

2017

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

95% of donated funds go directly to K-State cancer research, while 5 percent is used to advance the university.

\$500,000 or more is awarded each year to support cancer research and education.

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

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 www.found.ksu.edu/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@found.ksu.edu.

On the cover: Dr. Ryan Rafferty and Lydia Lawlor, a junior in chemistry and biology.

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Thank you for taking time to visit with us today. Dr. Rob Denell has retired after an extremely productive and meaningful career at K-State. I am serving as the interim director of the Johnson Cancer Research Center until a permanent director can be recruited. A professor in the Division of Biology, I have been at K-State since 1984. I am an immunologist and study various aspects of how people resist infectious pathogens and cancer. I also have served as an associate director of the cancer research center since 2003. I am very excited to serve as interim director at a time when many ground-breaking discoveries are occurring in the fight against cancer.

This year's Conquest captures the excitement of 2016 at the Johnson Cancer Research Center. For one, Eric Stonestreet, the K-State alumnus who plays Cam on the television show "Modern Family," visited with us and decided to help K-State fight cancer by directly supporting the research of Drs. Christopher Culbertson and Stefan Bossmann. We also explore how Dr. Ryan Rafferty is improving drug delivery for brain cancer treatment. We show off what our students can do by visiting with Raquel Ortega, a senior in chemistry who is developing nanoparticles to deliver natural chemicals called cytokines to tumors to destroy them. We spotlight Dr. Nick Wallace, an expert in the cancer-causing human papillomavirus. And we tell you about our Bascom Lecture, which showed how we can harness the power of the immune system and vaccination to prevent cancer from ever developing. Wow!

As I mentioned, we FINALLY let Dr. Rob Denell enjoy his retirement. He was scheduled to retire last spring, but because of delays in finding his replacement, he graciously stayed until the end of October. We enjoyed a big party at the Alumni Center and were able to reminisce about his career, which we discuss on Page 9. Rob has played an important role in the development of the center. When he started, the center funded just over \$80,000 in research and training. That has increased by over 620 percent! Rob transformed the management and organization of the center as well. I could go on, but suffice it to say all are thankful for his devotion and leadership for the past 13 years.

Lastly, I want to thank everyone who has helped fulfill the Johnson Cancer Research Center's mission. We were able to provide half a million dollars in research support to faculty and students in 2016. As interim director, I see things that I didn't before; I am even more amazed at the generosity and devotion of our supporters. Not only do people give financial support, many friends contribute time and effort! I invite you to visit the center. We have so many inspiring individuals associated with us — many brilliant minds, ideas and possible cures. We hope you will continue to help K-State fight cancer.

S. Keith Chapes / Interim Director

Breaking barriers

Chemistry professor reduces toxicity of cancer treatments

By Tiffany Roney

Ryan Rafferty is smuggling drugs across a border to kill cancer cells in both brain and blood cancers.

Rafferty, assistant professor of chemistry at Kansas State University, is studying how to best penetrate the blood-brain barrier with cancer treatments. His goal is to deliver treatments to the site of brain tumors without affecting healthy cells in other parts of the body or hindering a patient's quality of life.

"The key is to deliver drugs to the brain and figure out how to mask the drugs so they can penetrate the blood-brain barrier," Rafferty said.

Rafferty is studying how to impart rigidity to cancer drugs so they can cross the barrier faster and, when flowing out of the brain, can penetrate rapidly to allow a greater therapeutic window for them to work against cancers.

He thinks that divergent total synthesis, which is a process of crafting molecules from complex intermediates accessed within total synthesis routes, could be used to create complex anticancer agents. He aims to create these synthetic molecules in large batches so other researchers can test them for therapeutic applications regarding cancer and other diseases.

Additionally, Rafferty is investigating why certain anticancer agents are toxic to healthy cells and how to modify the treatments to reduce toxicity while maintaining their therapeutic value.

Because of two Innovative Research Awards from the Johnson Cancer Research Center, Rafferty has studied the toxicity of

the leukemia drug 6-thiopurine. He has found that if a certain molecular position on the drug is blocked, toxicity drops while retaining therapeutic efficacy.

"Previously, this had not been determined, so this is a major finding about the toxicity roles of this molecule," Rafferty said. "This finding has real results for cancer patients' quality of life."

Rafferty is developing two new classes of anticancer agents that especially target lung and prostate cancers, as well as skin cancers and leukemias.

