FINDINGS

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Program Leader

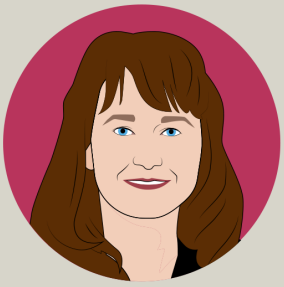
Tarantula Milker

Disease Prediction Pioneer

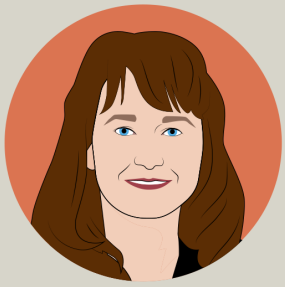
Swim Team Mom

Fleming Scholar

U.S. Presidential Award Winner



The Pride of Pond Creek, Oklahoma



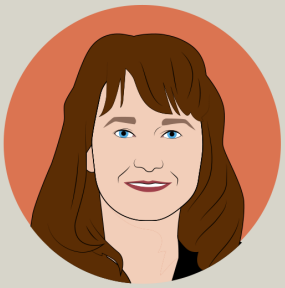
M.D.

Ph.D.

The Many Faces of Judith James

Renowned Lupus Researcher

Professor of Medicine



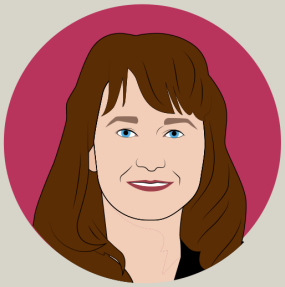
Classical Pianist

Superstar Scientist

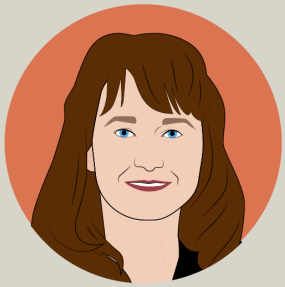
Carnegie Hall Performer

Rheumatologist

Prize-Winning Livestock Exhibitor



Clinical Immunologist



Non-Sleeper

Travis and Kym Mason

FINDINGS

Summer/Fall 2016

FEATURES

ALSO IN THIS ISSUE

Chartered in 1946, OMRF is an independent, nonprofit biomedical research institute dedicated to understanding and developing more effective treatments for human disease. Its scientists focus on such critical research areas as cancer, diseases of aging, lupus and cardiovascular disease.

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XX Marks the Spot

When Chip Morgan met the first class of Polish biology students to come to OMRF for a year-long training program in 2013, he couldn't help but notice something. "They were all women," says the foundation's long-time executive vice president and chief operating officer.

The next year, the story was the same. Ditto in 2015. "I began to wonder if they even had male biologists in Poland," Morgan says.

The answer, it turns out, is yes. Just not many.

For this year's installment of the program, OMRF's class consists of five women—and three men. "It's going to be a slight change for us, but we're excited," says Morgan. "Because every class of Polish students we've had has been wonderful."

This marks the fourth year OMRF has served as a host institution for the Visiting Research Graduate Traineeship Program. The initiative offers Poland's leading master's degree candidates in biology the chance to come to the U.S. for 12 months of hands-on research training. Program participation is selective, with almost 100 Polish graduate students applying for a total of roughly 30 slots available at OMRF and three U.S. universities.

The program came to OMRF with the arrival of Dr. Umesh Deshmukh, who joined the foundation's faculty from the University of Virginia in 2013. At Virginia, the immunologist had mentored students through the program, and he saw it as a perfect fit for his new scientific home in Oklahoma City.

"It's been a great addition to OMRF because it brings young, energetic students to our labs," says Deshmukh. "We've been happy with our trainees and plan to continue to look in that direction for top-level scientific talent."

In the lab, the Polish students conduct in-depth medical research projects that range from studying the biological effects of aging to the development of blood vessels to bioinformatics. All are paired with individual OMRF scientist mentors, who supervise the students as they complete their research projects.

Trainees review a description of possible laboratory assignments and submit a priority list for placement based on their scientific interests. Natalia Stec put the lab of OMRF's Dr. Ken Miller at the top of her list—and was ecstatic when Miller chose her to come to his lab for 2016-17.

