How Fallon families joined with University researchers to search for the cause of a deadly cancer cluster

By Melanie Robbins '06M.A.

Jeff Braccini stared at the Centers for Disease Control report that showed his 3-year-old son had concentrations of heavy metals and pesticide in his body far above safe levels. At first, he choked. Then he started raising community awareness.

Braccini’s son, Jeremy, was the 15th Fallon, Nev., child to be stricken with leukemia since 1997, in a cancer cluster that hit so hard and so fast it caught townspeople by surprise. Knocked the wind out of them, so to speak. The small town known for its international rodeo, Hearts O’ Gold cantaloupes and Navy Top Gun pilot training school had never experienced anything so deadly and so swift. The number of cases of childhood leukemia that occurred in the city within the next few years was so unusual that it could have happened by chance only once in 22,000 years.

Between 1997 and 2002, 16 children who either currently lived in Fallon or had previously lived there came down with acute lymphocytic leukemia and one additional child got sick with another form of cancer, acute myelogenous leukemia. Three of them have died of their disease. In 2004 a 17th child developed leukemia. No child living in Churchill County since 2004 has been diagnosed with leukemia.

Braccini, a 24-year retired Navy veteran now working for Boeing Aerospace as a Top Gun contractor, remembers every detail of the day his oldest son was diagnosed in December 2001.

“It was on a Friday, the start of the Christmas holiday, and he had had a couple of bruises that wouldn’t go away. He also had a cold that kept hanging on, so I took him to his pediatrician. She ordered some blood tests. I took Jeremy to Dairy Queen and left him with his mother. When I got back home, it was three o’clock in the afternoon. The hospital called and said they thought he had cancer.”

The nurse advised Braccini to get Jeremy to the airport immediately and medi-flight him to University of California, Davis Oncology.

“‘What do you mean?’ I said. ‘Take him where!’” “I basically started crying,” Braccini remembers.

Braccini grabbed his son and within 45 minutes had him at the Fallon Municipal Airport and on their way to Sacramento. From there, they took an ambulance to a pediatric oncology ward where Jeremy underwent blood transfusions that night. The little blond-haired, green-eyed boy’s temperature spiked to 108 degrees F.

“The Code Blue went off,” Braccini says. “I was standing back and freaking out.”

A COMPLICATED OASIS

Fallon, the county seat and only urban area in Churchill County, lies about an hour’s drive east of Reno on U.S. 50, the Loneliest Road in America. The next town eastward is Austin, 110 miles away. In 2000, the U.S Census Bureau reported that Fallon had a population of 7,536, which the Nevada State Demographer’s office estimates rose to 8,339 by 2005.

Many residents of Fallon have roots that go back to the turn of the 20th century when the newly formed U.S. Reclamation Service provided the town with irrigation waters diverted from the Truckee River, causing a settlement boom and the incorporation of Fallon in 1908. The newcomers made the town an agricultural oasis amidst the high desert, planting alfalfa for their dairy cows, corn and cantaloupes, and raising horses. Located in the Lahontan Valley, groundwater is the only source of drinking water and many residents have wells tapping into an aquifer.

However, the area’s water was known to have exceeded federal standards for arsenic for years, according to an expert panel consisting of the state health officer, the director of the state health laboratory, the state epidemiologist, and other epidemiological, pediatric and cancer experts from across the country. The group was empaneled to look into the Fallon cluster in conjunction with the CDC. In fact, the town’s municipal water had the highest levels of arsenic in the nation at 100 parts per billion, and some domestic wells had levels as high as 683 parts per billion, according to samples taken.

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On the day that Jeff Braccini of Fallon received the news that his son, Jeremy, was the close-knit rural Nevada community’s 16th child to be diagnosed with leukemia, he felt as if the wind had been knocked out of him. Today, Braccini’s emotions are much more positive; Jeremy’s health is good and more than $700,000 in research funding has been made available through the work of U.S. Sen. Harry Reid to find the reasons behind the cluster.

Photo by Theresa Danna-Douglas
University partners with community to win $700,000 grant

**NEVADA**
**WHO:** Chris Pritsos, biochemist and chair of the Department of Nutrition; Lisbeth Welniak, research assistant professor of animal biotechnology and a hematology expert; Ralph Seiler '99Ph.D, U. S. Geological Survey hydrologist
**WHERE:** University of Nevada, Reno
**RESEARCH:** Examining the biological impact of ingesting elements such as arsenic, tungsten and polonium 210 found in the Fallon drinking water.

