

2019

Conquest

Johnson Cancer Research Center



K a n s a s S t a t e U n i v e r s i t y

100% of donated funds remain at K-State and support cancer research and university advancement.

\$390,000 was awarded in 2018 for cancer research and training.

100 faculty researchers are fighting cancer in 23 departments of five colleges.



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The fight starts here!

From nanoparticles and stem cells to antioxidants and drug discovery, Kansas State University faculty are conducting the basic and translational cancer research that leads to new treatments and cures, as well as training tomorrow's scientists and medical professionals. To support the Johnson Cancer Research Center's vision to conquer cancer in our time, simply use the enclosed envelope to send your gift, or donate online at ksufoundation.org/cancer. With your help, we make a difference! To learn more about how you can support K-State cancer research and education, contact Shelley Carver at **800-432-1578** or shelleyc@ksufoundation.org.

Table of contents

Guinness record-holding 'manufacturing guy' 3D-prints bone tissue for breast cancer research	2
Better patient care stems from cells	4
As a matter of fat	5
From band nerd to lab rat	6
Cancer prevention gone viral	7
Counter-attacking cancer	8
Bill Snyder talks about facing cancer and supporting research	inside back cover



As we often lament, "time flies." Much has happened at the Johnson Cancer Research Center, or JCRC, during the past year — some happy, some sad.

On the happy side, it was a monumental year with the establishment of our Center of Excellence for Pancreatic Cancer Research. This multidisciplinary team of researchers will help advance diagnostics and treatments for the U.S.'s third most deadly cancer. We hope to fund a second center of excellence in the coming year. We also supported some other outstanding research and did several outreach activities. (You can read on page 7 about the HPV vaccine presentation we sponsored last March.)

Sadly, however, cancer took the lives of two of our biggest supporters, Les Regier and Dr. Rob Denell. Les Regier and his wife Sandy, with family and friends, established the annual Rob Regier Memorial Golf Tournament in 1998 in memory of their son. Their efforts helped to grow the JCRC, and the tournament is one of our most popular and successful events. Rob Denell was our center's director for more than 13 years before retiring in late 2016. He was responsible for its professional structure and significant growth, and his leadership will have a long-lasting impact.

Loss of loved ones reminds us all that we have a long way to go in the fight against cancer. In this edition of *Conquest*, we showcase some people on the front lines, performing cutting-edge cancer research at Kansas State University. JCRC associate director and stem cell expert Mark Weiss has had exciting success with his stem cell treatment for graft-versus-host disease, which affects some people who receive donated blood or bone marrow. Dong Lin 3D-prints bone tissue, a novel tool for cancer studies. Nora Springer studies obesity-caused changes in children's fat tissue that can lead to cancer later in life. Brian Geisbrecht investigates a protein that drives inflammation, which in turn can trigger cancer development. To demonstrate a hallmark of our center — the training of students in cancer research — we spotlight Jazmine Snow, who studies the cancer-causing human papillomavirus.

We also feature a different kind of fighter. Former K-State head football coach Bill Snyder, a member of our advisory council, talks about his experiences with cancer and why he supports research.

In closing, I must say many thank-you's. I never cease to be amazed by the many donors who provide the means for the JCRC to fulfill its mission. I laud our extraordinary researchers who have so many novel ideas and initiatives that offer hope. I'm in awe of the brilliant students who work in our labs and proud to nurture them. And I commend our staff, which works hard to pull off the multitude of things we get done each year.

No wonder 2018 went so fast! Please enjoy this edition of *Conquest*.

S. Keith Chapes / Interim Director

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Guinness record-holding 'manufacturing guy' 3D-prints bone tissue for breast cancer research

By Marcia Locke

He may take afternoon naps on a cot in his office, but Dong Lin, assistant professor of industrial and manufacturing systems engineering at Kansas State University, is no slacker. The Guinness world record-holder is passionate about being a good educator and innovator.

