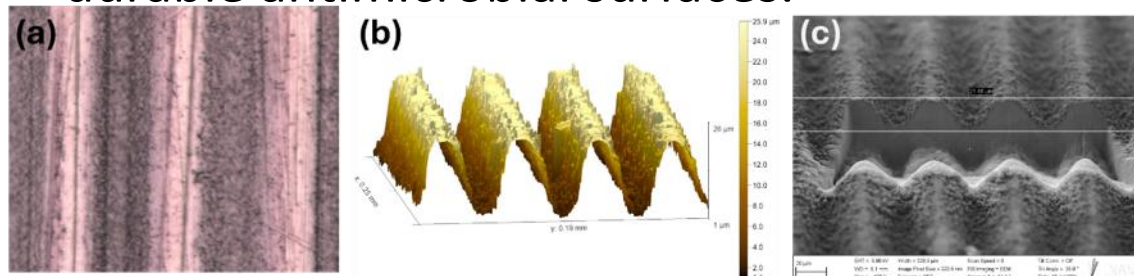
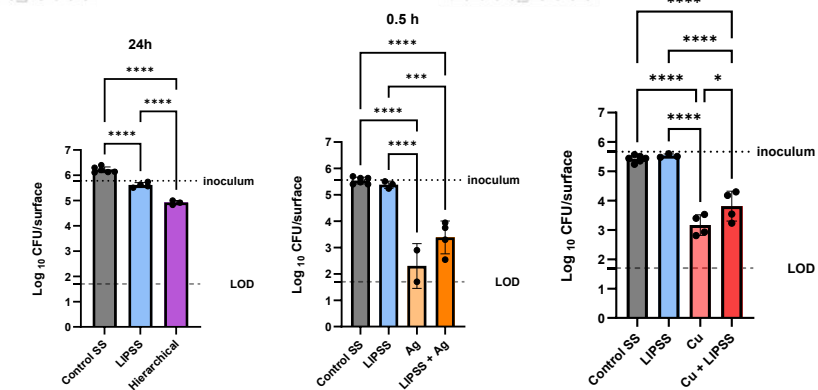
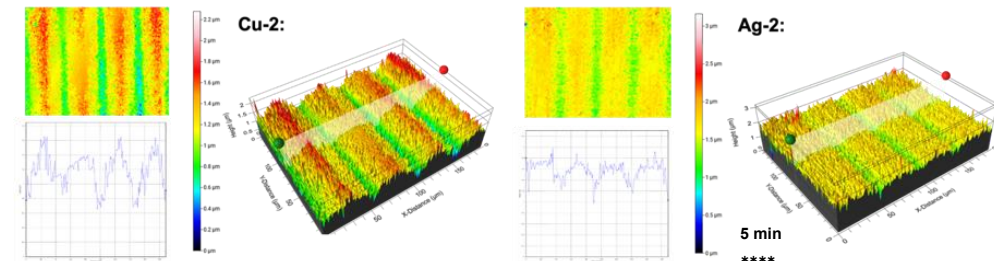
SARS-CoV-2





