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New published study from K-State virologists identifies potential COVID-19 treatment

Yunjeong Kim and Kyeong-Ok "KC" Chang, virologists in the College of Veterinary Medicine at Kansas State University, have published a study showing a possible therapeutic treatment for COVID-19.

Pathogenic coronaviruses are a major threat to global public health, as shown by severe acute respiratory syndrome coronavirus, or SARS-CoV; Middle East respiratory syndrome coronavirus, known as MERS-CoV; and the newly emerged SARS-CoV-2, the virus that causes COVID-19 infection.

The study, "3C-like protease inhibitors block coronavirus replication in vitro and improve survival in MERS-CoV-infected mice," appears in the Aug. 3 issue of the prestigious medical journal Science Translational Medicine. It reveals how small molecule protease inhibitors show potency against human coronaviruses. These coronavirus 3C-like proteases, known as 3CLpro, are strong therapeutic targets because they play vital roles in coronavirus replication.

"Vaccine developments and treatments are the biggest targets in COVID-19 research, and treatment is really key," said Chang, professor of diagnostic medicine and pathobiology. "This paper describes protease inhibitors targeting coronavirus 3CLpro, which is a well-known therapeutic target."

The study demonstrates that this series of optimized coronavirus 3CLpro inhibitors blocked replication of the human coronaviruses MERS-CoV and SARS-CoV-2 in cultured cells and in a mouse model for MERS. These findings suggest that this series of compounds should be investigated further as a potential therapeutic for human coronavirus infection.

Chang and Kim have been using National Institutes of Health grants to develop antiviral drugs to treat MERS and human norovirus infections. Their work extends to other human viruses such as rhinoviruses and SARS-CoV-2.

"The work that this group of collaborators has been doing on antivirals and inhibitors for SARS and MERS at K-State for a number of years has been vital to their ability to quickly pivot to emphasize research on SARS-CoV-2 virus and therapeutics," said Peter Dorhout, vice president for research at K-State.

Co-collaborators on the research include teams lead by Bill Groutas at Wichita State University, Stanley Perlman at the University of Iowa and Scott Lovell at the University of Kansas.

"Drs. Groutas, Perlman and Lovell brought decades of experience to our research team," Chang said. "We would not have been able to come this far without important collaborations with our colleagues at other institutions."

“Getting things published right now is very important for the scientific community," Kim said. "I think we are adding valuable information to the antiviral field."

The new compounds in the publication are exclusively licensed and being developed by Cocrystal

Pharma for COVID-19. K-State Innovations Partners handles commercial technology licensing for the university.

College of Education study finds top challenges of Kansas K-12 teachers during COVID-19 crisis

A survey by a multidisciplinary team of researchers at the Kansas State University College of Education has identified the top needs and challenges of K-12 teachers during the COVID-19 pandemic.

More than 800 teachers in rural, urban and suburban school districts across the state participated in the project, "Access, Engagement and Resilience During COVID-19 Remote Learning." Questions centered on four key areas: technology/access; student/parent engagement; educator resiliency; and social-emotional well-being.

The purpose of the study was to identify meaningful data for district administrators and policymakers for school reopening while informing K-State's teacher preparation program. The survey was sent in May, about two months into the pandemic.

Debbie Mercer, dean of the K-State College of Education, noted Kansas schools were the first in the nation to announce closure due to the pandemic, which opened the door for substantive inquiry.

"Ten days. That's how much time teachers and administrators had to move our state's half-million students to online instruction," Mercer said. "At the same time this immense transition was occurring, teachers themselves were dealing with uncertainties in their personal lives. Bottom line? Teachers need support."

The findings revealed a myriad of strengths and weaknesses and identified universal needs for students' social-emotional well-being, which was the teachers' top concern; broadband access, which was deemed a dire need by teachers; educator well-being; and strengthening engagement in diverse learning environments.

The survey revealed several bright spots, particularly in the area of engagement:

- Teachers reported that 69% of students were considered highly to somewhat engaged in learning.
- Among rural teachers, 36% reported a higher level of engagement with their students, while 27% of all teachers reported that their personal engagement with students had increased.
- Nearly two-thirds — 64% —of educators reported an increase in personal engagement with parents during the pandemic.