"We're starting to build up an arsenal of small molecules that we can use to create different types of therapies, which is really exciting," Rafferty said.

In addition to the Innovative Research Awards, two equipment awards from the Johnson Cancer Research Center have been instrumental in moving Rafferty's research forward.

The first equipment award allowed his laboratory to purchase a refractive index detector and fraction collector. Without these instruments, he had to analyze one sample at a time. With the instruments, he can examine up to 15 different samples at once, which greatly enhances and accelerates the drug discovery process.

The second award allowed him to purchase a liquid handling plate transfer system that automates the transfer of substances from one plate to another with high accuracy. This saves hours of student work and hundreds of pipettes, and it allows for rapid screening of compounds against numerous cancer cell lines and therapeutic agents.

Rafferty mentors two undergraduate students who have Cancer Research Awards from the center, five graduate students and four other undergraduates. He says having undergraduates in the lab is key to his research.

"When they make molecules that have never been made before, the look of wonderment and excitement on their faces rubs off on everyone else in the lab," Rafferty said. "When undergrads show me their end model like it's the most prized possession in the world, I realize that's why we do this; we want this wonderment."



\$72,217 supported graduate students who will lead the next generation of cancer research.

\$63,268 supported laboratory equipment purchases in 2016 — but hundreds of thousands of dollars are needed.



We invest up to **\$100,000** a year to train 50 undergraduates to do scientific research.

Protein power

Undergrad plays key role in early cancer detection research

By Tiffany Roney

Because of two awards from the Johnson Cancer Research Center and an honorable mention for the Barry M. Goldwater Scholarship, a Kansas State University student is playing an important role in early cancer detection research.

Raquel Ortega, senior in chemistry, narrowed her broad scientific interests to focus on cancer research after becoming involved in the laboratory of Stefan Bossmann, professor of chemistry, through the Developing Scholars program.

According to a wealth of cancer literature, certain proteins like proteases and cytokines are known to be overexpressed in cancers. On that basis, Bossmann and Ortega have worked on a blood test examining the levels of those proteins that can be used to diagnose cancer at earlier stages and predict the course and outcome of the cancer throughout treatment.

“Raquel has greatly improved the yields and purities of peptide sequences for protease and cytokine detection,” Bossmann said. “She is a diligent worker and very good in identifying and solving problems in synthesis and characterization of diagnostic peptide sequences and nanobiosensors for these proteins.”

The protein-detecting test is simple, affordable and could be done anytime a patient visits a hospital for a checkup. It could increase the amount of therapy options, maximize the patient’s chances of survival and hopefully decrease long-term effects of treatment.

The test also could be used in preventative care and in checkups for patients whose cancer is in remission. After a tumor is removed or a treatment is administered, the levels of proteins should decrease. If they don’t, the doctor can

use knowledge about the protein levels to adjust treatment options, Ortega said.

The diagnostic test is currently being tested in a clinical trial in China and experiencing a 95 percent accuracy rate.

“Stage zero cancer is a much better time to be diagnosed than any other stage, so if doctors can use these tests, they could potentially save many more people,” Ortega said.

She saw firsthand the value of early cancer detection on patients’ quality of life during summer 2016 when she participated in St. Jude’s Pediatric Oncology Education program, where she shadowed physicians and conducted research.

“I don’t think there’s anywhere else where you can find such a strong collaboration between

patient care and ongoing research,” Ortega said. “It was an incredible experience.”

Ortega would not have applied for the St. Jude internship if it weren’t for the awards from the Johnson Cancer Research Center and the Goldwater honorable mention. Ortega says those acknowledgements helped increase her confidence and paved the way for future opportunities.

“When I started doing research, I saw the mistakes I was making and felt like the process went slow for me, so I didn’t have confidence in myself,” Ortega said. “When I received those awards, I realized my research was being noticed and my work was paying off. Those awards showed me I was making a difference, deepened my interest in the research and helped mold my path.”



\$2,883,657 has been invested in promising cancer studies since 2003 — but \$4,802,256 was requested.

Stonestreet's gift boosts K-State chemists' new cancer detection technology

By Marcia Locke

Emmy Award-winning actor and Kansas State University alumnus Eric Stonestreet '96, of the hit television series "Modern Family" and the film "Secret Life of Pets," has donated \$50,000 to the Johnson Cancer Research Center to support a promising research project.

