

SPARC Johnson Cancer Research Center





\$325,432 was awarded to faculty and \$186,500 to students for cancer research and training in 2022.

80⁺ faculty researchers are fighting cancer in 20 departments of 5 colleges.

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The cure starts with us!

Kansas State University faculty members conduct basic and translational cancer research that leads to improved prevention, diagnostics and treatments while training the next generation of scientists and medical professionals. But the "us" includes many others as research requires help from everyone. To support the Johnson Cancer Research Center's vision to conquer cancer in our time, visit *cancer.k-state.edu/support* or scan the QR code. With your help, we make a difference!



Scan this QR code to give online.

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1 Chalmers Hall, 1711 Claflin Road, Kansas State University, Manhattan, KS 66506-3901

785-532-6705 | cancerresearch@k-state.edu | cancer.k-state.edu

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Welcome to the SPARC (Special Partners Advancing Research in Cancer)!

The Johnson Cancer Research Center has updated its annual magazine. We have provided a simplified, bulleted text and a QR code for those who want more, or the "rest of the story!" Our goal is to include everyone who sparks cancer research, as the cure starts with us! The "us" includes the faculty and student researchers, donors, volunteers, administrators and advisory council members as well as those who wear our t-shirts or give in memory of a loved one. Everyone's help is critical and appreciated!

In this issue of SPARC, you will learn:

- About a novel method to increase the effectiveness of new immunotherapies when treating triple-negative breast cancer.
- How cancer research has elevated the education of twin students as they provide pointers for others to follow in their footsteps.
- How studying gene regulation through tiny RNAs in transparent microscopic worms can lead to a better understanding of cancer and disease.
- How antibiotics in pregnant mice change the intestinal microbes in both the mom and the pup.
- How the Johnson Cancer Research Center has been at the cutting edge of student engagement for the past 40 years.
- How radiation oncology helps both pets and humans.
- How getting outside into a green space may improve mental health both during and after chemotherapy.
- About the philanthropic mindset of donors.

These stories spotlight a few of the special partners providing the **SPARC** to advance cancer research. Thank you to everyone who has provided a spark, and if you haven't, please consider being a part of our **SPARC** team!

Sherry DF 27

Sherry D. Fleming, Ph.D., Director and Fiedler Chair

Triple-negative breast cancer

Communication with the immune system

Anna Zolkiewska, professor of biochemistry and molecular biophysics, studies the triple-negative subtype of breast cancer. White blood cells poorly kill this subtype because it tries to evade anti-tumor immunity, forms an immunosuppressive tumor environment and often doesn't respond to new immunotherapies. The Zolkiewska laboratory is looking for ways to boost the immune system so the cancer environment will not suppress it. The lab conducts cell and mouse studies that examine immune checkpoints, proteins that keep the immune system under control. These studies strive to develop improved and more selective strategies to sensitize triple-negative tumors to immunotherapies.

- Zolkiewska has identified a protein, ADAM12, that prevents immune checkpoint inhibitors from being effective.
- ADAM12 is part of the ADAM protein class on cancer cells involved in cell migration, invasion and metastasis.
- These studies were funded in part by the Johnson Cancer Research Center and are published in Oncolmmunology, volume 12, 2023.

For the full story, please see the QR code.

We deleted the ADAM12 gene in breast cancer cells and injected these cells into mammary glands in mice. We found that tumors that arose from cells lacking ADAM12 responded to the checkpoint inhibitor therapy.

– Anna Zolkiewska, professor of biochemistry and molecular biophysics



Follow your gut

From film to mining microbes

Sonny Lee, assistant professor of biology, began his career making films in the hopes of capturing fish on camera swimming in the ocean. Though this start may sound out of the ordinary for a biology professor, Lee followed his gut. He eventually returned to college for a science degree and, ultimately, a Ph.D. in microbiology. Now at K-State, Lee studies host-microbe interactions using a combination of genomics-enabled technologies and wet-lab techniques that allow him to inventory microbial genes, functions and expressions. He focuses on the gut to understand how inflammation overreacts and may cause tumors or even cancer.