But in the social-emotional well-being and technology and access areas, the survey revealed some serious challenges.

Four out of 5 teachers — 82% — listed social-emotional well-being as their highest concern, and this was across all school classifications, from 1A to 6A, and in rural, suburban and urban districts.

"I fear a mental health crisis is coming," said Jessica Lane, a member of the research team and an assistant professor of special education, counseling and student affairs. "The survey results give voice to the experiences of Kansas educators and underscore the need going forward for policymakers and administrators to address the mental health and social-emotional well-being of both our students and educators. It is critical."

Lane's conclusion is particularly striking when the teachers' personal situations were addressed. Survey findings include:

- Two-thirds — 66% — of suburban and urban teachers were simultaneously serving as caregivers to either their children, other adults or the elderly. For rural educators, this number rose to 4 in 5, or 79%.
- Some economic insecurity was experienced by 36% of teachers.
- About 20% of responding educators faced food insecurity.

The shift to remote instruction revealed significant inequities concerning technology and access to the internet. The survey found that broadband and educational technology are not consistently available in Kansas, and when they are, that did not translate into in-home access. This required teachers and districts to provide varied forms of instruction.

Nearly 70% of teachers indicated their districts worked with local internet providers to coordinate reduced cost or even free internet. Nearly 50% reported their districts provided hot spots or worked with community partnerships to ensure access for their students.

Nearly two-thirds of respondents — 65% — used technology to provide continuous learning opportunities, while 30% reported the use of take-home packets for students and 5% listed other means of instruction.

K-State study first to show SARS-CoV2, which causes COVID-19, not transmitted by mosquitoes

A new study by Kansas State University researchers is the first to confirm that SARS-CoV-2 cannot be transmitted to people by mosquitoes.

Governor Laura Kelly visited K-State's Biosecurity Research Institute on August 6, 2020 to learn about this study and other COIVD-19 research being conducted at the university.

Stephen Higgs, associate vice president for research and director of the university's Biosecurity Research Institute, or BRI, together with colleagues from the BRI and the College of Veterinary Medicine had the findings published in July by Nature Scientific Reports.

The article, "SARS-CoV-2 failure to infect or replicate in mosquitoes: an extreme challenge," details the study's findings, which provide the first experimental investigation on the capacity of SARS-CoV-2, the virus that causes COVID-19 disease, to infect and be transmitted by mosquitoes.

"While the World Health Organization has definitively stated that mosquitoes cannot transmit the virus, our study is the first to provide conclusive data supporting the theory," said Higgs, Peine professor of biosecurity and university distinguished professor of diagnostic medicine and pathobiology.

The study, which was done at the BRI, a biosafety level-3 facility, ultimately found that the virus is unable to replicate in three common and widely distributed species of mosquitoes — Aedes aegypti, Aedes albopictus and Culex quinquefasciatus — and therefore cannot be transmitted to humans.

"I am proud of the work we are doing at K-State to learn as much as we can about this and other dangerous pathogens," said Higgs. "This work was possible because of the unique capabilities of the BRI and the dedicated BRI and institutional staff."

Colleagues involved with the study include Yan-Jang Huang, research assistant professor of diagnostic medicine and pathobiology; Dana Vanlandingham, professor of diagnostic medicine and pathobiology;

K-State's Rural Grocery Initiative receives Kauffman Foundation Heartland Challenge Grant

K-State's Rural Grocery Store Initiative has received an $88,225 Heartland Challenge Grant from the Ewing Marion Kauffman Foundation.

"This grant will help us address rural business transfer opportunities by providing education on models of shared business ownership, including business cooperatives," said David Procter, professor of communication studies.

Independently owned grocery stores are anchor businesses in rural communities. These businesses are an important source of healthful food, providing residents with fruits, vegetables, dairy, grains and meats. They are an important piece of the economic engine driving rural regions through jobs created, taxes paid and their economic multiplier effect. They are also an important social and civic anchor, serving as a recruiting asset and a site for social capital. Yet, many of these small businesses struggle to remain open and are closing due to owner retirements, shrinking markets, and a lack of investment capital.

