

It is not uncommon to hear the terms “viruses” and “bacteria” mentioned in the same breath, so it’s understandable that they are often thought to be the same thing. The fact is that they are NOT. It is important to recognize that viruses and bacteria are drastically different in their morphology (size, shape, and structure), the way they replicate, and how infections or diseases caused by them can be treated.<sup>1</sup>

## **BACTERIA AND VIRUSES: DIFFERENCES EXPLAINED**

Bacteria are single-celled, living organisms that can generate energy, make their own food, move, and reproduce.<sup>2</sup> This allows bacteria to live in many places (e.g. soil, water, plants, and the human body) and serve many purposes. Not all bacteria cause disease and many of them actually play an important role in our daily health, as well as the health of our ecosystem.<sup>3</sup> Less than 1% of bacteria species cause disease and are referred to as pathogenic bacteria.<sup>4</sup> Examples of bacterial disease include pneumonia, tuberculosis, tetanus, and food poisoning.<sup>5</sup> Diseases such as pneumonia and food poisoning can be caused by a variety of bacteria. For example, pneumonia, which refers to the condition of pus accumulation in the deep lung, can be caused by *Pseudomonas aeruginosa* and *Staphylococcus aureus* in healthcare environments.<sup>6</sup>

Viruses, unlike bacteria, are not living organisms, ranging in sizes from 0.02 to 0.25 micron in diameter, which is 10 to 100 times smaller than the smallest bacteria.<sup>7</sup> Viruses only grow and reproduce inside the host cells they infect;<sup>8</sup> outside of the host cells, they are dormant.<sup>9</sup> Their life therefore requires the hijacking of the biochemical activities of a living cell.<sup>9</sup> For example, Severe Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), which is the virus that causes COVID-19, binds and infects lung cells. New viruses are formed from materials drained from an infected host cell;<sup>10</sup> these new viruses then leave the host cell, killing it and move on to infect new host cells.<sup>11</sup> Viral illnesses such as influenza, measles, polio, AIDS, and COVID-19 can result in symptoms ranging from mild to life-threatening.<sup>3</sup>

While a healthy immune system can respond to most bacterial and viral attacks, more severe infections require intervention with drugs. The discovery of penicillin and other antibiotics has been a game changer in our fight against bacteria.<sup>12</sup> Antibiotics work by blocking vital processes in bacteria, either killing the bacteria or preventing their growth.<sup>13</sup> A major concern in combating bacteria is antibiotic resistance, which refers to the ability of bacteria to survive exposure to antibiotics thereby rendering them free to grow and multiply. Viral infections do not respond to antibiotics.<sup>3</sup> Unlike the broad spectrum of bacteria killed by typical antibiotics, antiviral drugs are much more specific and targeted to specific viruses.<sup>14</sup>

Some of the most dangerous infections are prevented through prophylactic vaccines.<sup>15</sup> Since their discovery in 1796,<sup>16</sup> vaccines continue to be a key safeguard against infections by harmful microbes. Vaccines are based on biological materials, typically resembling some part of a disease-causing organism, which when administered produces an immune response against that organism.<sup>17</sup> Vaccines have been developed against bacterial diseases such as diphtheria and tetanus and against viral diseases such as smallpox, polio, measles, and COVID-19.<sup>18</sup> Given the ineffectiveness of antibiotics against viruses, vaccines play a particularly prominent role in our defense against viruses.<sup>19</sup>

Drug and vaccine development against bacteria and viruses are a perpetual work-in-progress driven by their tendency to mutate and create new, dominant strains. Certain resistant bacteria and viruses like the norovirus have no effective countermeasures.<sup>20</sup> The norovirus is a very contagious virus and the second most frequent cause of acute gastrointestinal infections. Noroviruses are extremely resistant to most disinfectants (e.g., quaternary

†SARS-CoV-2 and Feline calicivirus (EPA proxy for human noroviruses)

‡*Staphylococcus aureus* (Staph) and *Pseudomonas aeruginosa*

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ammonium compounds and alcohol) and can remain infective for several months in a healthcare environment. Therefore, the environmental control of harmful microbes through good hygienic practices is important.<sup>21</sup> Infections can spread through the air or through surfaces, also referred to as fomites.<sup>22</sup> Specific pathogens have more dominant routes of infection preferring airborne or fomite-based transmission. The impact of infectious diseases is staggering. For example, hospital acquired infections affect 1 in 31 hospital patients in the United States,<sup>23</sup> leading to an estimated economic burden of ~\$40.8B annually.<sup>24</sup>

## **ADDITIONAL LAYER OF PROTECTION AGAINST VIRUSES AND BACTERIA**

In light of the current pandemic, an increasing number of homeowners and building owners are taking extra measures in providing a healthy and safe living and working environment. Hygiene has become an important part of our daily lives. Most of us utilize cleaning agents around our homes and workplaces, such as on our hands, light switches, door knobs, electronic devices, tables, and chairs. However, the largest surface in any indoor space that is often neglected and overlooked is walls.

