

# COPPER VS BACTERIA & VIRUSES RESEARCH

# ANTI-MICROBIAL SURFACE FILMS

Applied to Any Surface

Removable

Customizable

## Surface Protection Against Virus and Bacterial Growth



### Contact Copper Anti-Microbial Film & Copper Sleeve

Antimicrobial film, translucent, applicable to most surfaces.

Copper infused sleeve, applicable to door handles.

Can be applied permanent or semi-permanent.

Patented technology tested for antimicrobial effectiveness and tested for skin tolerance.

Long lasting protection on application surfaces.

Easy to clean (safe to clean with alcohol and bleach solutions)

### Copper Ion Technology

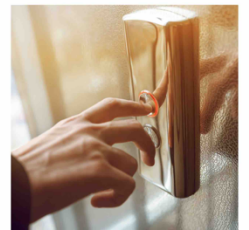
Contact Copper AMF is a laminate film that incorporates the properties of copper within the film to resist growth of microorganisms on its surface for long lasting performance.

Copper has been used for its antimicrobial properties for centuries, in a vast array of uses from plumbing to healthcare. The process involves the release of copper ions (electrically charged particles) when microbes are introduced to the surface from airborne particles or from touching. The copper ions prevent cell respiration and disrupt the cell membrane, thus inhibiting their growth.

### Customizable

Contact Copper AMF is a laminate that can be applied on most surfaces.

Product can be branded with a safety seal or your corporate message to emphasize your pledge to public health measures.

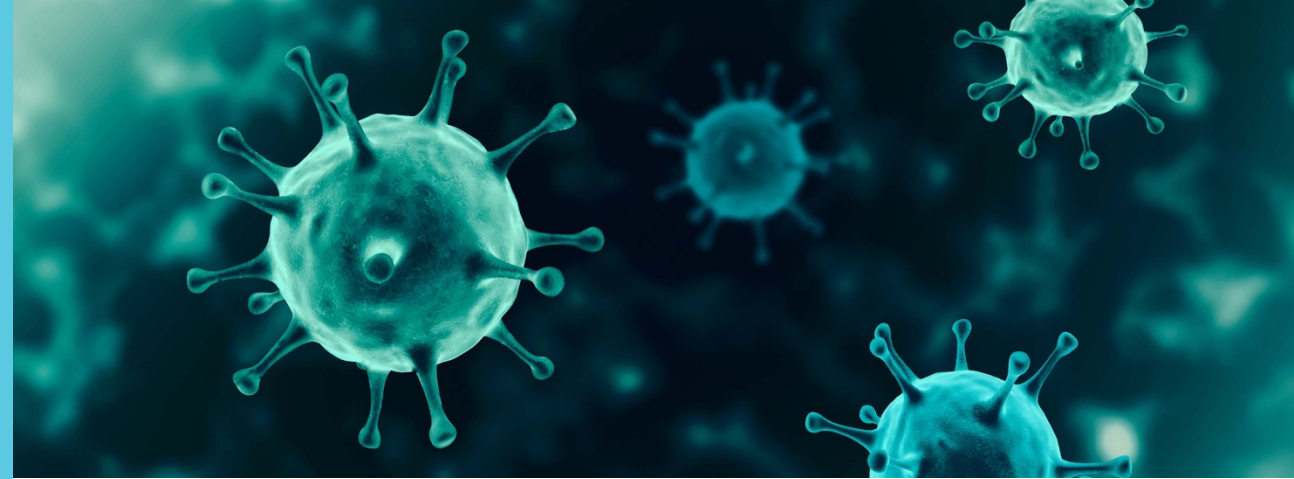


### Versatile Applications

Ideal for healthcare facilities, hospitality, office buildings.

Use areas: door pulls, push plates, elevator cabs and call buttons, kitchenettes, bathroom surfaces, high traffic surfaces, tables and desk tops, and wherever a clean surface is needed.

