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Mosquito immunity research gets boost from network science with $2.8 million NIH grant

Network science may be the answer to understanding how mosquitoes are able to transmit diseases and unveil a framework for biological control of the insect.

Kansas State University's Kristin Michel, associate professor in the Division of Biology, is the principal investigator for a recently awarded $2.87 million National Institutes of Health (NIH) grant that will use genetics, biochemistry and network science to understand mosquito immune response.

"Mosquitoes have to combat many different types of infection and prevent constant attack from pathogens encountered through their blood meal," Michel said. "At the same time, mosquitoes must be able to regulate their overzealous immune response and prevent it from attacking valid bodily functions. This balance is necessary for any organisms' immune systems, including humans."

According to Michel, mosquitoes have more than 7 million potential protein-to-protein interactions responsible for shutting down or activating immune system responses, which provide an ideal system to research how complex information networks function.

"This grant will allow us to get a 30,000-foot view of the mosquito's immune system," Michel said. "We can use network analysis to understand how all these interactions are integrated, visualize the data and make predictions as to how a mosquito's immune system will be activated if we shift the system."

Among the many attempts to control mosquitoes as carriers of deadly human pathogens are avenues that can affect the mosquito's immune system, such as entomopathogens, or fungi that act as parasites to kill or disable insects. According to Michel, a better understanding of the mosquito's immune system can help aid decisions for proper biological control of diseases.

Michel is working with K-State's Mike Knost, university distinguished professor of biochemistry, and Caterina Scoglio, professor of electrical and computer engineering; and Mike Osta, associate professor at the American University of Beirut. The interdisciplinary team will help bridge vector biology and genetics with protein biochemistry and computational modeling to answer questions about mosquito immunity.

The research will help biologists understand the mosquito's immune system better and advance network science. Computer and mathematical calculations will simulate how proteins are connected during mosquito immune responses to provide an innovative representation of a multilayer network.

Mosquitoes' immune systems are made up of a cascade of protein and enzyme reactions, Michel said. Very few of those reactions are understood and may influence other cascades in the systems. Network science can help sort out the perplexity and visualize the potential for how to interrupt the system.

Kansas State Polytechnic receives first patent for professor's work on wireless power transfer

A professor at the Kansas State University Polytechnic Campus has developed a way to improve wireless power transfer, an invention that is giving the campus its first patent.

Saeed Khan, professor and coordinator of the electronic and computer engineering technology and unmanned

aircraft systems design and integration degree options at Kansas State polytechnic has been granted a patent for a helical antenna wireless power transfer system by the U.S. Patent and Trademark Office. The purpose of the innovation is to provide a safe and more efficient way of transferring power from one place to another without the use of wires. What makes Khan's work so unique is his discovery of including a ground plane with the system, which increases the amount of power you can transfer at greater distances.

"Imagine sitting in a meting and underneath the conference table is a wireless charging system refreshing your computer's battery, or pulling into the mall and charging your electric car without plugging it in - these are just some of the exciting possibilities of the ingenuity of a helical antenna wireless power transfer system," said Khan.

The system contains two helical, or spiral, antennas tuned to resonate at similar frequencies. Electromagnetic energy is wirelessly transmitted from one antenna to the other in a communication space called the near field, which can be small or large depending on the frequency. By Khan adding a ground plane usually made from metal material like aluminum or copper to the system, the distance that the power can be transmitted and the efficiency of the transmission are both increased.

Kansas State University as a whole has a portfolio of more than 275 diverse patents.

"The Kansas State University Research Foundation (KSURF) received 93 invention disclosures in fiscal year 2018; the previous record was 73. We've now seen four straight record years and these are important metrics that demonstrate growth in the research enterprise at K-State," said Christopher Brandt, president and CEO of KSURF. "Technology transfer from the university tot he marketplace is also an important part of our land-grant mission. The commercialization of intellectual property developed by K-State accelerates the delivery of research results to the public and shows how our research is closely tied to the economic success of our state."

Mary Vanier gives second $1 million gift to advance KSU Foundation's successful K-State Family Scholarship Program

Mary Vanier, Manhattan, KS, has established a second Mary L. Vanier K-State Family Scholarship match fund of $1 million to create 30 additional matching gift scholarships for Kansas State University students as part of the K-State Family Scholarship Program.

What began as a $650,000 gift received a year ago launched the KSU Foundation Family Scholarship Program, and became a $6 million-and-growing investment in K-State students. Loyal and generous donors like Vanier created matching opportunities for new donors to establish their first endowed gift to the university. Already, 90 students have received these K-State Family Scholarships and new donors can help even more talented and deserving K-State students afford their education. Vanier's first Family matching Scholarship fund cultivated over 30 new donors to benefit students across the university.

