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Continuing the Fight

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CONTINUING THE FIGHT

Researchers work across disciplines to end COVID-19 pandemic

By Erin Pennington and Jennifer Tidball

When the world paused during the COVID-19 pandemic, many Kansas State University researchers did the opposite.

K-State researchers increased their efforts or pivoted focus to join the battle against the novel coronavirus. By February 2021 — nearly a year after the World Health Organization declared the COVID-19 pandemic — K-State had more than $35 million in coronavirus-related grant proposals, more than $12 million in contracts for COVID-19 research and several new technologies licensed to corporate partners to combat the disease.

Research across the university has ranged from treatment and vaccine development to understanding the pandemic's effects on early learners. Read more about the variety of K-State projects during the pandemic.

Candidate compound

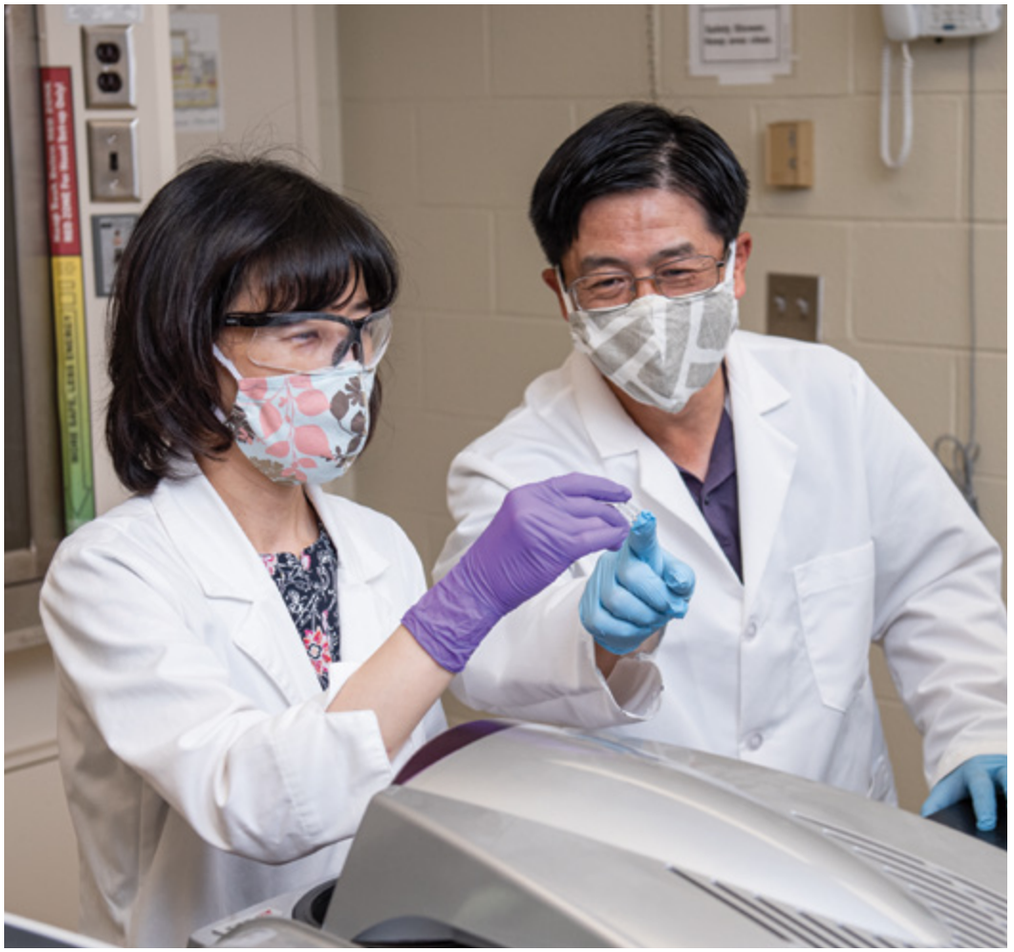
A series of protease inhibitors developed, patented and licensed by K-State continues to help the fight against coronaviruses, including SARS-CoV-2, the virus that causes COVID-19. Cocrystal Pharma Inc., a clinical-stage biotechnology company, has selected the protease inhibitors as a preclinical lead compound for further development.