## HOW DOES ANTI-MICROBIAL COPPER FILM WORK?



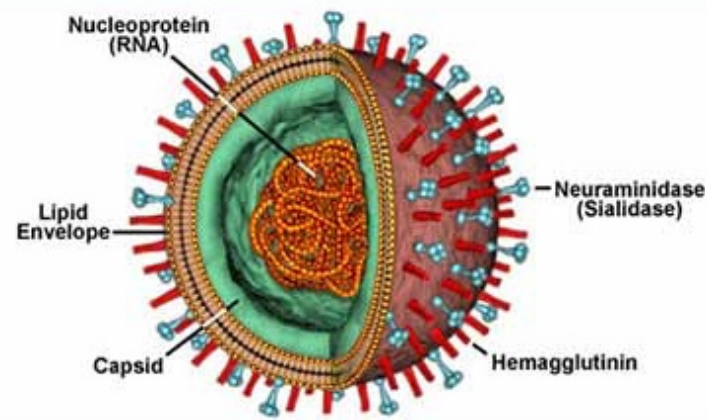
Bacteria are easily transmitted from surfaces to our hands and back to surfaces again. While most bacteria are harmless, bacteria create the necessary environment for virus replication whether on surfaces or on our hands.

Unlike bacteria, viruses can't reproduce on their own so they aren't considered 'living', but they can survive on surfaces for a varying level of time.

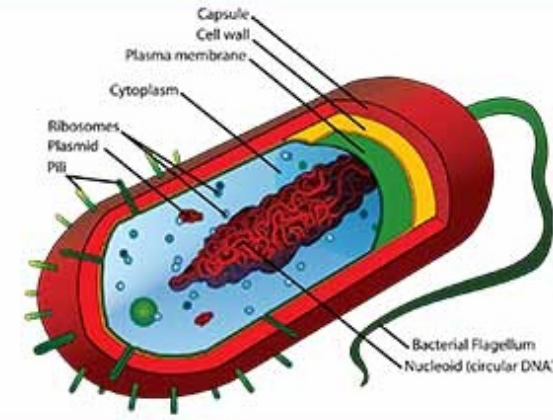
Anti-microbial copper acts as an inhibitor of virus RNA replication and prevents the viruses from self-replicating.

**Contact Anti-microbial Copper Film** is infused with copper and works the same way copper does; by inhibiting the replication of viruses and bacteria.

## DEFINING VIRUSES AND BACTERIA



**Virus**



**Bacterium**

### **Viruses**

Viruses are tiny organisms, ranging in size from about 20 to 400 nanometers in diameter. Billions can fit on the head of a pin. Viruses are packets of nucleic acid, either DNA or RNA, surrounded by a protein shell and sometimes fatty materials called lipids. Outside a living cell, a virus is a dormant particle, lacking the raw materials for reproduction. Only when it enters a host cell does it go into action, hijacking the cell's metabolic machinery to produce copies of itself that may burst out of infected cells or simply bud off a cell membrane. This lack of self-sufficiency means that they can only grow in living cells, like living tissue, or bacteria.

### **Bacteria**

Bacteria are 10 to 100 times larger than viruses and are more self-sufficient. Most bacteria carry a single circular molecule of DNA, which encodes (or programs) the essential genes for reproduction and other cellular functions. Unlike more complex forms of life, bacteria carry only one set of chromosomes instead of two. They reproduce by dividing into two cells, a process called binary fission. Their offspring are identical, essentially clones with the exact same genetic material. When mistakes are made during replication and a mutation occurs, it creates variety within the population that could—under the right circumstances—lead to an enhanced ability to adapt to a changing environment. Bacteria can also acquire new genetic material from other bacteria, viruses, plants, and even yeasts. This ability means they can evolve suddenly and rapidly instead of slowly adapting.

<https://www.ncbi.nlm.nih.gov/books/NBK209710/>

# 'Virus' vs 'Bacteria'

*The key differences between two common pathogens.*

## DEFINING VIRUSES AND BACTERIA



Viruses are not living organisms.



Viruses only grow and reproduce inside of the host cells they infect. When found outside of these living cells, viruses are dormant. Their "life" therefore requires the hijacking of the biochemical activities of a living cell.



Viruses are submicroscopic.



A viral infection is systemic. Viruses infect a host cell and then multiply by the thousands, leaving the host cell and infecting other cells of the body.



Systemic diseases caused by viral infection include influenza, measles, polio, AIDS, and COVID-19.



Bacteria are living organisms.



Bacteria are living organisms that consist of single cell that can generate energy, make its own food, move, and reproduce (typically by binary fission). This allows bacteria to live in many places—soil, water, plants, and the human body—and serve many purposes.



Bacteria are giant compared to viruses.

