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# From Bangalore to bovine

How pathogens and playoffs bind two lifelong friends



**V**eterinary school in India brought them together, research and teaching brought them to Kansas, and a passion for football brings them even closer.

M.M. Chengappa and T.G. Nagaraja are best friends who met more than 40 years ago in India. They're both diplomats of the American College of Veterinary Microbiologists and university distinguished professors of microbiology in the department of diagnostic medicine and pathobiology at Kansas State University's College of Veterinary Medicine.

They work together to develop patents and collaborate on research projects, and they attend Kansas State football games together on weekends. Their most prominent collaboration includes development of a vaccine that could save cattle producers millions of dollars every year.

**"I would say our friendship comes first, and our professional relationship as collaborators and researchers comes second," Nagaraja said.**

## A promising patent

As researchers, the two together, with the help of graduate students, developed a vaccine that could save Kansas beef producers millions of dollars every year. The vaccine, for which they received a patent, prevents liver abscesses in cattle — a problem that affects 20 percent to 40 percent of high grain-fed feedlot cattle in the United States.

In cattle that are fed grain, microorganisms in the rumen — the first compartment of the complex stomach of cattle — digest the grain and produce acid. Excessive acidity damages the lining of the stomach wall, and bacteria from the stomach pass through the wall, end up in the bloodstream, and eventually get trapped in the liver to cause abscesses.

Animals that have abscessed livers don't

perform as well as cattle with healthy livers because they eat less and gain less weight.

The patent would save up to \$65 dollars per head by eliminating liver condemnation and alleviating the negative impact on productivity of cattle that have this disease. It would only be given once instead of the current daily doses of antibiotics that are mixed in feed, which can lead to bacterial resistance.

Chengappa and Nagaraja hope their vaccine will become commercially successful. More than 20 years of collaborative research at the College of Veterinary Medicine made the vaccine possible. Together, they have five U.S. patents on this subject.

**"Research is like a puzzle that you try to solve," Nagaraja said. "When you try to find an answer to one question, you actually raise more questions that lead to more experiments and testing."**

## Safe food for all

The studies on microorganisms in the gastrointestinal tract of cattle led Kansas State University researchers to further study food-borne pathogens in cattle like *E. coli* O157:H7.

"Some of our primary research interests are to study and understand the pathogenesis of important infectious diseases of animals, particularly cattle, and to develop strategies to protect animals from these diseases," Chengappa said.

A small minority of cattle carries *E. coli* O157:H7 in the gastrointestinal tract by the time they go to slaughter. The organism causes no problems in the cattle, but it does get on their hides, the major source of *E. coli* in beef carcasses at the time of slaughter.

"To me, *E. coli* O157 is an important food-borne pathogen because it affects thousands of people every year, sometimes

fatally," Nagaraja said. "Children are particularly vulnerable. Many children who are exposed to it develop kidney failure and complications, forcing them to be on dialysis for the rest of their lives."

Nagaraja contributed to a finding that cattle fed a diet that includes the by-product distiller's grain have higher levels of *E. coli* O157. After starch from corn is removed to make ethanol, distiller's grain is left, which is a valuable feed commodity for cattle.

## The beginning

Chengappa and Nagaraja first met in veterinary school in Bangalore, India, in 1965. They both attended veterinary school after deciding not to become medical doctors. Their friendship blossomed five years later when they began their graduate programs in veterinary microbiology.

"If I had gone to medical school, I would be practicing in India and would have never bothered to come to the United States," Chengappa said. "Coming here opened up so many opportunities for me."

After earning degrees in India, their professors encouraged them to continue their research in America. Nagaraja earned a doctorate in microbiology from Kansas State University, where he stayed after graduation as a faculty member.

"My original plan was to go back to India after earning my doctorate, but that soon changed," he said. "Once I adapted and discovered the facilities, opportunities and support here at Kansas State, I knew this would be the ideal place to continue my research."

Chengappa, meanwhile, earned a doctorate from Michigan State University and became an associate professor and head of the department of microbiology at Murray State University in Kentucky.

The friends kept in touch and saw each other at conferences and scientific meetings. They finally reunited for good in 1988 when Chengappa accepted a position at Kansas State University.



### A strong friendship

Chengappa and Nagaraja's friendship goes beyond the lecture halls and laboratories inside the College of Veterinary Medicine. They tailgate outside of Bill Snyder Football Stadium before cheering on the Wildcats on Saturdays during the fall. They watch the Super Bowl together every year, travel to India together on occasion, and their families celebrate Christmas and Thanksgiving together.

Trust and mutual respect, they say, keep their friendship strong.

"I can't explain it, but we have worked together for decades and never had any difficulty, no red-hot arguments," Nagaraja said. "Sure, we disagree on a lot of issues, but we just agree to disagree and don't dwell on too many negatives."

Their friendship also unites their families.

"Since we don't have other family members here in the United States, we've become like each other's family in a way," Chengappa said. "I would do anything for T.G.'s family, and I know he would do the same for my family."

Research and teaching, however, continue to bring them together.

"Kansas State University is the ideal place to do animal research, particularly on beef cattle with so many resources and so much expertise available here," Nagaraja said. "There is no better place with this kind of support, interest and expertise, and our research in a small way has a direct impact on the Kansas economy."