Laser structuring and Ag/Cu layers produced durable active surfaces

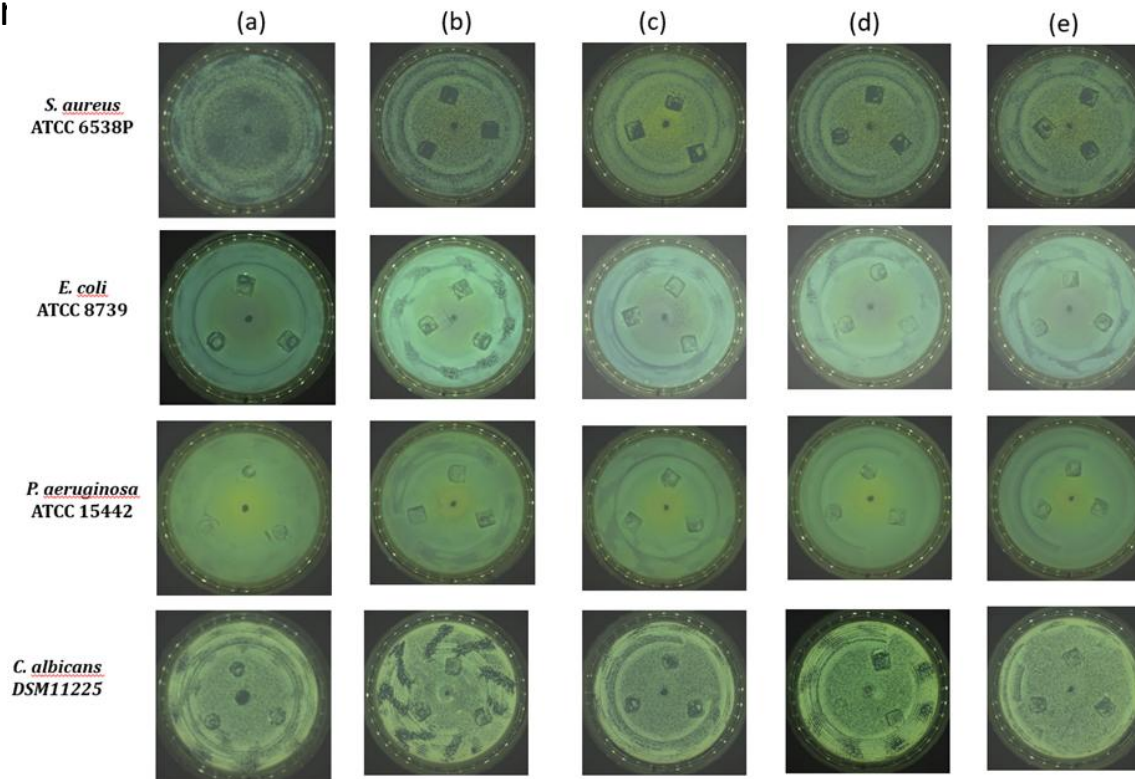
- Femtosecond laser processing produced LIPSS and hierarchical features on stainless steel. Combining these structures with sputtered Ag or Cu nanolayers gave strong antibacterial and antiviral effects. Morphology, wettability, surface chemistry and stability testing support their use as durable antimicrobial surfaces.