**ARIZONA**
**WHO:** Mark Witten, a research professor in the Department of Pediatrics
**WHERE:** University of Arizona
**RESEARCH:** Examining the role of tungsten, molybdenum and cobalt in the leukemic process, as well as looking into the role genetic variations play in developing cancer.

**CALIFORNIA**
**WHO:** Joseph Wiemels, a clinical researcher in the Division of Cancer Epidemiology
**WHERE:** University of California, San Francisco
**RESEARCH:** Studying leukemia cells to see if they harbor a common viral or chemical signature; comparing Fallon environmental data to data from similar towns.

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**Glossary**

**Acute Lymphocytic Leukemia (ALL)** is a type of cancer of the blood and bone marrow — the spongy tissue inside bones where blood cells are made. It’s called acute leukemia because it progresses rapidly and affects immature blood cells, rather than mature ones. The disease is identified as lymphocytic leukemia because it affects a group of white blood cells called lymphocytes, which normally fight infection. It worsens quickly if not treated, but it usually responds well to treatment. Acute lymphocytic leukemia is also known as acute lymphoblastic leukemia and acute childhood leukemia. About 4,000 new cases of ALL are diagnosed each year in the United States. It is the most common type of cancer in children, it also occurs in adults.

Source: MayoClinic.com and leukemia & lymphoma Society

**Arsenic** is a naturally occurring element widely distributed in the earth’s crust. It occurs naturally in soil and minerals and may therefore enter the air, water, and land from wind-blown dust and get into water from runoff and leaching. Arsenic cannot be destroyed in the environment. It can only change its form. Rain and snow remove arsenic dust particles from the air. Many common arsenic compounds can dissolve in water. Most of the arsenic in water will ultimately end up in soil or sediment.

Exposure to higher than average levels of arsenic occurs mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. At high levels, inorganic arsenic can cause death. Exposure to lower levels for a long time can cause a discoloration of the skin and the appearance of small corns or warts.

Source: U.S. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry

**Tungsten** is a naturally occurring element. Tungsten is used in products such as x-ray tubes, light bulbs, high-speed tools, welding electrodes, turbine blades, golf clubs and bullets. Occupational exposure to higher than background levels of tungsten may occur if you use tungsten metal or are engaged in the machining of these metals. Occupational exposure to tungsten carbide occurs during the machining of tungsten carbide tools in the manufacturing process. Tungsten has not been classified for carcinogenic effects by the government agencies.

Source: U.S. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry

**Polonium 210** is a radioactive material that occurs naturally at very low concentrations.

By mass, polonium is around 5 million times more toxic than hydrogen cyanide. Even in microgram amounts, handling polonium 210 is extremely dangerous, requiring specialized equipment and strict handling procedures.

The Russian spy Alexander Litvinenko was murdered in 2006 by a lethal dose of polonium 210. Polonium 210 is widely used in industry and readily available with little regulation or restriction.

Source: Health Protection Agency, United Kingdom, and Wikipedia

**F.I.S.T.** - Families in Search of Truth is a Fallon cancer cluster support and nonprofit, advocacy group.
by investigators. The Environmental Protection Agency’s maximum contaminant level for arsenic is now just 10 parts per billion, which is down from 50 parts per billion prior to 2006. In Fallon’s defense, the type of arsenic in the city’s water was believed for many years to be a non-toxic form of the chemical. However, it is known now that all arsenic is toxic.

After the CDC tested the Braccini family along with other families with sick children and found levels of arsenic in Jeremy’s urine of 130.9 parts per billion, almost three times the limit then set by the government, Jeff Braccini got fighting mad.

“That’s what set me off,” he says, noting that his son’s levels of other toxic metals and pesticides also exceeded safe limits. Cobalt, uranium, molybdenum and tungsten, a substance the CDC warned Fallon residents to avoid, but for which there is no established safe or unsafe levels, as well as the pesticides diazinon and parathion, were all in Jeremy’s 3-year-old body at levels that astounded his father.

“Jeremy had levels of tungsten in his body that were 40 times higher than the 95th percentile across the United States,” Braccini says, explaining that of all adults in the country, only five percent had even 0.48 parts per million tungsten showing up in their urine while Jeremy had 19.48 ppm. And Jeremy’s levels of uranium were almost 30 times higher than the 95th percentile.