Training program with a distinctly female flavor

"My lab is a perfect fit for me," says Stec. "We study nerve cells in a roundworm called *C. elegans.* I'm a basic science person, and this is exactly the kind of work I wanted to do."

When not busy at OMRF, the students live in an apartment complex north of the foundation. The first class purchased a 2002 Ford Taurus to get to work and around Oklahoma City. Each year, the new students have pooled funds to buy the car from the previous year's class. With the help of a few communal bikes and the always-packed Taurus, the students make sure they get to their labs on time.

Following their stints at OMRF, the students return to Poland to complete their degrees. Most plan to continue their education to earn their doctorates. In the past, a few have applied to the University of Oklahoma for Ph.D. programs. "And that is one of our aims," Deshmukh says, "to bring international talent to Oklahoma, expose them to top-notch science, and get them excited about continuing their research."

Deshmukh is pleased with the program's results: high-quality research at OMRF and valuable mentoring for the aspiring biologists. "We hope this program will encourage other well-trained, talented students from all over the world to consider coming to Oklahoma," he says. "We are excited to see it continue to grow and flourish."

And the prevalence of women? Deshmukh doesn't expect that to change any time soon. In Poland, he says, male science students tend to favor careers in engineering, while women gravitate toward biology. Talk about natural selection.

TEAM POLAND This year marks the first time that men have been among the class of Polish students who spend a year in OMRF's labs.

A Case of the Curiosities

Solving the mysteries of aging, one question at a time

Dr. Holly Van Remmen asks lots of head-scratchers. Like why do some diseases only happen when we get older? And what can we do to slow the aging process?

As the head of OMRF's Aging and Metabolism Research Program, she's well served by her inquisitiveness. Indeed, it's a trait that comes naturally to her.

As a child, Van Remmen loved to figure out how things work. Even her little sister's supposedly indestructible Fisher-Price transistor radio couldn't escape her inquiring mind. "I used butter knives, screwdrivers and all kinds of things to get inside it," says Van Remmen. "I just had to know what made the music play."

In college, a part-time job in a nursing home again stoked the fires of her curiosity. What, she wondered, was driving the biological changes she saw in the elderly men and women she helped care for? She decided to figure out for herself by enrolling in a graduate program focused on physiology and aging. After earning her doctorate, she spent more than two decades as an aging researcher at the University of Texas Health Sciences Center in San Antonio, then joined OMRF's scientific faculty in 2013.

Van Remmen's work focuses on age-related muscle loss and amyotrophic lateral sclerosis, also known as Lou Gehrig's disease. During her career, she has made a series of important insights on muscle degeneration, and this past year she led a study that found new links between traumatic brain injuries and neurodegenerative conditions. "The ultimate goal of this work," says Van Remmen, "is to help people to be stronger for longer."

In June, the American Aging Association recognized her work with its highest honor, the Denham Harman Award. Established in 1978, the prize is a lifetime achievement award that recognizes scientists who have made significant contributions to the field of research in aging.

"This is such a nice honor for me personally," says Van Remmen. "But it also says that our colleagues across the country now recognize Oklahoma as a force in research on aging."

Dr. Arlan Richardson, Van Remmen's former mentor and now a professor at the University of Oklahoma Health Sciences Center, agrees.

"Holly is a tremendously hard worker and has a gift for fostering collaboration," he says. "She has grown into a noted leader in aging research and is one of the top women of her generation in the field. Her selection for this award symbolizes that growth, and having her here draws more attention to Oklahoma and helps all of us, both at OMRF and OU."

Tips for Healthy Aging

Recommendations from Dr. Holly Van Remmen

1. **Stay active**
   Aim for 150 minutes of moderate exercise weekly
2. **Do some strength training**
   This helps maintain muscle mass and bone density
3. **Eat right**
   As you age, your body needs fewer calories but just as many nutrients

In 2015, working with a team that included Richardson, other OU and OMRF scientists, and researchers at the VA Medical Center, she helped secure a federal grant to establish a Nathan Shock Center of Excellence in the Biology of Aging in Oklahoma City. She and Richardson now serve as co-directors of that Shock Center, one of only six nationwide. Work at the Shock Center focuses on geroscience, the study of how aging impacts disease and how changes that occur in aging predispose people to disease.

The Oklahoma scientists hope their work will provide clues to understanding conditions ranging from Alzheimer's to age-related muscle loss, a topic of particular interest to Van Remmen. But regardless of what she finds, Van Remmen pledges to keep pushing ahead.