Kyeong-Ok "KC" Chang and Yunjeong Kim, virologists in the K-State College of Veterinary Medicine, developed the protease inhibitors in collaboration with William Groutas at Wichita State University and Stanley Perlman at the University of Iowa. K-State Innovation Partners licensed the protease inhibitors, which could lead to a possible COVID-19 drug or treatment.

"Further studies are required to reveal the therapeutic potency of our protease inhibitor compared to other approved drugs," Kim said. "Drugs targeting different virus proteins are often combined to maximize their efficacy, so it is always nice to have a repertoire of drugs that work in different ways."

Preclinical animal studies of these K-State coronavirus compounds published in the prestigious medical journal Science Translational Medicine showed efficacy against Middle East respiratory syndrome, or MERS, a related deadly human coronavirus infection, in a mouse model.

Further testing allowed Cocrystal to identify this promising candidate for preclinical lead development for COVID-19. According to the company, the compound potentially could be delivered through injection or inhalation and could be used as both a therapeutic and prophylactic, which protects uninfected individuals who may become exposed.



Virologists Yunjeong Kim, left, and Kyeong-Ok "KC" Chang have developed a series of protease inhibitors.

With the selection of this candidate, Cocrystal will initiate studies to evaluate potential toxicity risks and conduct safety pharmacology studies before the phase 1 clinical trial.

Developing the research space

K-State recently received a $1.2 million University SARS-CoV-2/COVID Research and Diagnostic Capacity Support Grant from the Kansas Department of Commerce as part of the Coronavirus Aid, Relief and Economic Security Act — known as the CARES Act — distribution. These funds will launch a Biotechnology Development Module, or BDM, at the K-State Biosecurity Research Institute, or BRI.

The National Bio and Agro-Defense Facility, or NBAF — nearing completion adjacent to K-State's Manhattan campus — will house a BDM for companies to increase manufacturing for a limited number of select agent countermeasures. The K-State BDM at the BRI will be a complementary pilot-scale facility for research that does not focus only on NBAF-priority diseases.

The K-State BDM will allow researchers and corporate partners to develop diagnostic, therapeutic and preventive countermeasures for a broad range of emerging zoonotic diseases, including SARS-CoV-2 and African swine fever virus. The facility will be located in unique close proximity to containment and non-containment animal facilities as well as the Kansas State Veterinary Diagnostic Laboratory.

"K-State's strengths in addressing threats to plant, animal and human health are more important than ever before," said Beth Montelone, interim vice president for research. "This grant will enable K-State to continue to grow its vaccine and other countermeasure development strategy to address new and emerging diseases."

A Biotechnology Development Module at the Biosecurity Research Institute will allow research on emerging pathogens.

A K-State study focuses on how long the SARS-CoV-2 virus survives in different climates and on different surfaces, such as gloves, masks, glass and cardboard.

Environmental stability

K-State researchers are helping understand how long SARS-CoV-2 can survive on different types of surfaces and in various temperatures.

A Center of Excellence for Emerging and Zoonotic Animal Diseases, or CEEZAD, team recently completed a BRI study on the topic. The researchers, also from the College of Veterinary Medicine, included Taeyong Kwon, doctoral student in pathobiology; Natasha Gaudreault, research assistant professor of diagnostic medicine and pathobiology; and Jürgen A. Richt, Regents distinguished professor and CEEZAD director.

The study resulted in several important insights into SARS-CoV-2 survival, including:

- The virus survived the longest — 21 days after contamination — on surfaces under winter conditions.
- In spring and fall conditions, the virus survived up to seven days.
- No infectious virus was found three days after contamination under summer conditions.
- Under indoor conditions, infectious virus was recovered from cloth up to one day after contamination; for up to three days from concrete, polypropylene, stainless steel and galvanized steel; and for up to four days from nitrile gloves, Tyvek, N95 masks, Styrofoam, cardboard, rubber and glass.