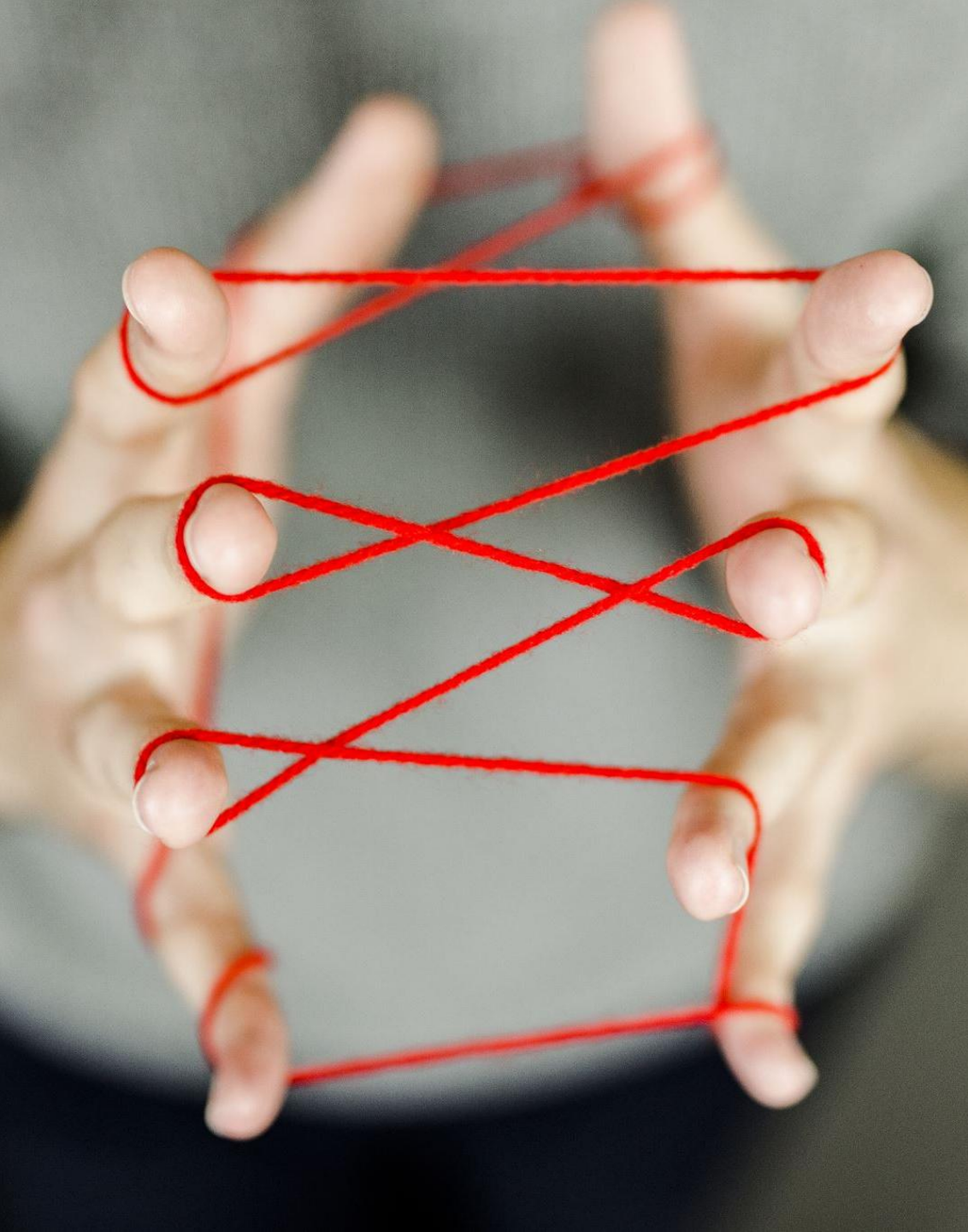


Water-based coating formulations are stable and spray compatible

Stable formulations were produced with **TiO₂**, **MXenes**, **graphene oxide**, **peptides** and **polymer** additives. Non-ionic stabilisers retained TiO₂ activity better than charged polyelectrolytes, with Pluronic F-127 among the best systems. Al₂O₃ improved the dispersion of graphene oxide and MXenes in non-fluorinated polymer



ScreenTT test results for (a) Dynasylan® SIVO 121, (b) 98wt% Dynasylan® SIVO 121 + 2wt% SiO₂-COOH,Acetyl-KR12, (c) 98%wt. Dynasylan® SIVO 121 + 2%wt.SiO₂-COOH,FMOC-KR12, (d) 98%wt. Dynasylan® SIVO 121 + 2%wt. SiO₂-NH₂,Ac-KR12 and (e) 98%wt. Dynasylan® SIVO 121 + 2%wt. SiO₂-NH₂,FMOC-KR12)



Methods now link coating structure, durability and transfer efficacy

- **GISAXS and XRR methods were set up to quantify coating coverage, thickness, peptide orientation and abrasion-related change.**
- Reproducibility work and interlaboratory ring trials were also started for the pathogen-transfer test methods developed by the consortium.



Biological questions

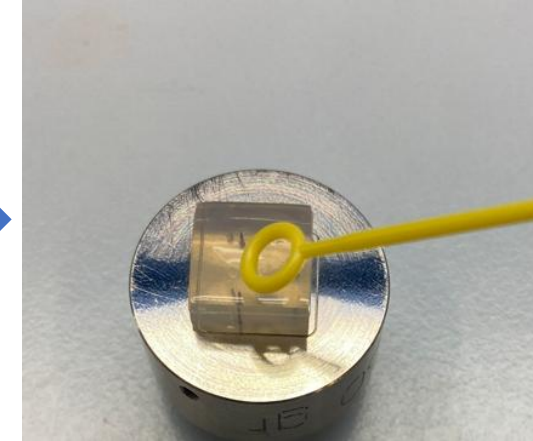
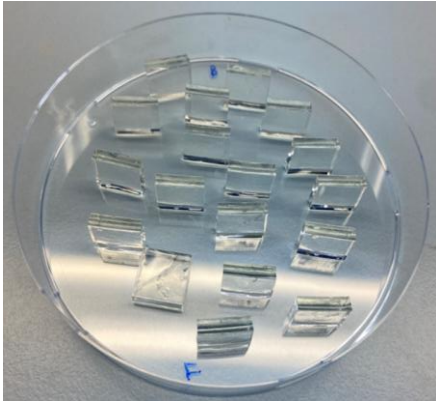


