

Long-lasting disinfectant promises to help fight pandemics

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Dr. Griff Parks, a College of Medicine virologist, partnered with an engineer and entrepreneur to develop the disinfectant. Credit: University of Central Florida

University of Central Florida researchers have developed a nanoparticle-based disinfectant that can continuously kill viruses on a surface for up

to seven days—a discovery that could be a powerful weapon against COVID-19 and other emerging pathogenic viruses.

The findings, by a multidisciplinary team of the university's virus and engineering experts and the leader of an Orlando technology firm, were published this week in *ACS Nano*, a journal of the American Chemical Society.

Christina Drake, a UCF alumna and founder of Kismet Technologies, was inspired to develop the [disinfectant](#) after making a trip to the grocery store in the early days of the pandemic. There she saw a worker spraying disinfectant on a refrigerator handle, then wiping off the spray immediately.

"Initially my thought was to develop a fast-acting disinfectant," she said, "but we spoke to consumers—like doctors and dentists—to find out what they really wanted from a disinfectant. What mattered the most to them was something long-lasting that would continue to disinfect high-touch areas like doorhandles and floors long after application."

Drake partnered with Dr. Sudipta Seal, a UCF materials engineer and nanosciences expert, and Dr. Griff Parks, a College of Medicine virologist who is also associate dean of research and director of the Burnett School of Biomedical Sciences. With funding from the National Science Foundation, Kismet Tech and the Florida High Tech Corridor, the researchers created a nanoparticle-engineered disinfectant.

Its [active ingredient](#) is an engineered nanostructure called [cerium oxide](#), which is known for its regenerative antioxidant properties. The cerium oxide nanoparticles are modified with small amounts of silver to make them more potent against pathogens.

"It works both chemically and mechanically," explained Seal, a who has

been studying nanotechnology for more than 20 years. "The nanoparticles emit electrons that oxidize the virus, rendering it inactive. Mechanically, they also attach themselves to the [virus](#) and rupture the surface almost like popping a balloon."

Most disinfecting wipes or sprays will disinfect a surface within three to six minutes of application but have no residual effects. This means surfaces need to be wiped down repeatedly to stay clean from a number of viruses like COVID-19. The nanoparticle formulation maintains its ability to inactivate microbes and continues to disinfect a surface for up to seven days after a single application.

"The disinfectant has shown tremendous antiviral activity against seven different viruses," explained Parks, whose lab was responsible for testing the formulation against "a dictionary" of viruses. "Not only did it show antiviral properties toward coronavirus and rhinovirus, but it also proved effective against a wide range of other viruses with different structures and complexities. We are hopeful that with this amazing range of killing capacity, this disinfectant will also be a highly effective tool against other new emerging viruses. "

The scientists are confident the solution will have a major impact in health care settings, in particular, reducing the rate of hospital acquired infections—such as Methicillin-resistant *Staphylococcus aureus* (MRSA), *Pseudomonas aeruginosa* and *Clostridium difficile*—which cause infections that affect more than one in 30 patients admitted to U.S. hospitals.

And unlike many commercial disinfectants, the formulation has no harmful chemicals, which indicates it will be safe to use on any surface. Regulatory testing for irritancy on skin and eye cells, as required by the U.S. Environmental Protection Agency, showed no harmful effects.

"Many household disinfectants currently available contain chemicals that can be harmful to the body with repeated exposure," Drake said. "Our nanoparticle-based product will have a high safety rating will play a major role in reducing overall chemical exposure for humans."

More research is needed before the product can go to market, which is why the next phase of the study will look at how the disinfectant performs outside of the lab in real world applications. That work will look at how the disinfectant is affected by external factors such as temperature or sunlight. The team is in talks with a local hospital network to test the product in their facilities.

"We're also exploring developing a semi-permanent film to see if we can coat and seal a hospital floor or door handles, areas where you need things to be disinfected and even with aggressive and persistent contact," Drake added.

Seal joined UCF's Department of Materials Science and Engineering, which is part of UCF's College of Engineering and Computer Science, in 1997. He has an appointment at the College of Medicine and is a member of UCF's prosthetics Cluster Biionix. He is the former director of UCF's Nanoscience Technology Center and Advanced Materials Processing Analysis Center. He received his doctorate in materials engineering with a minor in biochemistry from the University of Wisconsin and was a postdoctoral fellow at the Lawrence Berkeley National Laboratory at the University of California Berkeley.

Parks came to UCF in 2014 after 20 years at the Wake Forest School of Medicine, where he was professor and chairman of the Department of Microbiology and Immunology. He earned his doctorate in biochemistry at the University of Wisconsin and was an American Cancer Society Fellow at Northwestern University.

The study was co-authored by post-doctoral researchers Candace Fox, from UCF's College of Medicine and Craig Neal from UCF's College of Engineering and Computer Sciences and graduate students, Tamil Sakthivel, Udit Kumar and Yifei Fu from UCF's College of Engineering and Computer Sciences.

More information: Craig J. Neal et al, Metal-Mediated Nanoscale Cerium Oxide Inactivates Human Coronavirus and Rhinovirus by Surface Disruption, *ACS Nano* (2021). [DOI: 10.1021/acsnano.1c04142](https://doi.org/10.1021/acsnano.1c04142)

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