"Research is a journey," she says. "As you put together more pieces of the puzzle, more questions arise, and you have to follow where they lead."

How Not to Get Blindsided by Shingles

Dr. Eliza Chakravarty *joined OMRF in 2011. A rheumatologist and researcher, she treats patients with autoimmune diseases and specializes in guiding lupus patients through high-risk pregnancies.*

Dear Dr. C,
I've noticed an increase in the number of stories on shingles lately. I'm glad to see it, because I've had shingles, and it's a painful, miserable condition. My doctor had me take the vaccine, and now I tell everyone to take it so they can avoid what I've been through. But when is the best age for most people to get vaccinated? *Bill Ashford, Oklahoma City*

His commercials may seem corny. But when former NFL quarterback Terry Bradshaw says, "Shingles is like being blindsided by some linebacker," he's right.

Shingles is a blistering skin rash that typically appears in one wide strip across the body, often on the torso. The condition causes intense pain and flu-like symptoms (fever, headache, chills, upset stomach), and it typically lasts for three to five weeks.

In addition, shingles can also bring on a common complication called post-herpetic neuralgia. PHN can cause excruciating nerve pain with a persistent stabbing, burning pain where the rash occurs. Advil, Tylenol and narcotic medications are ineffective in treating the condition, which can last for months or even years.

Shingles and its complications are caused by the chickenpox virus. If you've had chickenpox in your lifetime—which nearly every one of us has—the virus is already in your body, and it stays in your nervous system forever. When you're young, your immune system tends to keep the virus in check. But as you age, your body's defenses can break down, and that increases the likelihood of a bout of shingles.

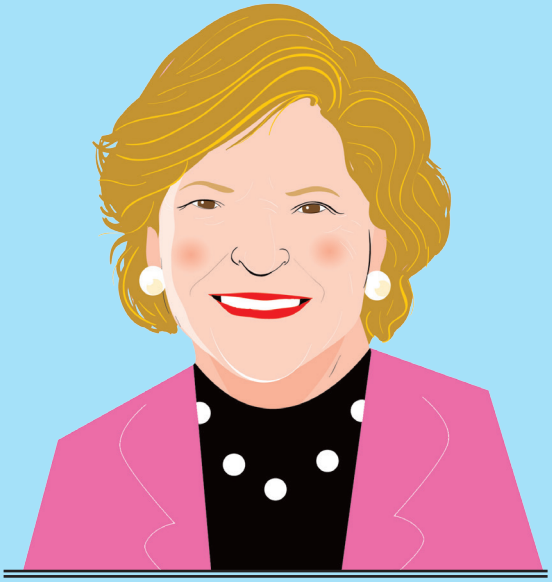
While the shingles vaccine (known as Zostavax) is not perfect, it reduces the risk of getting shingles by 51 percent and PHN by 67 percent. If you do develop one of those conditions, you'll experience less severe symptoms if you've been vaccinated. And even if you've already had shingles, getting vaccinated is still worth it, because the condition recurs in one in 20 people.

The vaccine itself is a live attenuated vaccine, meaning it's made from a mutant version of the virus called varicella zoster. No serious side effects have been associated with the vaccine, but it's not uncommon to experience mild swelling, soreness or itching at the site of the injection.

The Food and Drug Administration initially approved the vaccine for healthy individuals age 60 and older, which is the age at which the rate of shingles starts to increase significantly. But even among those 50 to 59, the risk of shingles is not insignificant—approximately five in 1,000 people in this age group develop the condition each year.

Subsequent research studies found that in those aged 50 to 59, the vaccine prevents approximately 70 percent of shingles cases. As a result, the FDA approved lowering the vaccination age to 50.

So if you're 50 or older, ask your doctor about getting the shingles vaccine. It carries few risks, and it could well protect you from a painful, protracted illness.



Libby Blankenship

LONG-TIME OMRF DONOR

Why do you support education programs at OMRF?

"It's so important to help young people along when they're just starting out ... They need to know that they're important in the world, and as Fleming Scholars at OMRF, they've started on the right journey, whether or not they pursue a career in science. My father only made it through eighth grade, and he didn't want any of us to marry until we got a college degree. I believe in our young people, and it's wonderful to be a part of a special place like OMRF, where we can invest in the generations to come. When you've been blessed, you should always be ready to help the next one up the ladder."