Lin is the principal investigator behind 3D-printed graphene aerogel, the world's least-dense 3D-printed structure according to Guinness World Records. And now, the self-proclaimed "manufacturing guy" is applying his expertise in the fight against breast cancer.

With funding from the Johnson Cancer Research Center at K-State, Lin's team is switching gears to do bio-mimic 3D printing. That is, they are creating structures modeled on biological entities and processes. Specifically, they are printing bonelike structures that will be useful for studying breast cancer, which is prone to metastasize to bone.

Lin's novel technique, which can be done with a variety of materials, including graphene, nanowire, Hydroxylapatite, collagen and cellulose, combines inkjet printing, or extrusion, and freeze-casting to create truly 3D, complex structures with controlled and variable porousness and no boundaries — like bone.

"Traditional 2D cell culture systems do not provide a good representation of the 3D morphology and cellular diversity of a tumor in the body, and newer 3D cell culture systems show promise but often cannot simulate the interaction between breast cancer cells and native bone cells," Lin said.

"3D printing of bone structure provides one of the most effective models for breast cancer cell culture, and we are able to better mimic real bone structure with our 3D-printed aerogel scaffold," Lin said.

Lin's novel scaffolds have macro and micro porosity, like bone, offering a truer microenvironment on which to grow bone cells. This will permit better observation of cell-cell interaction and thus cancer progression.

To grow the bone cells, Lin will collaborate with stem cell biotechnology expert Mark Weiss, professor of anatomy and physiology at K-State and an affiliate of the Johnson Cancer Research Center, and Shuting Lei, professor of industrial and manufacturing system engineering at K-State.

Lin's preliminary findings were recently published in the article "Biomimetic 3D Printing of Hierarchical and Interconnected Porous

Hydroxyapatite Structures With High Mechanical Strength for Bone Cell Culture" in the journal *Advanced Engineering Materials*.

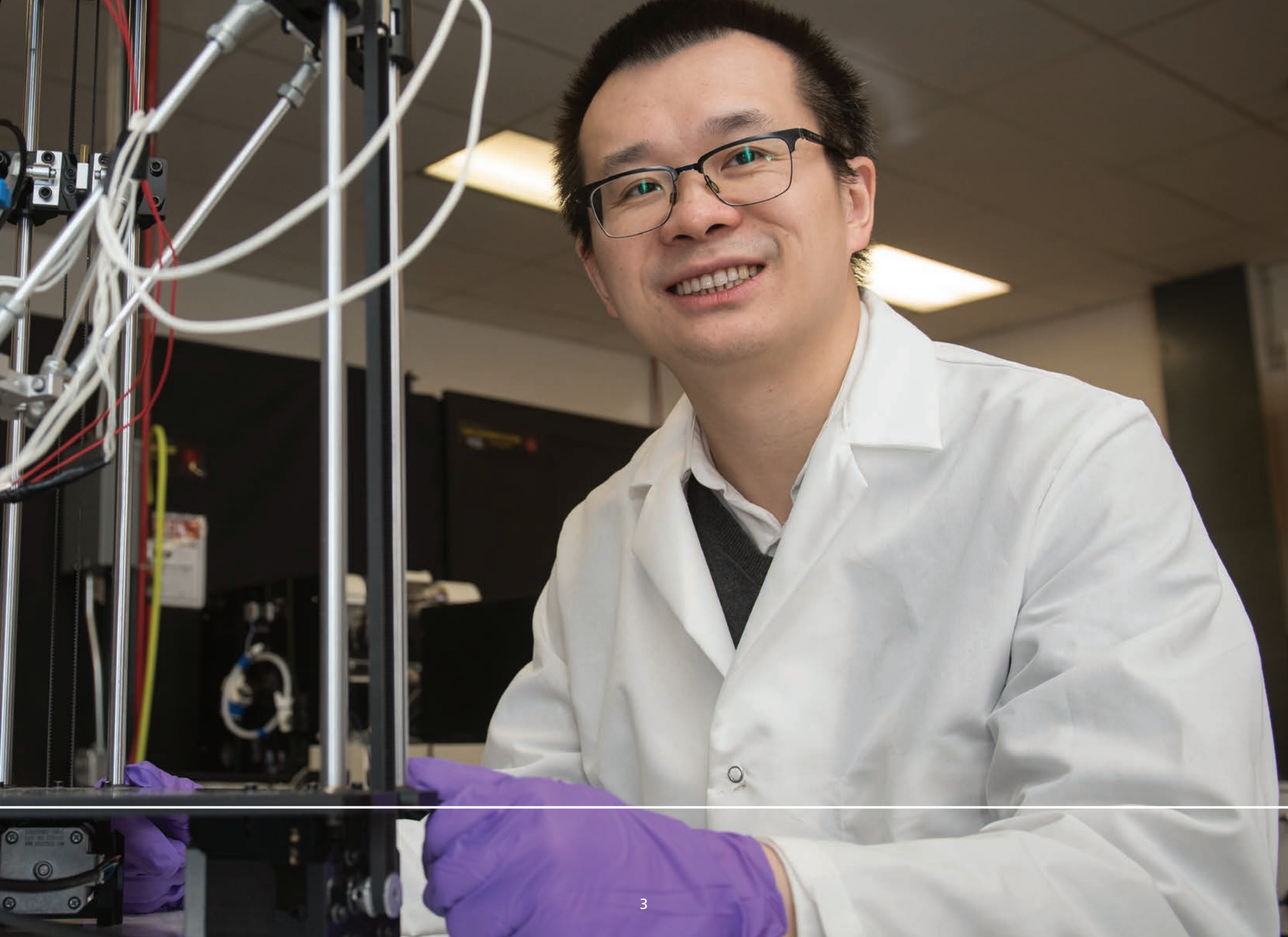
Lin is grateful for the Innovative Research Award from the Johnson Cancer Research Center that allowed him to delve into this new area of study. With more support for materials than many grants offer, Lin was able to upgrade his laboratory with crucial equipment, including a new temperature-control platform for 3D printing that has transformed his ability to do this research.