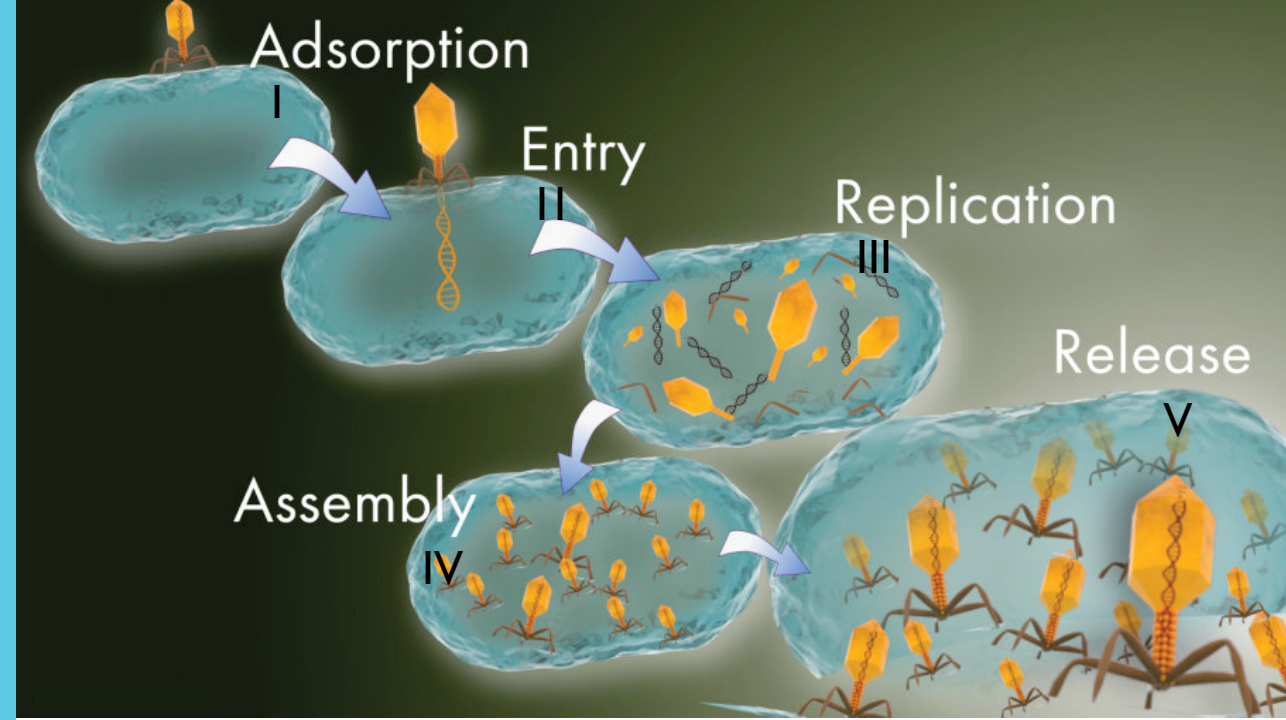


Bacterial infection is usually confined to a part of the body, described as a localized infection. Infections may be caused by the bacteria or by toxins (endotoxins) produced.



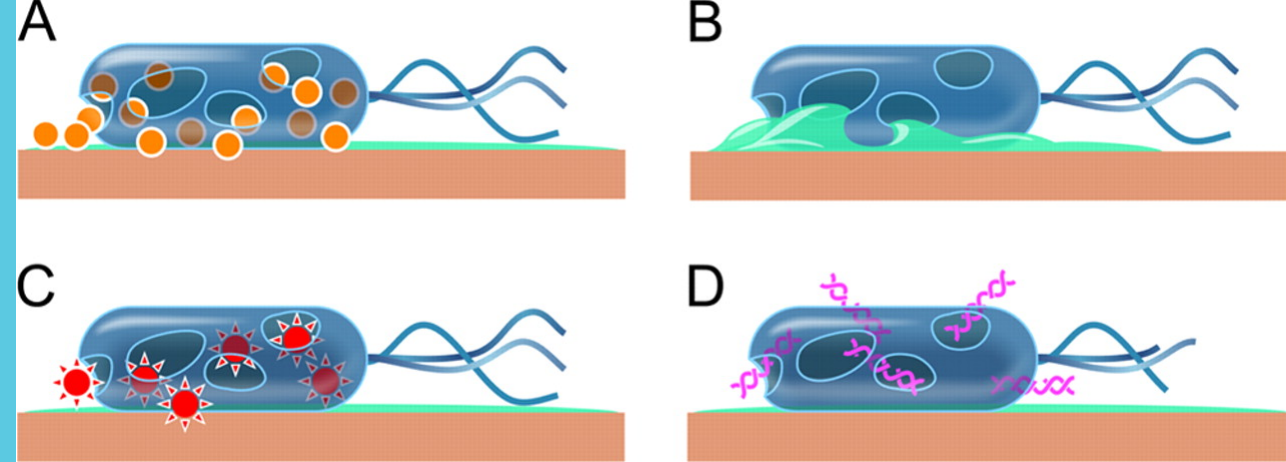
Bacterial diseases include pneumonia, tuberculosis, tetanus, and food poisoning.