"Cancer research is near and dear to my heart because, like so many others, it's touched my life," said Stonestreet, referring to his mother's and other family members' battles with the disease.

Stonestreet's gift was immediately used to advance collaborative research being done by two chemistry professors to develop a technology to detect breast, prostate and other cancers at their earliest stages, when they are more likely to be curable.

With Stonestreet's gift, Stefan Bossmann, professor of chemistry and expert in nanobiosensor technology, and Christopher Culbertson, associate professor of chemistry and expert in microfluidic — also known as "lab-on-a-chip" — technology, will create a working prototype of their cancer-detection device.

"Thanks to Mr. Stonestreet's support, we will be able to better compete for federal funding so that we can test our device with clinical samples," Culbertson said.

"Stefan and I have each been working independently for over a decade on approaches for the diagnosis of a variety of diseases," Culbertson said. "We recently have combined our efforts to create a potentially transformative technology for early diagnosis of cancer."

Detecting cancer at its earliest stage can mean a better prognosis for the patient and less expensive treatment options.

Culbertson and Bossmann's point-of-care device can automatically — within seconds — process samples of blood, urine or other bodily fluids to isolate biomarkers that can be detected using an array of nanobiosensors developed by Bossmann.

Bossmann's nanobiosensor array is powerful because no single biological marker for cancer is different enough from its normal concentration in the body to make an accurate diagnosis. However,

the combination of several markers slightly out of their normal ranges can be detected using statistical methods to give a robust diagnosis.

Culbertson's lab has developed the technology to package these nanobiosensors into a small, inexpensive and partially disposable microfluidic platform for analysis, which can also be integrated with a smartphone.

"We envision that such a device could be used in a physician's office during annual checkups to diagnose a variety of cancers in their earliest stages," Culbertson said.

"We're so grateful for Mr. Stonestreet's generous gift," said Rob Denell, director emeritus of the Johnson Cancer Research Center and university distinguished professor of biology. "Gifts like this can really propel early, promising work toward the ultimate goal of conquering cancer."

"It's an exciting time in cancer research and I'm proud to be able to contribute in some way to the good work being done at the Johnson Cancer Research Center at K-State," said Stonestreet, who won the Emmy Award for outstanding supporting actor in a comedy series in 2010 and 2012. "I encourage all K-Staters to take a look at the research being conducted at K-State to help make cancer more detectable, more treatable and more survivable, and to support this important work however you can."

Join the fight

4th annual K-State Fighting for a Cure Day
Oct. 14



Show your pride in Kansas State University cancer research with a Fighting for a Cure shirt, and wear it to the home football game or anywhere Oct. 14, 2017, for the fourth annual

K-State Fighting for a Cure Day. We also invite you to cheer on the 'Cats with us that day at our Tailgate Party in Cat Town.

Join K-State Football's first lady Sharon Snyder and family, President Richard Myers, former K-State and Kansas City Chiefs football player Kevin Lockett, "Modern Family" actor and K-State alumnus Eric Stonestreet, K-State Marching Band Director Frank Tracz and many others in celebrating the university's fight against cancer and honoring its cancer survivors and researchers with a Fighting for a Cure shirt.

The shirts are purple with a white Powercat and the phrase "Fighting ever fighting for a cure," inspired by the K-State fight song, "Wildcat Victory." They are available from the Johnson Cancer Research Center for \$20 each in men's, ladies' and youth sizes.

Shirt sales have raised \$20,000 for K-State cancer research and education so far!

Information and online purchasing, as well as photos of K-State celebrities and other friends wearing the shirt, are available at cancer.k-state.edu. Orders can also be made by phone at 785-532-6705.

#HelpKStateFightCancer



Meaning in minutes

Biology professor addresses cancer-causing viruses

By Tiffany Roney

For Kansas State University cancer researcher Nick Wallace, eight years of work matter because of what happens every two to three minutes.

According to Wallace, assistant professor of biology, someone dies from HPV-caused cancer every two to three minutes, which motivates him to fight cancer.

"If I think of what I do in a two- to three-minute period, it's hard to convince myself there's anything more important to do in that time span than find a better way to treat those diseases," Wallace said.

Wallace is studying HPV, or human papillomavirus, biology to improve therapies and preventative methods for it and HPV-caused cancers, which affect the head, neck, genitals and skin.