Next, Lin will try his new technology to print wood polymer structures that would be similar to his bone structures but also biocompatible and thus useful for carrying medicine to sites in the body.

With such big goals, passion and achievements, occasional naps are totally understandable.

\$19,000

supported laboratory equipment purchases in 2018, but hundreds of thousands of dollars are needed.





Better patient care stems from cells

by Jennifer Tidball

Mark Weiss has devoted his career to basic science that can help patients struggling with a variety of diseases, from osteoarthritis to Parkinson's disease to graft-versus-host disease and complications from cancer treatment.

"Ever since I was a child, my mother has encouraged me to do something that helps people," said Weiss, Kansas State University professor of anatomy and physiology. "Now I feel like I am doing that."

Back in 2010, Weiss and his team patented a plentiful and noncontroversial source of stem cells from a substance in the umbilical cord. A few years later, the Johnson Cancer Research Center awarded Weiss \$117,000 in special funding made possible by Margaret Ruth Hannah, to further investigate the use of the stem cells to ameliorate negative effects of transplanted immune cells on host tissues.

Weiss' patented stem cell therapy involves umbilical cord-derived stem cells. The patent addresses procedures to isolate, culture and bank stem cells found in Wharton's jelly — the substance that cushions blood vessels in the umbilical cord. These cells are called cord matrix stem cells and are different than those obtained from the blood cells in umbilical cords.

The patent was developed by a Kansas State University team that included Deryl Troyer, professor emeritus of anatomy and physiology and former Johnson Cancer Research Center affiliate; Duane Davis, professor emeritus of animal sciences and industry; and Kathy Mitchell, former professor.

Weiss continues to develop the stem cell therapy. One application being investigated is the treatment of graft-versus-host disease, a possible complication of leukemia or lymphoma treatment. When a cancer patient receives a stem cell or bone

marrow transplant, graft-versus-host disease may develop when donated bone marrow or blood stem cells attack the recipient's body because they recognize it as foreign. The disease can become life-threatening.