Staff with K-State's Rural Grocery Initiative provide education on alternative ownership models as they relate to succession planning for grocery stores. Collaborating with existing succession planning resource providers, RGI staff will integrate emerging models of grocery ownership into a curriculum for business development specialists. Additionally, staff will convene regional workshops for grocery store owners, community leaders, and economic development representatives in rural communities. Finally, RGI staff will provide additional resources, such as mentoring, to grocery store owners and communities who are at the stage of transitioning their grocery store ownership.

"Entrepreneurship represents an opportunity for this region to reverse a decades-long trend of economic decline," said Melissa Roberts Chapman, senior program officer in entrepreneurship at the Kauffman Foundation. "Creating more equitable ecosystems,

Ashley Bilyeu and Haelea Sharp, research assistants in diagnostic medicine and pathobiology; and Susan Hettenbach, research assistant at the BRI.

Researchers at the BRI have completed four additional studies on COVID-19 since March and this is the first peer-reviewed publication based on SARS-CoV-2 experiments wholly conducted at K-State.

Research at the Biosecurity Research Institute has been ongoing with other animal pathogens that can be transmitted from animals to people, including Rift Valley fever and Japanese encephalitis, as well as diseases that could devastate America's food supply, such as African swine fever and classical swine fever. The research was in part supported by the National Bio and Agro-Defense Facility Transition Fund provided by the state of Kansas.

"We have remarkable talent and capabilities working within our research and training facility at the BRI," said Peter Dorhout, K-State vice president for research. "The BRI is one of the critical anchor facilities in the North Campus Corridor, which serves as our growing research and development space for private sector and government agency partnerships with K-State."

U.S. Department of Energy announces CAREER Award for K-State physicist

Lado Samushia, Kansas State University cosmologist and assistant professor of physics, has been awarded a grant through the U.S. Department of Energy Office of Science's Early Career Research Program for $750,000 over five years for his work in cosmology.

Samushia's project, "Robust Dark Energy Constraints With Dark Energy Spectroscopic Survey," aims to make high-accuracy observations of the universe and measure the properties of dark energy to learn more about its underlying nature.

"Dark energy is one of the hottest topics in modern cosmology," Samushia said. "We know that 70% of the universe is made of a mysterious substance that we call dark energy — dark because it does not emit any light — but we don't really have a good idea of what it is."

Samushia's project specifically will measure positions and properties of tens of millions of distant galaxies. He hopes that a statistical analysis of the distribution of those galaxies and the patterns they make will help us to better understand dark energy.

The DOE early career grants are awarded yearly and are designed to bolster the nation's scientific workforce by providing support to exceptional researchers during crucial early career years when many do their most formative work. The grants are very competitive and only two of the 76 awardees this year had cosmology proposals.

revitalizing rural communities and accelerating IP-driven business creation will help the region work together to meet the challenges ahead of us."

For more information visit ruralgrocery.org.

KSU mechanical & nuclear engineering department and Manhattan tech firm awarded funding for joint project

A team from the Alan Levin Department of Mechanical and Nuclear Engineering has been awarded a subcontract as part of a nearly $1 million, two-year U.S. Department of Energy grant to Radiation Detection Technologies Inc.

The Kansas State University team will be led by Amir Bahadori, assistant professor of mechanical and nuclear engineering, along with co-investigators Walter McNeil, assistant professor, and Douglas McGregor, university distinguished professor, both also from that department.

For the first year of the project, Kansas State University will receive $252,238 from the Department of Energy for work on "X-DSMSND: A Dual-Sided Microstructured Semiconductor Neutron Detector with Integrated Pixel Read-Out." Second-year funding will be based on the team's progress as determined by the federal energy department.

The remainder of the award will go to Radiation Detection Technologies Inc. in Manhattan, where principal investigator will be Steven Bellinger, CEO of the company.

Radiation Detection Technologies Inc. was founded in 2011 out of the Kansas State University SMART Lab in the mechanical and nuclear engineering department. The company focuses on manufacturing quality radiation detectors and detector readout-electronic technologies for use in multiple industries including healthcare, defense and energy.

This award is part of DOE's Small Business Technology Transfer program that supports scientific excellence and technological innovation through the investment of federal research funds in critical American priorities to build a strong national economy.

DID YOU KNOW?

The K-State Alumni Association's K-State License Plate Program has raised $5 million for student scholarships and recognition of achievements.

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