Wallace's work suggests that nonsexually transmitted HPV in the skin worsens the effects of sunburns. Additionally, researchers are learning that sexually transmitted HPVs that cause cancer stop the body from repairing damaged DNA.

The latter finding is especially important because many of the cancer drugs that target DNA pathways are not often used on HPV-caused cancers, according to Wallace. He said this finding may reduce the side effects people experience from cancer treatment.

Wallace has received funding from the Kansas IDeA Network of Biomedical Research Excellence and the Johnson Cancer Research Center.

Wallace said he is especially impressed with the center's unique relationship with the community, which is apparent through the center's outreach events and the support it receives from donors and event participants.

"The way the center reaches out and the community responds is fantastic," Wallace said.

Much of his research is made possible through a surprise donation. Wallace received an email from the cancer research center in 2015 inviting him to come over and explain how he would spend a direct gift if it were awarded to him. The potential donors were Les and Virginia Clow, a couple whose family has faced cancer.

"From getting the email and giving the pitch, I had about a half-hour — the biggest, craziest half-hour of my life," Wallace said. "I was texting my wife and friends about how great of an opportunity this was while preparing a pitch for a large gift that could have a huge effect on my work."

That afternoon, he pitched his hypothesis. A few months later, the Clows selected Wallace. The gift has allowed him to hire a research assistant and a postdoctoral fellow for two years.

"Scientists in other places can hardly believe there's a university where private donations come in and change your lab like this," Wallace said. "That's one of the awesome things about K-State."

Wallace initially became excited about doing research because of the opportunity to join a lab as an undergraduate, so he is eager to provide research opportunities to the next generation of undergraduates.

Because of funding from the Johnson Cancer Research Center, Wallace employs two undergraduate Cancer Research Awardees to study another cancer-related disease: Merkel Cell Polyomavirus, a viral pathogen that causes a rare but deadly skin cancer.

"K-State has such talented students and they're a wonderful resource for me," Wallace said. "For them, it's an opportunity to apply their classroom learning to benefit people they'll never meet. That's life-changing. It couldn't be more important."

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

Expert on cancer-preventive HPV vaccine delivers 15th Bascom Lecture

By Marcia Locke

A human papillomavirus, or HPV, expert involved in developing diagnostic tests and vaccines for the condition spoke at Kansas State University as part of the Johnson Cancer Research Center's George S. Bascom Memorial Lecture Series on Current Issues in Clinical Medicine.

Michael Hagensee, M.D., Ph.D., presented "HPV vaccination: from laboratory to...bedside?" on Nov. 3 to a large audience of students, faculty and other Manhattan community members, in the K-State Student Union Little Theatre.

Hagensee is a professor in the department of medicine's section of infectious disease at Louisiana State University Health Sciences Center, where he is also vice chair of research. He is an expert in the human body's immune response to HPV, the virus that causes most cervical cancers as well as some anal, oral and other cancers.

Hagensee is developing an HPV-detection home test and ways to improve HPV vaccination. He also is studying a potential interaction between Epstein-Barr Virus and HPV in the development of cervical and anal cancers. In his clinical work, Hagensee focuses on the care of HIV-positive individuals and on prevention of both cervical and anal cancers in this population.

Hagensee received both his doctoral degree in cell biology and his medical degree from Baylor College School of Medicine in 1986 and 1988, respectively. He did his medical residency and postdoctoral research, and was an instructor, at University of Washington Affiliated Hospitals in Seattle before going to Louisiana in 1996.

For the Bascom Lecture, Hagensee explained how HPV causes cancer and discussed the historical development of today's HPV vaccines, from laboratory to clinical application. He described the problems with — and possible solutions to — the low HPV vaccination rates, claiming that cervical cancer is now preventable, if only people would get vaccinated. He also looked at the ongoing issues with HPV-related diseases in the vaccine era.



The Bascom Lecture Series, initiated in 1996, brings distinguished experts to Kansas State University to present to faculty, students, medical providers and the general public about challenges faced in clinical medicine and research.

The series was named in honor of the late George S. Bascom, a revered Manhattan surgeon, community leader and poet who served on the Johnson Cancer Research Center's first advisory council. Bascom died of cancer in 1993, and in 1996 a group of donors established a fund for the lecture series in his honor.