Tumor imaging is another area Weiss' work could be helpful. His team recently demonstrated that exosomes, small vesicles made by umbilical cord cells, accumulate in tumor cells in the body. Working with Santosh Aryal, Kansas State University assistant professor of chemistry, they labeled the exosomes with gadolinium and found that they accumulated at osteosarcoma tumors in mice. This suggests that the technique could perhaps be used to identify metastatic cancers through non-invasive imaging. This research was recently accepted for publication in the journal, *Theranostics*.

"Once you realize that your work can translate into clinical applications, it really changes the way you think about your science," Weiss said. "You start thinking strategically about the best way to do it again."

\$3,362,456 has been invested in promising cancer studies since 2003, but \$5,260,853 was requested.

As a matter of fat

Pathologist studies how obesity changes fat tissue and promotes tumor growth

by Marcia Locke

Obesity-related conditions, including certain cancers, are some of the leading causes of preventable, premature death in the U.S., so Nora Springer wants to offer more than just a prescription to lose weight.

"Losing weight is a real struggle for most people, and even those who lose weight have an increased risk of developing colorectal cancer in adulthood if they were obese during childhood," said Springer, assistant professor of pathology and veterinarian in the Kansas State University College of Veterinary Medicine.

Springer wants to know exactly how obesity increases the risk of developing cancer. She studies how adipose tissue — fat tissue — that has undergone cellular and structural changes caused by obesity becomes a microenvironment that is ripe for tumor growth.

"An improved understanding of the long-lasting effects of obesity on adipose tissue function is necessary for developing effective interventions and preventing future cancers," Springer said.

During obesity, fat undergoes numerous structural changes, including fibrosis, that mimic the tumor microenvironment. According to Springer, such changes appear to prime fat tissue for future cancer development, and weight loss alone may not reverse these changes.

"We're seeing similar fibrotic changes in aged tissue, leading to our hypothesis that childhood obesity accelerates tissue aging, contributing to cancer initiation," Springer said.

With an Innovative Research Award from the Johnson Cancer Research Center, Springer's team will use models of childhood obesity to investigate indicators of aging in fat. They will identify which changes are irreversible with weight loss and how the changes contribute to colorectal cancer development.

"It's not enough to just tell people to eat right and exercise," Springer said. "Education and lifestyle practices alone are unlikely to resolve the obesity epidemic due to socioeconomic factors. Not

to mention, some factors even in utero can predispose people to being overweight or obese.

"Understanding how childhood obesity promotes cancer later in life is essential to developing multimodal preventative strategies for this at-risk population," she said.

Springer is grateful to the Johnson Cancer Research Center and its supporters for making this project possible.

"I wouldn't have been able to do some expensive parts of this study with only my college startup funds," she said. "Getting center support is absolutely huge for new faculty. It is critical seed funding that allows us to generate data we can use to apply for federal and larger funding."

Springer is also studying the link between obesity and cancer in companion animals.

"Dogs and cats share our environment and therefore our cancer risk factors," she said. "It's probable that obesity in our pets predisposes them to cancer, too. One of the benefits of being a veterinarian-scientist is the ability to make comparisons between human beings and companion animals for the benefit of all species."

When not working on research or writing pathology reports for the Veterinary Health Center or Kansas State Veterinary Diagnostic Laboratory, Springer enjoys loving up on her dog, River, an English pointer. She also helps rescue others as a board member and foster home provider for Pointer Rescue Organization, a volunteer-based national rescue group for purebred English pointers.

Programs to advance K-State cancer research and education are made possible by private donations.



From band nerd to lab rat

Undergraduate appreciates opportunities presented throughout her education

By Marcia Locke

Jazmine Snow always thought she would study music education and become a music teacher. But when the time came to enroll in classes at Kansas State University, the self-proclaimed “band nerd” changed her mind and majored in microbiology instead.