## VIRUSES & BACTERIA INTERACTION MECHANISM



- I. A virus particle attaches to a host cell (bacteria).
- II. The injected genetic material recruits the host cell's enzymes.
- III. The enzymes make parts for more new virus particles.
- IV. The new particles assemble the parts into new viruses.
- V. The new particles break free from the host cell.

## BACTERIA & COPPER INTERACTION MECHANISM



- (A) Copper dissolves from the copper surface and causes cell damage.
- (B) The cell membrane ruptures because of copper and other stress phenomena, leading to loss of membrane potential and cytoplasmic content.
- (C) Copper ions induce the generation of reactive oxygen species, which cause further cell damage.
- (D) Genomic and plasmid DNA becomes degraded.

UNIVERSITY OF  
**Southampton**

<https://aem.asm.org/content/82/7/2132>

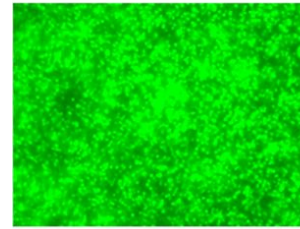
<https://aem.asm.org/content/77/5/1541>

Metallic copper surfaces have been shown to rapidly kill a range of microorganisms and viruses (for a recent review, see Grass et al. [2011](#)). This so called 'contact killing' has raised renewed interest in the use of copper for touch surfaces. In health care settings, copper holds great promise as an added measure to curb nosocomial infections and a number of hospital trials have been conducted or are underway. First studies showed that copper surfaces can diminish the bacterial surface-loads up to 90% as compared to surfaces of other materials (Casey et al. [2010](#); Marais et al. [2010](#); Mikolay et al. [2010](#); Rai et al. [2012](#); Schmidt et al. [2013](#)) and can significantly reduce nosocomial infections (Salgado et al. [2013](#)).

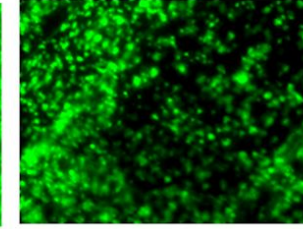
<https://onlinelibrary.wiley.com/doi/full/10.1002/mbo3.170>

## BACTERIA & COPPER INTERACTION MECHANISM

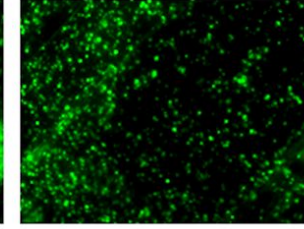
### Destruction of MRSA on copper surfaces



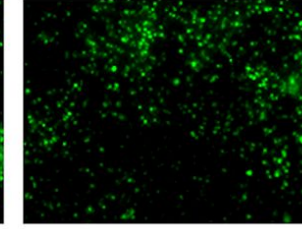
Copper Time 0



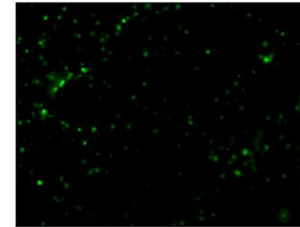
Copper 1 minute



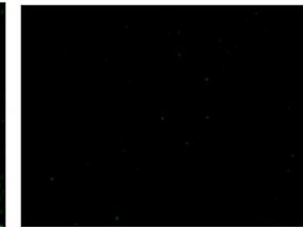
Copper 2 minutes



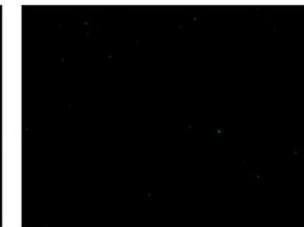
Copper 3 minutes



Copper 4 minutes



Copper 5 minutes



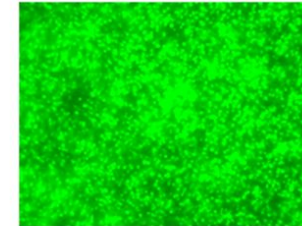
Copper 6 minutes



Copper 7 minutes



Copper 8 minutes

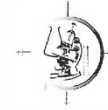


Stainless steel 20 minutes

**Destruction of the DNA of an epidemic strain of methicillin-resistant *Staphylococcus aureus* (EMRSA) on copper surfaces.**