Past Bascom Lecture speakers have included top university, industry and government researchers and medical practitioners. The lectures have covered topics such as cancer causes, prevention and therapies, as well as research ethics, clinical trials and the future of cancer research.

Presentations, tours, educational events and information are provided to raise awareness of cancer, risk reduction and research.

Statewide Walk Kansas program sponsors 5K for the Fight

By Marcia Locke

The health initiative known as Walk Kansas motivates thousands of Kansans to improve their health each year by getting more physically active and eating more fruits and vegetables. On May 7, 2016, the program, coordinated by K-State Research and Extension, also offered an event to support Kansas State University cancer research.

The inaugural Walk Kansas 5K for the Fight, on K-State's beautiful Manhattan campus, added a little extra fun and motivation to the usual Walk Kansas program while also raising funds for the Johnson Cancer Research Center.

The partnership is very fitting since exercise, good nutrition and maintaining a healthy weight all reduce cancer risk.

Walk Kansas is an eight-week program in which participants, organized in teams of six and representing most counties of the state, figuratively walk 423 miles — which is roughly the distance across the state. The Walk Kansas 5K for the Fight was the program's first event to bring all its participants together for fun, fitness and a good cause.

Nearly 100 people — some of them Walk Kansas participants, some not — took part in the 5K run/walk and the 1.5-mile fun



Team Hartley, partially pictured here, ran in memory of their father/father-in-law/grandfather, J. Herbert Hartley, a K-State alumnus who passed away in June 2015 from stomach cancer.

walk. Participants ranged in age from 1 to 78 years old and traveled as far as 260 miles. Planned in only a few months, the event raised \$1,025 and immeasurable awareness for K-State cancer research.

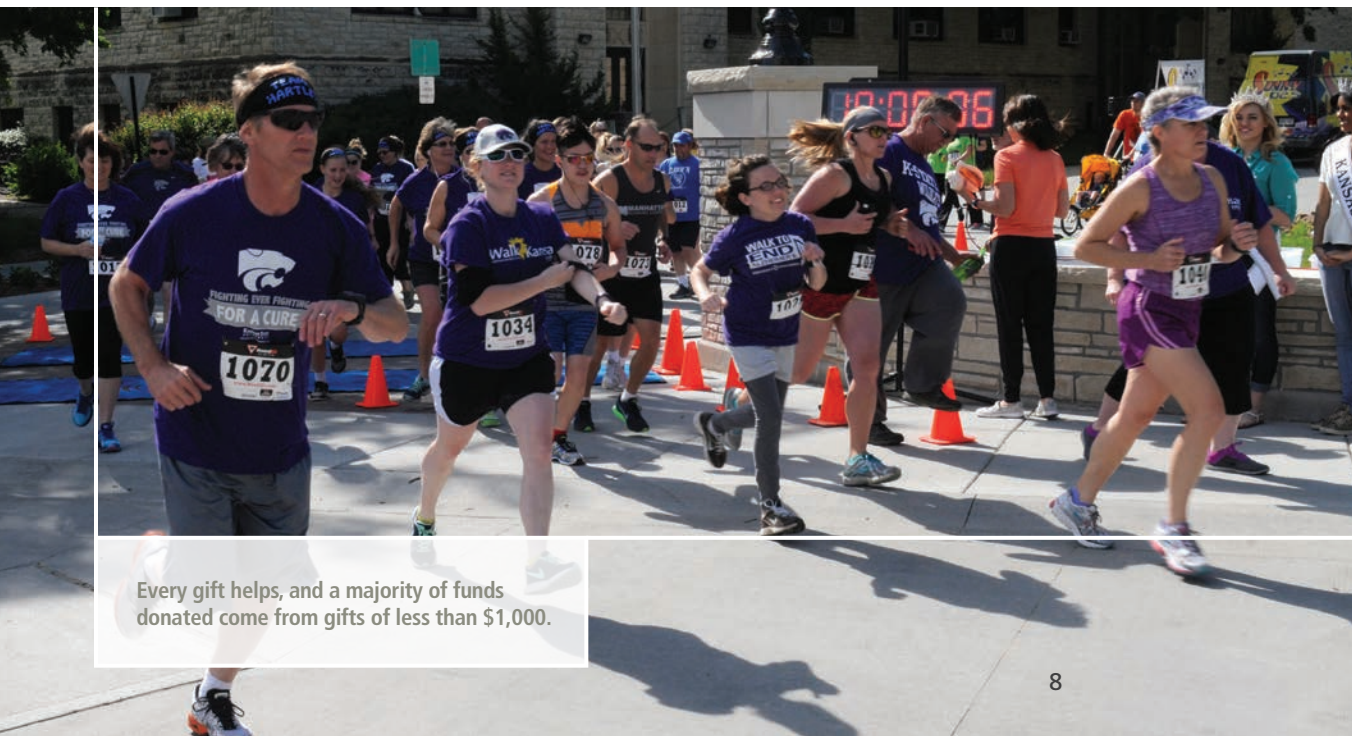
The 5K, timed by the Manhattan Cross Country Club using the IPICO chip timing system, started at the Johnson Cancer Research Center in Chalmers Hall and looped around Bill Snyder Family Stadium. The three fastest males and females in each age category received medals.