“Yeah, I kind of did a 180,” said Snow, a December 2018 K-State graduate in microbiology. “My mom was pretty confused about that.”

But Snow knew during her first semester that she had made the right decision. Although she still enjoyed playing clarinet in the K-State Marching Band, her Phage Hunters class in the Division of Biology convinced her that she would like pursuing science.

By her second semester, she had already joined the laboratory of a new, enthusiastic researcher. Nick Wallace, assistant professor of biology, studied human papillomavirus, or HPV, and Snow knew she wanted to do biomedical research and work with cells.

The Wallace lab investigates how HPV causes DNA damage in the cells that it infects — generally, skin cells — and leads to cancer formation. HPV causes virtually all cervical cancers as well as cancers of the throat, genitals and other sites.

According to Snow, the main treatment for cervical cancer, which kills one person every two to three minutes, is a 50-year-old drug called Cisplatin that causes lots of undesirable side effects.

With funding from the K-State Johnson Cancer Research Center, Snow is dissecting the molecular details of how HPV changes normal cells, and targeting those changes with different drugs currently on the market in hopes of discovering better therapies against HPV-caused cancers.

“Jazmine is a prolific scientist, especially for her age,” Wallace said. “We had to get her keys to the building and lab because it’s not uncommon for her to stay late and arrive early. She is the prototypical ‘lab rat’ and everything you could want from a scientist trying to identify future therapies for such a deadly cancer.”

Snow has appreciated her research experience for many reasons. For starters, it has helped her understand her class material and be a better student.

“It’s nice to see real-life applications of my class work and to know that the stuff I’m learning is really going to pertain to my future,” Snow said. “Plus, my research motivates me to learn more so that I can understand it better.”

Research experience has also helped her get more scholarships, including two Cancer Research Awards and many awards from the Division of Biology, the Office of Undergraduate Research & Creative Inquiry, and more. She’s glad she doesn’t have to worry about finances and can instead focus on research and school.

Snow appreciates the role the Johnson Cancer Research Center has had in enhancing her education and advancing the Wallace lab.

“The center has helped our lab immensely,” Snow said. “It has funded pretty much my entire project. The Les Clow family donation helped to get my research started and hire a postdoc, who has been my mentor, and the Cancer Research Awards have helped me financially. I also like that the center brings experts in my field to campus and offers students opportunities to meet them.”

The Wallace lab is passionate about science outreach in the community, and Snow enjoys co-hosting Johnson Cancer Research Center visitors and showing them the lab.

Snow now works full time in the lab, building on her research and making plans for graduate school. She thinks she wants to get a doctorate in viral oncology.

“I didn’t know when I first got into biology that I’d be working with cancer,” Snow said. “But the research I’m doing is so fulfilling. Cancer affects so many people; you know that what you’re doing with your research — trying to impact lives — might help someone have a better prognosis. And there are still so many questions that need answering.”

\$1,581,000 has been invested in undergraduate research training since 1980.



Presentations, tours, events and information help inform the public about cancer, risk reduction and research.

Cancer prevention gone viral

HPV vaccine expert presents 16th Bascom lecture

by Marcia Locke



How many times have you heard somebody wish for a cancer vaccine? Well, now there is one, but not enough people are taking advantage of it.

Human papillomavirus, commonly referred to as HPV, is a virus that causes more than 99 percent of all cervical cancers. It also causes cancers of the throat, genitals and other sites in the bodies of both men and women. It is transmitted through intimate skin-to-skin contact and is so common that most people get it at some time in their lives. In the U.S., 14 million HPV infections occur each year.

This is a serious problem because HPV causes 33,700 cancers in the U.S. each year. Worldwide, someone dies from an HPV-caused cancer every two minutes.

There is hope, however. A vaccine is available to prevent HPV and thus the cancers it causes. The HPV vaccine is usually offered at age 11 or 12, well before risk of exposure. The Centers for Disease Control and Prevention states that most HPV-caused cancers —

about 31,200 per year in the U.S. — could be prevented through vaccination.