Behr Paint Company has developed an innovative coating, BEHR® Copper Force™ paint, that kills certain viruses<sup>†</sup> and bacteria<sup>‡</sup> within two hours of contact on the painted surface and lasts for up to six years after proper application. BEHR Copper Force paint kills 99.9% of SARS-CoV-2, Feline calicivirus (EPA proxy for human noroviruses), Staphylococcus aureus (commonly known as Staph), and Pseudomonas aeruginosa within two hours of exposure to those pathogens on a surface painted with it. It also continues to kill 99.9% of these viruses and bacteria following repeated contamination of these surfaces. BEHR Copper Force paint's virucidal<sup>†</sup> and antibacterial<sup>‡</sup> properties last for up to six years as long as the paint film's integrity is maintained and is one part of a comprehensive infection control and hygiene program. Standard cleaning protocols do not compromise the paint's ability to kill viruses and bacteria on the painted surface.

## **WHAT MAKES THIS PAINT DIFFERENT**

BEHR Copper Force paint is formulated to kill the four aforementioned human pathogens within two hours of contact on painted surfaces. As a product making a kill claim against pathogens that are a threat to public health, the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) requires that it be rigorously tested, validated and registered by the U.S. Environmental Protection Agency (EPA). The EPA considers it a public health claim to state that human pathogens can be killed via their direct contact with BEHR Copper Force paint. In addition to inhibiting the growth of mold and mildew on the surface of the paint film, BEHR Copper Force paint provides the benefit of killing 99.9% of viruses<sup>†</sup> and bacteria<sup>‡</sup> within two hours of contact on the painted surface.

## **EPA REGISTRATION JOURNEY**

To obtain EPA registration, BEHR Copper Force paint had to successfully undergo third-party laboratory testing to validate all aspects of public health claims. Successful completion of the tests permits the manufacturer, in this case Behr Paint Company, to use the term "virucidal" and "antibacterial" paint. Outlined below are the major requirements of the rigorous process that Behr satisfied to achieve this.

1. The EPA reviewed and approved the efficacy testing protocol Behr designed and proposed to support the claims.
2. The product was tested using that protocol in a third party, EPA-accredited lab that follows Good Laboratory Practice (GLP).
3. The product claims were validated on painted surfaces exposed to the specified organisms, validating the claim that all four indicated pathogens were eliminated to the 99.9% level within two hours.
4. The painted panels passed a continuous kill test following exposures to the indicated pathogens to validate the 99.9% efficacy claim.

<sup>†</sup>SARS-CoV-2 and Feline calicivirus (EPA proxy for human noroviruses)

<sup>‡</sup>Staphylococcus aureus (Staph) and Pseudomonas aeruginosa

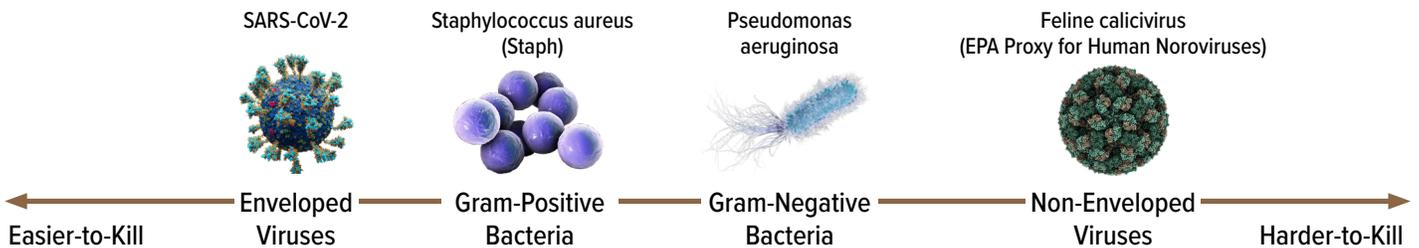
5. The product passed vigorous washability tests, which exposed test panels to cleaning products and protocols typically used in healthcare facilities in accordance to CDC guidelines. The paint was subjected to both scrubbing and exposure tests to make sure that when exposed to standard cleaning procedures it maintains its effectiveness for up to six years when the integrity of the surface is maintained.
6. Raw materials used in the product formulation were subjected to a toxicological review, risk-based assessment of ingredient effects on human health and the environment. This ensures that all components of the product are on the EPA inert ingredients approved list.
7. The product label was reviewed to ensure that critical information about how to handle and safely use the product and avoid harm to human health and the environment are provided. Other product claims were also reviewed to ensure that they do not constitute heightened efficacy claims.