All participants received snacks and souvenir water bottles. The Johnson Cancer Research Center also awarded K-State Fighting for a Cure T-shirts to the couple who drove the farthest, 267 miles from Garden City.

Adding to the fun atmosphere were music and emcee services donated by Sunny 102.5 FM radio and personality John Anderson. Miss Kansas Racya Doyle and Miss Teen Kansas Elissa Bergmeier also were present to cheer on participants. Not to mention, the weather was beautiful.

A special aspect of the event was that it honored the memories of Ann Religa, Harvey County Extension 4-H agent, Newton, and Rod Buchele, Southwest Area Extension 4-H specialist, Garden City, revered community members who lost their lives to cancer in 2015. Members of their families were in attendance to show their support.

The next Walk Kansas 5K for the Fight is set for May 6, 2017, and will include a kids' fun run. Information and online registration, as well as 2016 results and photos, are available on the Johnson Cancer Research Center's website, cancer.k-state.edu.



Every gift helps, and a majority of funds donated come from gifts of less than \$1,000.

Well-served: A look back at the career of Rob Denell

By Marcia Locke

The Johnson Cancer Research Center's second director, Rob Denell, university distinguished professor of biology, retired from Kansas State University Oct. 31, 2016, after 43 years, including 13 years as director of the center.

Denell was hired as the Johnson Cancer Research Center's director in spring 2003. He succeeded the center's founding director and namesake, Terry C. Johnson, who died of liver cancer in fall 2002 — just as the center was moving into Chalmers Hall, the brand-new building Johnson had helped make a reality.

Fresh out of grueling cancer treatment himself, Denell was especially drawn to the director position and to the opportunity for his next step in life to be significant in the fight against cancer. Having been a research affiliate of the center since its beginning, he was familiar with its strengths and weaknesses.

An easy-going guy adept at seeing the big picture, the new cancer research center director went to work building relationships with the center's staff and advisory council members, some of whom worked with him to devise an official vision and mission for the center.

Denell also formalized and streamlined the center's award funding process, creating distinct faculty and student awards with deadlines and applications, which would be judged by a committee of center-affiliated faculty.

The reenergized center was soon growing its faculty and endowment. The number of cancer research faculty members increased from around 40 in a few departments to 100 in 20 departments. The center's research and education funding capacity quickly grew to its current average of half a million dollars a year.

Not bad for a guy who was still visiting his oncologist in Nebraska several times a year.