However, too few people are getting the vaccine, especially in Kansas, according to Kevin Ault, an HPV vaccine expert and obstetrician-gynecologist at the University of Kansas Medical Center.

Ault gave the presentation, "The HPV Vaccine: A Missed Opportunity for Cancer Prevention," on March 12, 2018, for the Johnson Cancer Research Center's George S. Bascom Memorial Lecture Series. The event was co-sponsored by Lafene Health Center and a video is archived on the center's Facebook page.

Ault offered insight on the use and results of HPV vaccination around the world, pointing out that many more lives would be saved if more people would get vaccinated against HPV.

He also emphasized that HPV is not just a women's health issue, as some people think. Not only do men spread the virus, they also develop cancers caused by it. In fact, men's HPV-caused cancers are increasing at an alarming rate.

Ault has been involved in HPV vaccine development and research for more than two decades. He has published extensively in medical journals on the topics of infectious diseases, women's health and the development of the second-generation HPV vaccine.

The George S. Bascom Memorial Lecture Series on Current Issues in Clinical Medicine brings distinguished experts to Kansas State University to present about challenges faced in clinical medicine and research. Bascom was a revered Manhattan surgeon and community leader who served on the Johnson Cancer Research Center's first advisory council. He died of cancer in 1993. In 1996, a group of donors established a fund for the series in his honor.



Counter-attacking cancer

Biochemist investigates tumor growth trigger linked to immune system

By Marcia Locke

If the protein gC1qR shows up on the surface of a cell, you know something's wrong. Or at least Brian Geisbrecht, professor of biochemistry at Kansas State University, does. And now he wants to learn all about the protein and its potential use in cancer detection and treatment.

Geisbrecht is an expert on the body's complement system, which he compares to a surveillance and alarm system that detects foreign invaders and injury, and alerts other components of the immune system to prepare to fight.

Specifically, Geisbrecht studies the gC1qR protein, which is normally present inside healthy cells but shows up on the outside surface of damaged cells.

This phenomenon is important for at least a couple of reasons. For one, it is a sort of marker, a sign that the cell is damaged. Indeed, gC1qR is expressed on the surface of cancer cells.

Second, the protein's presence on a cell's surface can activate the complement system and drive inflammation. Inflammation is a process that sets the stage for the immune system to counterattack an assailant.

The problem is that inflammation — although essential for the immune response to help the body fight viruses, bacteria and fungi — can become overactive and harmful, in some cases causing diseases like arthritis, lupus and even cancer.

"A lot of the same players — the same molecules, pathways and cells — that are involved in fighting off infection are also important in driving the initial inflammatory events that promote tumor development," Geisbrecht said.

The gC1qR protein is a key player in this process, according to Geisbrecht.

"Cell surface-exposed gC1qR is known to trigger

specific inflammatory reactions — including the complement system — that, themselves, drive tumor growth and metastasis," Geisbrecht said.

So, Geisbrecht wants to capitalize on this phenomenon. Can it be developed into a tumor marker? Can the inflammation process be blocked so that tumor growth is slowed or avoided?

Geisbrecht initiated this project in fall 2014 with a \$15,000 Innovative Research Award from the Johnson Cancer Research Center, made possible by private donations.

"Thanks to the center's award, I was able to generate a panel of antibodies that recognize and bind to gC1qR, and use them as tools in my research," Geisbrecht said.

Working with Berhane Ghebrehiwet, professor of medicine and pathology at Stony Brook University in New York, Geisbrecht parlayed that

award into a \$150,000 High Priority, Short-Term Project Award from the National Institutes of Health. The NIH will consider providing their team further funding in 2019.

A perfect example of basic research, Geisbrecht's venture to completely characterize his antibodies in terms of their interactions with the gC1qR protein, and determine if they can block downstream inflammatory reactions, could help improve diagnostic and therapeutic approaches to many diseases, including cancer.