As the EPA determined that BEHR Copper Force paint could be used without causing unreasonable adverse effects, and all claims were independently validated, the product and its labeling were assigned an EPA registration number, i.e., EPA Reg. Number: 32273-10. The next step was to work with each state to obtain registration at the state level. Once a state has registered BEHR Copper Force paint, Behr can begin distributing and selling the product in that state.

## HARNESSING THE POWER OF COPPER

The antimicrobial properties of copper are well-known. For thousands of years, long before bacteria or viruses were discovered, people have known of copper’s disinfectant powers.<sup>25</sup> Corning® Guardian® particles harness the benefits of metallic copper by stabilizing the most bioactive state of copper (copper ions) in a glass matrix.

An antimicrobial coating is only as good as its breadth of effectiveness. The most common viruses and bacteria fall into four categories that exist within a spectrum of difficulty-to-kill: enveloped viruses, gram-positive bacteria, gram-negative bacteria, and non-enveloped viruses.<sup>26</sup> BEHR Copper Force paint kills 99.9% of the following viruses and bacteria within two hours of contact on the painted surface and lasts for up to six years\*:



\*Effective for up to 6 years according to EPA test protocol as long as the integrity of the painted surface is maintained and is one part of a comprehensive infection control and hygiene program.

## EXCLUSIONS AND LIMITATIONS

It is a violation of federal law to use this product in a manner inconsistent with its labeling.

BEHR Copper Force paint is only recommended for use on hard, non-porous interior surfaces such as walls, doors, trim and ceilings. It is not suitable for floors, exterior surfaces or for any portion of an operating room, which undergoes more stringent cleaning protocols. The use of an antimicrobial treated surface is a supplement to and not a substitute for standard infection control practices. Users must continue to follow all current infection control practices, including those practices related to cleaning and disinfection of walls and other painted surfaces. The painted surface material has been shown to reduce microbial contamination after proper paint application and maintenance, but does not necessarily prevent cross-contamination.

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Periodic cleaning to remove dirt and stains is necessary for good sanitization and to assure the effective virucidal and antibacterial performance of the surface. Cleaning does not reduce the virucidal and antibacterial performance of the surface. To ensure continuous protection, repaint the surface if the paint film becomes damaged (peeled, cracked, etc.) or if the paint becomes covered with oils, grease, wax, other paints and other foreign substances; or within 6 years.

The appropriate cleaning agent depends on the type of soiling and the measure of sanitization required. The preferred cleaning method is to use a soft damp cloth or sponge and a mild detergent solution (a small amount of dishwashing liquid in water). Gently wipe the soiled area (using the least amount of pressure) until the stain is removed then follow by rinsing the surface with clean water. Do not scrub the surface as this can actually cause the stain to spread. Do not use harsh or abrasive cleansers or pads, which can scratch, burnish, or damage the paint film. **DO NOT USE OXIDIZING CLEANERS/DISINFECTANTS, SUCH AS BLEACH AND HYDROGEN PEROXIDE, OR ENZYME-BASED CLEANING SOLUTIONS AS THEY WILL CAUSE DISCOLORATION AND REDUCE THE EFFICACY OF THE SURFACE.**

## BEHR-CORNING COLLABORATION

Behr Paint Company has worked closely with Corning to develop BEHR Copper Force paint powered by Corning® Guardian® antimicrobial copper ion technology. Corning Guardian antimicrobial particles have the potency of copper, a naturally occurring, inorganic material that kills viruses and bacteria. To learn more about Corning Guardian, visit:

<https://www.corning.com/worldwide/en/innovation/corning-emerging-innovations/corning-guardiant.html>



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