1) Can we reproduce transfer of bacteria through fingertips in the lab?

2) Can we test use it to study antimicrobial surfaces?



Fingertip mimicking: touch transfer of bacteria



Thermoresponsive Hydrogel

Bacterial inoculation

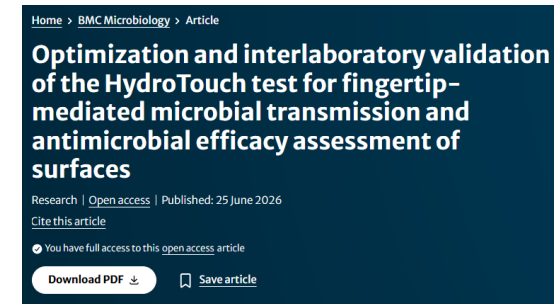


Test surface

“Stamping”

Quantitative Assessment of Microbial Transmission onto Environmental Surfaces Using Thermoresponsive Gelatin Hydrogels as a Finger Mimetic under In Situ-Mimicking Conditions

Mihyun Lee ^{1,✉}, Luzia Wiesli ¹, Frank Schreiber ², Angela Ivask ³, Qun Ren ^{1,✉}

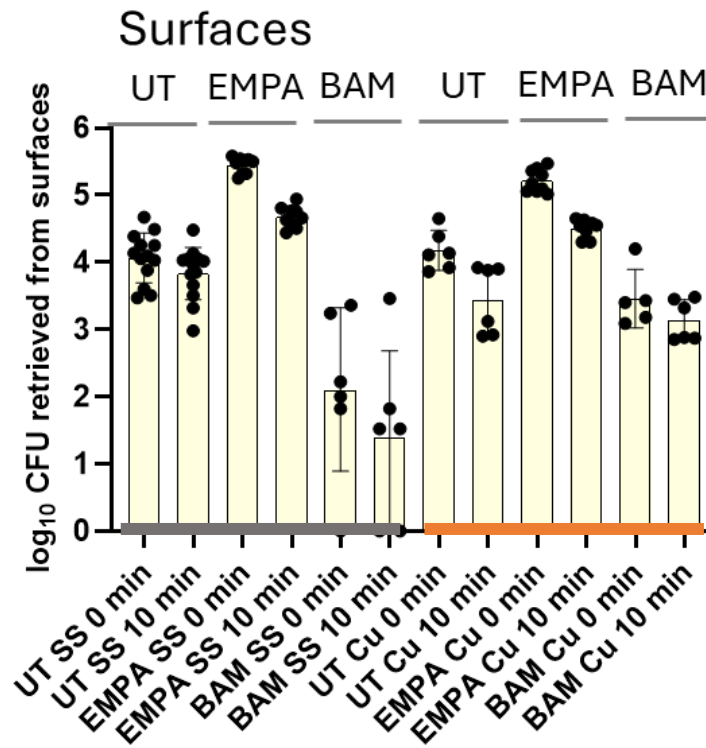
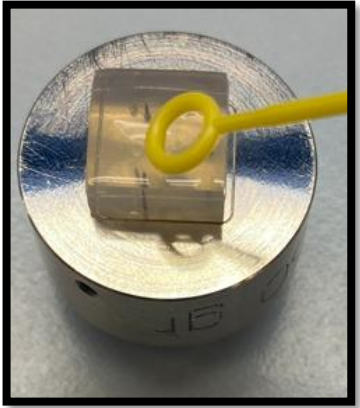