College of Education's Project KSTEP-Up awarded $1.6 million

K-State's College of Education was recently awarded a $1.6 million teach quality partnership grant by the U.S. Department of Education to address teacher supply and retention in two Kansas high-needs school

Wheat code finally cracked; wheat genome sequence will bring stronger wheat varieties to farmers

K-State scientists, in collaboration with the International Wheat Genome Sequencing Consortium, published in the international journal Science a detailed description of the complete genome of bread wheat, the world's most widely cultivated crop.

This work will pave the way for the production of wheat varieties better adapted to climate challenges, with higher yields, enhanced nutritional quality and improved sustainability. The article is titled "Shifting the limits in wheat research and breeding using a fully annotated reference genome."

The research article - authored by more than 200 scientists from 73 research institutions in 20 countries - presents the reference genome of the bread wheat variety Chinese Spring. The DNA sequence ordered along the 21 wheat chromosomes is the highest-quality genome sequence produced to date for wheat. It is the result of 13 years of collaborative international research and the support of the National Science Foundation, the U.S. Department of Agriculture's National Institute of Food and Agriculture, Kansas farmers and many others.

Kansas farmers grow an average of 340 million

districts. The innovative program begins with high school teacher pathway programs and concludes with two years of professional development.

Project KSTEP-Up, and acronym for Kansas Statewide Teacher Education Pathway for Underserved and Place-bound, includes seven partners: The Kansas State Department of Education; K-State College of Education; K-State College of Arts and Sciences; Kansas City Kansas Community College; Seward County Community College ; USD 500 Kansas City Kansas Public Schools; and USD 480 Liberal Public Schools.

"I am thrilled for what this program means for the teaching profession in Kansas, for what it means for students who want to become teachers but aren't able to move to a college campus and for schools districts that need highly prepared teachers," said Debbie Mercer, dean of the College of Education.

The site-based program allows for 60 future teachers, half in Kansas City, to earn associate's degrees at their local community colleges and complete their education degrees through K-State online. The program targets underserved populations, individuals who want to teach in rural areas and others. While still in high school, participants will attend K-State's successful weeklong immersive camp, the Kansas Advanced Teacher Academy.

"We know there are capable people in urban and rural communities who cannot leave their homes and families to go to college," said Todd Goodson, co-principal investigator on the grant. "This program brings the resources of K-State to these talented future teachers and gives them access to our faculty and programs. We believe it is part of our mission to find innovative ways to serve diverse populations."

Project KSTEP-Up is essentially divided into four steps: Step 1: Students in the diverse districts join their high school's teaching career pathway program; Step 2: Students take credit classes at Kansas City Kansas Community College or Seward County Community College and complete degrees locally; Step 3: Students complete K-State elementary education degrees after site-based, one-year clinical residency in high-need Local Education Agencies; and Step 4: New teachers are hired by high-need Local Education Agencies and complete two-year induction.

bushels of wheat each year, but acres planted to wheat have dropped dramatically over the past decade, from 10 million acres to fewer than 8 million. To meet future demands of a projected world population of 9.6 billion by 2050, wheat productivity needs to increase by 1.6 percent each year. To preserve biodiversity, water and nutrient resources, the majority of this increase has to be achieved via crop and trait improvement on land currently cultivated, rather than committing new land to cultivation. In order for farmers to dedicate these precious resources to wheat production rather than production of other crops, wheat farming must become profitable.

With the reference genome sequence now completed, breeders have at their fingertips new tools to address global challenges. They will be able to more rapidly identify genes and regulator elements underlying complex agronomic traits such as yield, grain quality, resistance to fungal diseases and tolerance to physical stress - and produce hardier wheat varieties.

It is expected that the availability of a high-quality reference genome sequence will boost wheat improvement over the next decades, with benefits similar to those observed with maize and rice after their reference sequences were produced.

Sequencing the bread wheat genome was long considered an impossible task because of its enormous size - five times larger than the human genome - and complexity - bread wheat has three sub-genomes and more than 85 percent of the genome is composed of repeated elements.

"This international effort, toward something that was once deemed impossible, will have tremendous impact on wheat in Kansas, and the world," said Jesse Poland, associate professor at Kansas State University and director of the Wheat Genetics Resource Center and the U.S. Agency for International Development Innovation Lab for Applied Wheat Genomics.

DID YOU KNOW?

The retention of freshmen to sophomores is the highest in K-State's history at 85.5 percent, and the university graduated a record 3,258 students in May. The university's four-year graduation rate is 40.4 percent and six-year graduation rate is 64 percent - both records for the university.

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