Sarah L. Warnes, and C. William Keevil Appl. Environ. Microbiol. 2016; doi:[10.1128/AEM.03861-15](https://doi.org/10.1128/AEM.03861-15)

# TEST REPORTS CONTACT ANTI-MICROBIAL FILMS



5-8-2020

To:

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[info@whitesquareinc.com](mailto:info@whitesquareinc.com)

From:

Peter Nielsen  
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Coopersville, MI 49404  
[peter@aatestlabs.com](mailto:peter@aatestlabs.com)

Subject:

Measurement of Antibacterial Activity on antimicrobial copper film, (RF7051CU).

## BACKGROUND:

Antimicrobial Copper Film (RF7051CU) was evaluated for Antibacterial Activity against *Staphylococcus aureus* ATCC No. 25923 and *Escherichia coli* ATCC 25922 using ISO Method 22196:2011(E) § 7.1 – 7.7.

## CONCLUSION:

Using ISO Method 22196:2011(E), Antimicrobial Copper Film (RF7051CU) reduced inoculated *Staphylococcus aureus* ATCC No. 25923 and *Escherichia coli* ATCC No. 25922 ranging from 99.99% to 99.9999% in 24 hrs. at 35°F. Reference Test Result Report Sample ID No.2015282.

## RESULTS / DISCUSSION:

Samples of Antimicrobial Copper Film (RF7051CU) were inoculated with *Staphylococcus aureus* and *Escherichia coli* following ISO Method No. 22196:2011(E) protocol. Inoculated samples were enumerated after 24 hrs. incubation at 35°F. Results of the reduction are shown in Table No.1. Antimicrobial Copper Film Samples were evaluated in triplicate.

## PROCEDURE:

Reference ISO 22196:2011 (E).



Alliance Analytical Laboratories, Inc.  
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www.aatestlabs.com

Table No.1 Antimicrobial Copper Film Reduction of *Staphylococcus aureus* ATCC No. 25923 and *Escherichia coli* ATCC No. 25922.

*Staphylococcus aureus* @ 35°C

4/28/2020

	Starting Concentration Log 10	Ending 24 hr. log 10	Log 10 Reduction	% Reduction
Replicate 1 of 3	8.6	1	7.6	99.999
Replicate 2 of 3	8.6	2	6.6	99.999
Replicate 3 of 3	8.6	1	7.6	99.999

*E. coli* @ 35°C

4/28/2020

	Starting Concentration Log 10	Ending 24 hr. log 10	Log 10 Reduction	% Reduction
Replicate 1 of 3	8.6	1	7.6	99.999
Replicate 2 of 3	8.6	1	7.6	99.999
Replicate 3 of 3	8.6	1	7.6	99.999

Peter Nielsen

MPH, Registered Microbiologist NRCM  
Food Processing Authority

# TEST REPORTS CONTACT ANTI-MICROBIAL FILMS

## TEST REPORT



APPLICANT : R&F Chemical  
REPORT NO. : M291-21-27561  
SAMPLE RECEIVED DATE : 2020-04-03  
REPORT ISSUED DATE : 2020-04-06  
PAGE : 1 OF 4

DESCRIPTION : ONE(1) PIECE OF SUBMITTED SAMPLE SAID TO BE FILM.

ITEM : RF7051CUAnS-microbial Copper Film

TEST CONDUCTED : AS REQUESTED BY THE APPLICANT, FOR DETAILS PLEASE SEE ATTACHED PAGES.

PREPARED AND CHECKED BY  
FOR FITI

*Hak Joo Lee*

HAK JOO LEE  
QUALITY MANAGER

AUTHORIZED BY  
FOR FITI

*Jun Se Goo*

JE-GOO JUN  
PRESIDENT

※ Report Verification No.: 3DGG-QDAS-MG9R ※  
(You can see the authenticity of your test report through the above "Report Verification No." at FITI homepage.)

### e-DOCUMENT SERVICE

The test results contained in this report are limited to results on the sample(s) that is provided by client and are not necessarily indicative or representative of the quality of the lot from which the sample(s) was taken or of all products. Results contained in this report are not based on the quality certification of sample by the FITI quality certification program unless specifically requested by the client. Further use of the results of this report is prohibited unless allowed under a separate agreement set forth in an official document that is established between the client identified on this letter and the FITI. This test report is irrelevant to KS Q ISO/IEC 17025 and KHLAS accreditation.