\$167,446

was awarded in 2018 to graduate students who will lead the next generation of cancer research.



Former K-State head football coach Bill Snyder helps promote the Fighting for a Cure shirt, which raises awareness and funds for cancer research at Kansas State University.

It's about people

Bill Snyder talks about facing cancer and supporting research

by Marcia Locke

Like many people, former Kansas State University head football coach Bill Snyder developed a greater appreciation for cancer research after being personally touched by the disease, more than once. Supporting the university's Johnson Cancer Research Center is his way of helping the fight against cancer.

Snyder has lost several relatives to cancer, but none as significant to him as his mother, Marionetta.

"As an only child in a single-parent home, my mother had a great impact on my life," Snyder said.

Marionetta was first diagnosed with breast cancer at age 67. She died from it 10 years later, during Snyder's early years at K-State.

"After she was treated the first time, everything seemed good," Snyder said. "She got through it, lived those next 10 years, and then it came back."

Following that experience, he became more in tune with cancer's serious impact on the world and the number of people affected by it.

"I realized it's not just breast cancer, but so many different types of cancer faced by so many people," Snyder said. "There are so many different treatments and areas of research. I wondered what works, what doesn't, what can we do to prevent it?"

Snyder believes in the power of research.

"Research can draw all these thoughts together and, eventually, I'm confident, we will utilize all these resources and find a more precise solution to what causes cancer and how to treat it and prevent it," he said.

Soon after his mother died in 1995, Snyder joined forces with Sunny 102.5-FM on the annual Wildcat Challenge to Tackle Cancer. Now sponsored by 580 WIBW-AM, the ongoing radio ad and mailing campaign has raised \$416,665 for the Johnson Cancer Research Center.

In 2006, impressed by the center's mission and people, Snyder accepted an invitation to join the university's Cancer Research and Education Advisory Council.

"It's about people — the quality of all the people involved with the center, how much they care, their passion," he said. "It's an amazing resource to have on campus. Having 100 researchers from so many diverse areas of the university is so significant. I think that's what is needed to fight cancer."

Snyder said that being on the advisory council has been very informative for him.

"I've learned a great deal about what the needs are and how dramatic an impact cancer has on our society," he said.

In December 2016, cancer struck closer to home. The esteemed coach himself was diagnosed with throat cancer.

Every gift helps, and last year, more than 95% of funds donated came from gifts of less than \$1,000.

MD Anderson Cancer Center, in Texas, was his first stop. But after learning his treatment would last several months, he arranged to do it at the University of Kansas Medical Center so it wouldn't interfere so much with his work.

For nearly three months, he drove 250 miles round-trip between Kansas City and Manhattan multiple times a week to receive intravenous chemotherapy and radiation treatments, all while continuing to work a fairly normal schedule.

Snyder believes that staying busy and keeping a routine benefited him.

"I didn't spend much time thinking about it," he said. "I didn't really fret about it. I knew that wouldn't do any good."

It wasn't until after he completed therapy late that spring that he felt the physical toll of it.

"Eventually, the treatments wear on you and drain your energy," he said.

Snyder said he feels well now, even though he can't answer whether he's back to normal.

"I've never known what normal is, but the fatigue has dissipated a great deal," he said.

Snyder truly is guided by his well-known mantra, "it's about people." Even as he reflects on supporting Kansas State University cancer research, he honors his mother and others who have fought cancer, praises the people of the Johnson Cancer Research Center for their passion, commends the researchers for their talent and dedication, and thanks the supporters for making it all possible. He helps K-State fight cancer because he hopes, like we all do, to find more answers and save more lives.

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Bill Snyder
-HIGHWAY HALF-
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Coach Snyder has selected the Johnson Cancer Research Center to be one of four great organizations supported by the 2019 Bill Snyder Highway Half-Marathon and 5K. Join the fun in Manhattan, Kansas, May 25! billsnyderhighwayhalf.com

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