"These findings clarify a major concern among scientists, and also among members of the general public, namely the ability of the SARS-CoV-2 to survive on various surfaces under varying climatic conditions," Richt said. "It shows that the virus's ability to remain a threat is greatest in winter and less in summer. But it also shows that even in indoor conditions, SARS-CoV-2 remains viable for several days depending on the surface."

Understanding quarantine

Kyle Goerl, medical director of K-State's Lafene Health Center, is part of a collaborative team providing research-based guidance during the COVID-19 pandemic. The Centers for Disease Control and Prevention has used the team's research to update and shorten quarantine guidance.

Goerl is a co-author of a quarantine-related publication that recently appeared in the CDC Morbidity and Mortality Weekly Report and involved multiple organizations and universities.

The publication describes a sample of COVID-19-exposed collegiate athletes in 17 states from June to October 2020. Twenty-five percent of the athletes tested positive during quarantine and the positive test occurred an average of 3.8 days after quarantine started. As quarantine progressed, the probability of testing positive dropped from 27% after day five to less than 5% after day 10.

"These findings show that after 10 days of quarantine, the risk of COVID-19 is relatively low," said Goerl, also a team physician for Kansas State University Athletics. "This helps to support a quarantine period that is shorter than 14 days. If the quarantine period is shortened, it is more likely that people will follow important quarantine measures."

Kyle Goerl, K-State medical director, is helping provide research-based quarantine guidance.

Effect on early learners

Adelaide Klutse, master's student in applied family science in the College of Health and Human Sciences, is studying how teachers are facilitating the social-emotional development of children ages 0 through 5 during the COVID-19 pandemic.

Her research is providing knowledge on the availability and kinds of support targeted at empowering early educators during the pandemic.

Klutse is working with adviser Bradford Wiles, associate professor of applied human sciences, to understand how teachers facilitate social-emotional development in children when close contact and touch are major risks for disease transmission. She is researching how teachers' perceived levels of stress affect their classroom qualities and their abilities to help children with social-emotional development.

According to Klutse, this study is significant because current research does not include early childhood education teachers who are facilitating development in the early years.

"Research suggests children spend a considerable number of hours with their teachers and these teachers' abilities to facilitate socioemotional development in children goes a long way toward influencing family outcomes in current and future families," Klutse said.

Adelaide Klutse, master's student in applied family science, is studying how children are adapting during the pandemic.

Analyzing contact tracing

K-State engineers are investigating some of the hidden mechanisms behind the spread of COVID-19.

In their latest work, the researchers in the Carl R. Ice College of Engineering are modeling the spread of COVID-19 and evaluating the effectiveness of disease mitigation measures. Specifically, they have studied the benefits and costs of contact tracing and how effective it is in containing the spread of COVID-19.

"Contact tracing plays a vital role as a critical mitigation strategy for COVID-19," said Sifat Afroj Moon, doctoral student in electrical and computer engineering. "Our investigation indicates that a sufficient amount of contact tracing can reduce the impact of COVID-19 spreading in the reopening process of a location."

Moon works with Caterina Scoglio, the LeRoy and Aileen Paslay professor and Steve Hsu Keystone research scholar in the Mike Wiegers Department of Electrical and Computer Engineering. They recently published their findings on contact tracing in Nature Scientific Reports.

The researchers are continuing their modeling research and also are studying and simulating the effectiveness of multiple COVID-19 vaccination strategies.

By the numbers

K-State COVID-19 research

$35 million+
In grant proposals.

$12 million+
In grant awards.

3
Technology option or license agreements.

20+
Studies at the Biosecurity Research Institute conducted during 2020 and 2021.

25+
Researchers and staff involved in COVID-19 research at the Biosecurity Research Institute.

Seek more

Read more and find K-State research publications related to COVID-19.
k-state.edu/seek