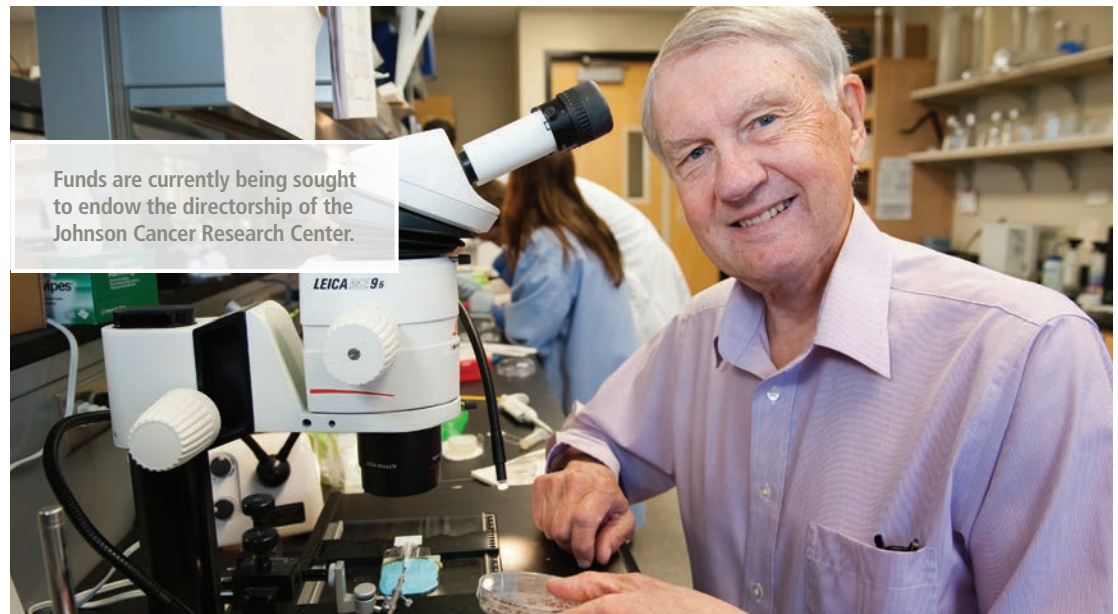
Denell was diagnosed with nasopharyngeal cancer in 2001. A biopsy for a lump in his neck led to the discovery of cancer on the left side of his face above the oral cavity. He temporarily quit working and he and his wife Mardi, a 10-year breast cancer survivor herself, lived in Nebraska for nine months while he underwent rigorous and debilitating radiation and chemotherapy.

Yet Denell persevered, even with his newfound deafness, malfunctioning salivary glands, low blood pressure, dizziness, numb fingertips and other challenges. He returned to the lab, directed the cancer research center and even played golf again, never complaining because, as he said, "Treatment was worth it."

Having grandchildren probably helped, too. While director of the center, Denell went from having one granddaughter to having three. And with his family living fairly close by in Kansas and Missouri, he was able to enjoy their company regularly.

During his research career, Denell conducted genetic, developmental and molecular studies on insects, focusing on the genetic control of early embryonic organization. The genes he studied in fruit flies and red flour beetles are also found in humans and have been implicated in the origins of some cancers.

Denell received many grants and honors throughout his years at K-State. Hired as an assistant professor by the Division of Biology in 1973, he rose through the ranks to full professor by 1983, and earned K-State's highest faculty ranking of distinguished professor in 2000. He received more than \$12 million in funding for his research and was a fellow of the American Association for the Advancement of Science, a Conoco distinguished graduate faculty member and a Dolph Simons Higuchi Research Achievement Award recipient.



In addition to teaching many classes, Denell mentored 15 postdoctoral fellows, four graduate students and several undergraduate students. He also published almost 100 papers, which have been cited thousands of times. On top of all that, he stayed active in the faculty basketball league in the '70s and '80s.

Denell earned his Bachelor of Arts in zoology from the University of California, Riverside in 1965, and his master's and doctoral degrees in genetics at the University of Texas, Austin in 1968 and 1969. He was a postdoctoral fellow at the University of California, San Diego and a Ford Foundation research fellow at the University of Edinburgh in Scotland before coming to K-State.

Although officially retired, Denell is still helping the center through this transitional period as it embarks on a new strategic plan, with S. Keith Chapes serving as interim director. Denell also spends time at his and Mardi's soon-to-be-permanent home in Kansas City, closer to their family.

Denell leaves the Johnson Cancer Research Center well poised to take an even greater role in conquering cancer in our time.

Cancer Research Departments

College of Arts and Sciences

Biochemistry and Molecular Biophysics
Biology
Chemistry
Mathematics
Physics
Statistics

College of Agriculture

Entomology
Grain Science and Industry
Horticulture
Plant Pathology

College of Engineering

Biological and Agricultural Engineering
Chemical Engineering
Electrical and Computer Engineering
Engineering Extension
Industrial and Manufacturing Systems Engineering
Mechanical and Nuclear Engineering

College of Human Ecology

Apparel, Textiles, and Interior Design
Food, Nutrition, Dietetics and Health
Kinesiology

College of Veterinary Medicine

Anatomy and Physiology
Clinical Sciences
Diagnostic Medicine/Pathobiology
Nanotechnology Innovation Center
Veterinary Diagnostic Laboratory

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