“How does a 3-year-old child get this much toxicity in his system?” he wonders aloud, noting that the comparison levels are based on what is expected in an adult, with many years of exposure. Children’s levels ought to be much lower. Another consideration: Jeremy stayed every other week with his father ever since his parents separated when he was 10 months old. At his father’s house Jeremy had been drinking only water treated by reverse osmosis, which removes about 80 percent of toxins. On alternate weeks, his mother was giving him bottled water to drink, but she continued to cook with tap water.

As the CDC results came in, speculation about what caused the cancer cluster ran rampant through the town. “There were theories and there were conspiracy theories,” Braccini notes. Among the top contenders: A jet-fuel pipeline that runs through the center of Nevada Wolf Pack Fans Find Holiday Fashions At Michael & Son’s. They are among the master craftsmen at Michael & Son’s. They create dazzling Wolf Pack jewelry and gifts for the whole family.

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town; naturally occurring uranium found in well water along with polonium 210, another radioactive metal; viruses brought in by the thousands of outsiders attending the Naval Air Station's carrier air group training — the so-called “population mixing” factor; an unlined, pesticide container dumpsite north of town; heavy metals and toxins in the air and water; a tungsten refinery in town; and errant genes.

Many likely suspects, but no known culprits. Not even arsenic, a known carcinogen, can be named responsible for the cluster because both sick and well children, as well as the rest of Fallon residents, had been drinking water with too much arsenic for years, and the cluster itself didn’t start until 1997.

At first, Braccini didn’t care what caused the cancer. “All I cared about was the cure.”

Seeking support, he joined Families in Search of Truth, also known as FIST, a Fallon cancer cluster support group, and there met Patty Wadsworth, whose niece had been diagnosed with cancer. The group had formed in 2000, and by 2001 it was very strong but only as support. When Braccini’s son became the 16th victim, Wadsworth, Brenda Gross, also a FIST member, and Braccini worked with Trust For America’s Health, a Washington D.C.-based nonprofit organization dedicated to making disease prevention a national priority, to expand the scope of FIST with the goal of seeking sound, scientific research into the Fallon cancer cluster. On March 4, 2003, FIST itself gained nonprofit, 501(c)(3) status.

About this time, the CDC issued an advisory to Fallon urging residents not to drink or cook with Fallon water because of the high levels of arsenic and tungsten. Wadsworth and Braccini became concerned that the Fallon children would continue to drink untreated tap water at schools. A state-of-the-art arsenic water-treatment plant was in the works, thanks to $12 million in federal funding secured by Sen. Harry Reid, D-Nev., but didn’t come online until 2004, some two years later.

So Braccini and Wadsworth set out to find allies. They, along with several local supporters, stood in front of the Fallon Safeway and Wal-Mart stores, petitions in hand, and got close to 4,000 residents to sign in favor of clean water in schools. They traveled twice to Carson City where Braccini testified before the state legislature. They spent close to $1,000 on paper, copying madly and sending packets of information to everyone they could think of with any political pull. Finally, with the help of former Assemblywoman Marcia deBraga, they got through to Reid, who met with the group at the local hospital.

“He basically said, ‘Let’s do it,’” Braccini remembers. Reid helped secure a $133,000 grant to provide bottled water to Fallon schools, but FIST ended up having to find money to pay for the storage, a forklift and an employee to service the schools with water.

It wasn’t about the cancer cluster at that point. “We wanted to clean up this town,” Braccini says. “Arsenic is a known carcinogen and it weakens the immune system. We didn’t want our children drinking it.” The questions about what caused the cancer cluster remained and FIST, now educated in community activism, wanted straight answers.

TURNING TO THE UNIVERSITY FOR HELP

“We wanted solid science and independent research,” Wadsworth says. And then Reid’s office suggested they get in touch with William Murphy, professor of microbiology and immunology and a cancer researcher in the University of Nevada School of Medicine. Murphy currently serves on several National Institutes of Health boards that review grants. In addition, prior to coming to Nevada in 2002, he served for 12 years as the director of basic research at the National Cancer Institute in Frederick, Md. And thus began a unique collaboration between the small band of community activists, the University and a senator that led to a $700,000 research grant to fund serious science on the Fallon cancer cluster.

Reid had been able to secure research funding, but the non-scientists of FIST were not qualified to distribute the money. Even though they were well aware of the issues surrounding the cluster, they needed to ensure that the research passed scientific muster.

“We didn’t want to lose all the money and the research it would provide,” Wadsworth says, and that’s when Murphy and colleague Glenn Miller, a professor in the Department of Natural Resources and Environmental Science and an environmental toxicology expert, stepped in and took the reins of the project — but only as liaisons in an advisory capacity to FIST.