- Using model systems ranging from mice to human samples, the Lee Lab analyzes the role of bacteria, fungi and viruses in causing inflammation and explores how to prevent the inflammation from getting worse and keep tissues from being persistently inflamed.
- The lab treated pregnant mice with antibiotics to kill and "unbalance" some of the gut microbes, and they found that the pups had the same unbalanced microbes as their mothers.
- They believe that some of the unbalanced microbes may remove nutrients from the mouse's intestines, preventing the mouse from repairing the damage from the inflammation.
- According to Lee, the most rewarding part of his job is working with students that are clever, creative, motivated and passionate about science. The Johnson Cancer Research Center helps fund his graduate students during the summer.



For the full story, please see the QR code.

We use a human cancer cell model and a mouse model to look at which microbe causes this persistent inflammation. If the moms get antibiotics, their pups have the same imbalance in the gut, which differs from pups whose moms did not get any antibiotics.

-Sonny Lee, assistant professor of biology



All in the family

Identical but different

It was cool to present research at our annual banquet to people who may not have heard about or understood the project and talk to people who have personal experience with cancer and see why we do what we do.

— Ashlyn Bugbee, senior in medical microbiology

I needed a way to make money and balance work, classes and being in the lab. The Cancer Research Awards program gave me an opportunity to focus more time in the lab and not have to take on another job.



— Taylor Bugbee, senior in biology



Taylor and Ashlyn Bugbee are identical twin sisters who have worked on cancer research for more than three years. The twins, who will graduate in May 2023, are determined to make a difference in the fight against cancer at Kansas State University. Taylor, pictured top right, is a biology major whose research focuses on killing pancreatic cancer cells. Ashlyn, pictured bottom right, is a medical microbiology major, and her research centers on immunotherapy, killing cancer cells with white blood cells. Both Bugbee twins say they have thoroughly enjoyed their cancer research journey and being involved with the Cancer Research Awards program.

Working in Nicholas Wallace's lab, Taylor uses inhibitors to block DNA repair and allow chemotherapy to kill more cancer cells.

- Pancreatic cancer is deadly approximately 10% of patients survive for five years after diagnosis.
- Chemotherapy is a common treatment that kills cells by damaging DNA. Cancer cells can repair this damage.
- · Taylor hopes to publish her results in the near future.

Working in Kalyani Pyaram's lab, Ashlyn studies how lymphocytes, a type of white blood cell, can kill cancer cells with anti-oxidation proteins.

- Each cell type has its own anti-oxidative proteins. Ashlyn studies one protein's function and how it affects the body's ability to fight off cancer and tumors.
- Ashlyn and her lab mates investigate new ways to change cells, and they hope to use the information for new therapies that kill cancerous cells.

The twins offer advice to future students wanting to pursue cancer research:

- · It's okay to have trial and error and even failures.
- Be open-minded to all opportunities.
- Get out of your comfort zone.
- Be involved with extracurricular activities both in and outside your major.
- Don't be afraid to ask questions and reach out to professors and your advisor.

Taylor and Ashlyn both:

- Achieved awards and were involved with other curricular activities throughout their undergraduate career.
- Received Cancer Research Awards, were involved with K-INBRE and were recognized as most promising students in the Division of Biology.
- Are applying to graduate school and want to pursue Ph.D.s after graduation in May 2023.





Environment and cancer

Nature's benefits

Gina Besenyi, assistant professor of kinesiology, is the director of the Physical Activity Research in Community Settings, or PARCS, lab. Besenyi examines the interactions between time spent in nature and physical and mental health benefits. She hopes to incorporate these studies into cancer treatment and survivorship. Spending time in nature — even relaxing or taking a short walk at the park — may improve mental health and cancer-related outcomes.

- Spending time in nature has a wide variety of health benefits that go beyond those of physical activity alone.
- Chemotherapy patients have multiple mental and physical challenges due to the side effects of the treatment. Besenyi believes spending time outside, socially connecting with other people and being active can be an important part of cancer treatment.
- Besenyi's research on outdoor activity and social interactions may apply across the cancer continuum, from prevention to treatment to survivorship.

I'd like to show the effectiveness of environmental interventions and physical activity on reducing cancer risk.

- Gina Besenyi, assistant professor of kinesiology



For the full story, please see the QR code.

The canine connection

Early in life, **Chieko Azuma**, clinical associate professor in clinical sciences, knew her goal was to become a veterinarian, scientist and professor like her older brother. After working at several universities, Azuma came to Kansas State University in 2019 as a veterinary radiation oncologist at the K-State Veterinarian Health Center.