REPORT NO.: M291-21-27561 PAGE 2 OF 4

01. ANTIMICROBIAL ACTIVITY AND EFFICACY ( JIS Z 2801 : 2010, FILM-CONTACT METHOD)  
: CFU/on', VALUE OF ANTIMICROBIAL ACTIVITY : log

		BLANK	#1
BACTERIA-1	AT BEGINNING	$1.7 \times 10^4$	$1.7 \times 10^4$
	AFTER 24 h	$2.6 \times 10^4$	< 0.63
	VALUE OF ANTI-MICROBIAL ACTIVITY	-	
BACTERIA-2	AT BEGINNING	$1.4 \times 10^4$	$1.4 \times 10^4$
	AFTER 24 h	$1.1 \times 10^4$	< 0.63
	VALUE OF ANTI-MICROBIAL ACTIVITY	-	6.2

NOTE) STANDARD FILM : STOMACHER®400 POLY-BAG

TEST CONDITION : THE SOLUTION ARE FIXED AT (35 ± 1) 'C, 90 % R.H. FOR 24 h, AND DETERMINE BACTERIA CELL GROWTH INHIBITION RATE BY POUR AGAR PLATE METHOD.

ANTIMICROBIAL EFFICACY: THE VALUE OF ANTIMICROBIAL ACTIVITY SHALL NOT BE LESS THAN 2.0 log TEST BACTERIA : BACTERIA-1 - *Staphylococcus aureus* ATCC 6538P BACTERIA-2 - *Escherichia coli* ATCC 8739

e-DOCUMENT SERVICE

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## TEST REPORTS CONTACT ANTI-MICROBIAL FILMS

## REFERENCES

### **“Metallic Copper as an Antimicrobial Surface”**

[Gregor Grass](#), <sup>1</sup> [Christopher Rensing](#),<sup>2</sup> and [Marc Solioz](#)  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3067274/>

**“Copper’s Virus-Killing Powers Were Known Even to the Ancients. The SARS-CoV-2 virus endures for days on plastic or metal but disintegrates soon after landing on copper surfaces. Here’s why.”**

<https://www.smithsonianmag.com/science-nature/copper-virus-kill-180974655/>

### **“Copper kills coronavirus. Why aren’t our surfaces covered in it?”**

<https://www.fastcompany.com/90476550/copper-kills-coronavirus-why-arent-our-surfaces-covered-in-it>

### **“Contact killing and antimicrobial properties of copper”**

M. Vincent, R.E. Duval, P. Hartemann and M. Engels-Deutsch

<https://sfamjournals.onlinelibrary.wiley.com/doi/pdf/10.1111/jam.13681>

**“Bacteria are killed within minutes on surfaces of copper or copper alloys containing at least 60% copper. In contrast, cells can survive for days on surfaces of stainless steel, glass, or plastics.”**

[Salima Mathews](#),<sup>a</sup> [Ranjeet Kumar](#),<sup>b</sup> and [Marc Solioz](#)  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4542256/>

### **“Copper destroys MRSA at a touch”**

<https://www.sciencedaily.com/releases/2016/02/160223074835.htm>

**“Avani Hotels, which has 33 properties in 18 countries, is installing “antimicrobial copper films” over high-touch surfaces, such as door handles and elevator buttons...”**

<https://www.barrons.com/articles/hotels-prepare-for-a-post-pandemic-world-01589815833>

### **“Why copper could help prevent future pandemic, and what it does to coronavirus.”**

<https://www.cleveland.com/news/2020/03/why-copper-could-help-prevent-future-pandemic-and-what-it-does-to-coronavirus.html>

### **“Copper Surfaces Reduce the Rate of Healthcare-Acquired Infections in the Intensive Care Unit”**

[Cassandra D Salgado](#), [Kent A Sepkowitz](#), [Joseph F John](#), [Robert Cantey](#), [Hubert H Attaway](#), [Katherine D Freeman](#), [Peter A Sharpe](#), [Harold T Michels](#)  
<https://pubmed.ncbi.nlm.nih.gov/23571364/>

### **“Staphylococcus aureus and Destruction of Their Genomes on Wet or Dry Copper Alloy Surfaces”**

Sarah L. Warnes, C. William Keevil

<https://aem.asm.org/content/82/7/2132>



*“Let’s Get Back to Work”*



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