The two University professors were able to negotiate, according to Murphy, the extensive red tape of the Environmental Protection Agency and get that department to oversee the grant. With the EPA officially in charge, Murphy, who was named principal investigator for the grant even though the research funding would go to other investigators, put together a peer review panel of nationally recognized experts and advertised for proposals in an internationally respected journal Cancer Research supported by the American Association for Cancer Research. Six came in. All good. Three were chosen.

The unusual arrangement amounts to “one plus one plus one equaling 10,” Murphy says. “FIST couldn’t have done it without Senator Reid; Senator Reid couldn’t have done it without the University. But nothing would have ever occurred if not for FIST starting the process and working with Senator Reid. The research that is being done will be rigorous and will spur on more research.”

Murphy is in charge of progress oversight on the grant and must report to the EPA for the next three years. Annual symposiums will keep the public informed about research progress and allow other cancer researchers to collaborate.

SOLID RESEARCH

The research awardees are nothing short of stoked to get funding. Several have already been researching the Fallon cluster on their own dime. Mark Witten, a research professor in the department of pediatrics at the University of Arizona, has spent five years and close to $30,000 investigating the connections between the Fallon cluster and similar clusters in Sierra Vista, Ariz.; Elk Grove, Calif.; and Hoisington, Kan. With the grant money, he will continue to examine the role of tungsten, molybdenum
— a metal very similar molecularly to tungsten — and cobalt in the leukemic process, as well as look into the role genetic variations play in developing cancer.

The Centers for Disease Control found by DNA testing that 11 of the Fallon children with cancer had variations in the SUOX gene, which is responsible for telling the body how to make the enzyme sulfite oxidase. This enzyme's job is changing unsafe chemicals in the body to safer ones. It is not known what effect the variation has, if any, on sulfite oxidase, according to a CDC report. Some 40 percent of Fallon children without cancer also had this variation, so the variation alone can't account for the cancer, but might be a contributing factor, researchers suspect. Witten is also collaborating with others, including Paul Sheppard, a University of Arizona tree-ring expert. Sheppard and Witten have already published close to a dozen papers on the Fallon cancer cluster, receiving some funding from the Gerber Foundation and the Cancer Research and Prevention Foundation before winning the EPA grant. Among other issues related to the cluster, their research investigates the high levels of airborne tungsten and cobalt particulates, as evidenced by evaluating multiple environmental indicators including dust, lichens, and tree rings.

Joseph Wiemels, a clinical researcher in the Division of Cancer Epidemiology at the University of California, San Francisco, who has been studying the epidemiology of childhood leukemia for a decade, will look at leukemia cells to see if they harbor a common viral or chemical signature. Wiemels will also study the mortality and morbidity statistics of the Fallon cluster in relation to Nevada disease registries, and will compare Fallon environmental data on jet-fuel spills, tungsten and cobalt, electromagnetic fields, changes in the area’s water table, arsenic and well levels to data from towns similar to Fallon.

Chris Pritsos, a biochemist and chair of the Department of Nutrition at the University of Nevada, Reno, in conjunction with Lisbeth Welniak, a research assistant professor of animal biotechnology and hematology expert, and Ralph Seiler ’99Ph.D, a U. S. Geological Survey hydrologist, will examine the biological impact of ingestion of elements such as arsenic, tungsten and polonium 210 found in the Fallon drinking water. Providing mice with Fallon water, for their drinking water, they will look at oxidative stress as well as overall immune function in these mice as precursors to developing leukemia.

ON THE ROAD TO DISCOVERY

Back in Fallon, 8-year-old Jeremy is doing well. He's the only child in his third-grade class in the gifted and talented program and, at five years out from his diagnosis of leukemia with no relapse, is considered cured. But like other children who fought leukemia and survived, he lacks athletic ability, Braccini observes. "He tries at sports, but he just doesn't have the physical stamina that a normal child has. He lost three years of his childhood from the age of 3 to 6."

But Witten and other researchers are hopeful that the Fallon cancer cluster could lead to research discoveries about the cause of leukemia and other cancers, such as brain and breast cancer, which are also found in clusters and may have genetic as well as chemical causes.

"I think we are onto something very important," Witten says. If scientists can tease out the knotty mass of genes, chemicals and viruses and come to conclusive findings regarding the cause of childhood leukemia, pollutants could be remediated, measures could be taken, and future cancers might be avoided.