- Radiation therapy is one form of cancer treatment for human and veterinary patients. Azuma's goal is to maximize tumor death without damaging critical organs of the body.
- Cancer treatments for companion animals benefit both veterinary and human patients because the beneficial therapies in dogs can often be rapidly translated into human medicine.
- Dogs sniff the environment closer to the earth and pick up more toxic chemicals. Azuma's group wants to determine if nasal tumors in dogs are linked to environmental exposures.



Up, up and beyond

From JCRC to outer space



Keith Chapes, professor emeritus of biology, was the director of the Johnson Cancer Research Center, or JCRC, from 2016-2019 after serving as associate director for many years. Chapes' research involved the macrophage responses to Ehrlichia chafeenis and immune cell-tumor cell interactions focusing on macrophage activation to kill cancer cells. Some of Chapes' accomplishments during his tenure at the Johnson Cancer Research Center include:

- Creating the first Cancer Research Collaboration of Excellence for pancreatic cancer research.
- Mentoring and teaching many students, including the current director, Sherry Fleming.
- Creating an outside, peer-reviewed process for innovative research awards.
- Investigating the immune response in space through more than a dozen experiments that traveled on the space shuttle and two experiments on the International Space Station.



There is currently a big push for educational engagement, and the cancer center was doing this forty years ago by actively placing students into laboratories from the beginning.

– Keith Chapes, professor emeritus of biology



For the full story, please see the QR code.





Worm's-eye view

Gene choices and development

Anna Zinovyeva, assistant professor of biology, studies how genes are regulated using the transparent worm Caenorhabditis elegans, commonly referred to as C. elegans. To produce an organism, whether it is C. elegans or human, many genes must be precisely activated and deactivated to make the correct amount of protein at the right time. As most genes make proteins with essential functions, this process must be tightly regulated at different times during development or in different tissues or cells. Zinovyeva's laboratory performs foundational research to understand how these processes work.

 Using worms, Zinovyeva examines both how normal cells regulate genes being activated and deactivated and how the loss of this regulation leads to cancer and developmental disorders.

- Zinovyeva aims to understand gene regulation through microRNAs — tiny RNAs that are potent gene repressors. Her research includes studying how the cellular machinery decides which microRNAs are kept, integrated and used and which are discarded. Understanding these decisions may lead to discovering how to correct the wrong choices cells sometimes make in disease.
- Science is not simple hypotheses are tested through experiments, and experiments produce data, but the data always leads to more questions. Even though the research doesn't always yield definitive answers, new insights into the inner workings of the cell are gained with each step.



— Anna Zinovyeva, assistant professor of biology

K-INRD



For the full story, please see the QR code.

Living and giving

Gifts from alumni advance cancer research

Casey and **Cheryl Mussatto** met early in their collegiate careers while part of the K-State Marching Band. They graduated, married and now reside in Osage City, Kansas. Casey and Cheryl stay active with their family, careers and the K-State Alumni Association, and they enjoy attending K-State Athletics events. The Mussattos like to give back to others, especially K-State. Thanks to a generous donation from the Mussattos, the Johnson Cancer Research Center is able to support an undergraduate cancer researcher.

- The Johnson Cancer Research Center was a great fit for the Mussattos' philanthropy as Casey was diagnosed with stage IV non-Hodgkin's lymphoma 19 years ago.
- Though the causes of non-Hodgkin's lymphoma remain unknown, there is a 60-75% survival rate.
- Non-Hodgkin's lymphoma is a cancer of specific white blood cells in the lymph, the fluid in which white blood cells travel. Johnson Cancer Research Center researchers are trying to understand how specific white blood cells may lead to cancer rather than killing tumor cells.
- Ultimately, the three key results they hope for are prevention, early detection and treatment.

For the full story, please see the QR code.







College of Arts and Sciences Johnson Cancer Research Center

1 Chalmers Hall 1711 Claflin Road Manhattan, KS 66506

785-532-6705 cancer.k-state.edu 152-003

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Biochemistry and Molecular Biophysics Biology Chemistry Physics Sociology, Anthropology, and Social Work Statistics

College of Agriculture

Entomology Grain Science and Industry Horticulture and Natural Resources Plant Pathology

Carl R. Ice College of Engineering

Chemical Engineering Electrical and Computer Engineering Engineering Extension Mechanical and Nuclear Engineering

College of Health and Human Sciences

Food, Nutrition, Dietetics and Health Kinesiology

College of Veterinary Medicine

Anatomy and Physiology Clinical Sciences Diagnostic Medicine/Pathobiology

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