Roberto B.M. Marano, Mihyun Lee, Celeste Peterson, Brenda Raid, Mila S. Wolters, Niclas Nordholt, Susann Wiltner, Luzia Wiesli, Mati Kook, Henryk Schnaars, Dagmar K. Willkomm, Qun Ren, Frank Schreiber & Angela Ivask ✉

<https://doi.org/10.1007/s00103-025-04061-1>

<https://link.springer.com/article/10.1186/s12866-026-05312-0>

Touch transfer of bacteria on antimicrobial surfaces (copper) and control (stainless steel) and recovery of cells after 0 and 10 minutes



- 3-17% of bacteria transferred through simulated touch.
- Environmental variables (humidity, soiling, dessiccation) are accounted for.
- **Real life conditions** suggest that even just 1-2 log₁₀ reduction from the antimicrobial material could be enough to mitigate surface-transfer of pathogens.

SS= stainless steel; Cu = copper. Incubation time: 0 and 10 minutes





-
- It is possible to **mimic** surface transfer of pathogens through a modeled **fingerprint**, and this can be used to test **antimicrobial surfaces**.
 - **Problems encountered:**

The method encompasses higher than expected biological variety (but reflects reality).



Laboratory validation has moved to field testing

Current technology readiness is **TRL 3–5**.

Real-world testing is being prepared in nursing homes in Finland and Greece, marking the move from controlled laboratory studies to testing under realistic operating conditions.

We developed an epidemiological model based on existing literature data and aim to interpret real-world testing outcomes using it.



Further public and public-private support is still needed

Most technologies remain in advanced validation and early demonstration. Grant and **public-private funding remain important. As selected systems reach** higher TRLs, industrial finance and product-development routes should become more suitable.

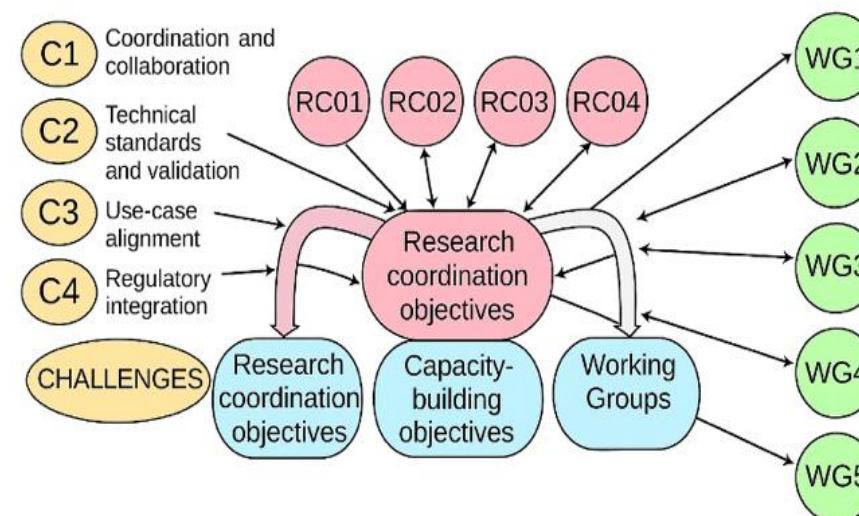
COST ACTION

Reducing Surface Microbial Transmission

DEADLINE: 28 October 2026

Open invitation

Contact: a.stamboulis@bham.ac.uk



Network diagram illustrating the structure of the RedSMiT Action: the main challenges (C1-C4), the research coordination objectives (RCOs), the capacity-building objectives (CBOs), and the working groups (WGs).



STOP addresses five gaps in European antimicrobial surfaces

1. Durable activity under realistic use, cleaning and wear.
2. A combination of efficacy, safety, scale-up and environmental acceptability.
3. Better preparedness for outbreaks and healthcare-associated infections.
4. Standardised tests that reflect real pathogen transfer.
5. European capacity in nanomaterials, peptides, laser structuring, coatings and advanced analysis.

STOP
Surface Transfer of Pathogens

Thank you for listening