Libby Blankenship joined OMRF's board of directors in 1980. For 35 years, she and her husband, G.T., have made annual gifts to OMRF's Sir Alexander Fleming Scholar Program, a science education program for Oklahoma high school and college students.

DR EVERYTHING

PIONEERING LUPUS RESEARCHER. DEDICATED PHYSICIAN. CLASSICAL PIANIST. IS THERE ANYTHING JUDITH JAMES CAN'T DO?

BY ADAM COHEN
PHOTOS BY STEVE SISNEY

HOW DO YOU MILK A TARANTULA?

It may sound like the set-up to an old joke. But for Judith James, the question of how to extract venom from a fanged spider roughly the size of a tea saucer was no laughing matter.

In zoology class at Oklahoma Baptist University, each student received an animal to study and care for throughout the semester. James, then a sophomore, knew her professor would not let his star pupil take the easy road; there'd be no cute and cuddly rabbits or hamsters for her.

"I assumed that because I hated snakes, he'd give me one," she says. So she tried a little misdirection, delivering an Oscar-worthy display of feigned serpentine affection. "I spent three days holding snakes, even wrapping them around my neck." The ploy worked—sort of. On D-day, James learned she'd spend the semester not as a would-be herpetologist but, rather, ministering to a group (technically, a wisp) of tarantulas. "They were," she recalls with a slight shiver, "the biggest, hairiest spiders I'd ever seen."

Most of her classmates came up with projects that analyzed their animals' behaviors. They looked at things like whether mice were more active in day or night and how temperatures affect the activity levels of fish. But James decided she wanted to, in her words, "do something chemistry-ish." She'd analyze her spiders' venom, which can paralyze prey like insects and frogs. But how, exactly, do you get the fluid out?

After some research, she identified a professor at Oklahoma State University who worked with Brachypelma, as the furry arachnids are scientifically known. Come to my lab, he told her, and I'll show you all you need to know. So she herded her eight-legged charges into a makeup case, packed it into her Pontiac Firebird, and headed an hour north on Highway 177 from Shawnee to Stillwater.

There, in a session that was part *Addams Family,* part *CSI*, James learned that step one in milking spiders is to put the animals to sleep. She accomplished this by placing them in shoebox-sized plastic cages, then adding dry ice and ether. Once the tarantulas lost consciousness due to the fumes, James would lay them on their backs in hollowed-out sponges. After securing each of their legs with Velcro strips (repurposed from kids' sneakers), she'd apply a small electrical current at the base of the spiders' fangs. And, voilà, out dripped the venom, which she'd catch in a capillary tube.

James had hoped to find components of the venom that stimulated changes in the neurons. Unfortunately, her grand plan didn't quite pan out. "The venom pretty much killed everything." Still, what she now describes as "an epic fail" did have its upsides.

First, no spider ever bit her. And when she recounted her tarantula tale in an interview for OMRF's Sir Alexander Fleming Scholar Program, which had rejected her on two previous occasions, she was admitted. That brought her in the summer of 1988 to OMRF's labs, where she'd spend two months. Or so she thought.

Because, you see, once James came to OMRF, she never left. Within days of her arrival, she'd already started down the road that would ultimately lead her to become one of the world's pre-eminent lupus researchers.

Like so much of James' life, the path she chose and the resulting outcomes were at once wholly unexpected and completely predictable.

MAKING HOUSE CALLS

James' parents both grew up in Oklahoma farming and ranching families. They met showing cattle in the Angus Association. After marrying, they settled on an acreage in Pond Creek, a town of 800 or so that sits more or less halfway between Enid and the Kansas border.

The land had been in James' father's family since before the Land Run. And though James, the oldest of three children, spent a good deal of time helping her dad farm and ranch, it was always clear that her future lay elsewhere. "I can't remember not wanting to be a doctor," she says.

As a child, her pastime of choice was something she called doll hospital. Instead of tea and imaginary crumpets, James would feed medicine (actually, crushed vitamins) to her Raggedy Ann and stuffed animals. She would also acquiesce to play store with her younger sister, but only, she says, if that store was a pharmacy and its "employees"—the James girls—"could pick up the medicine to deliver to the children of Nepal or the doll hospital."

James suffered from asthma, a big problem if you live on a farm, so she visited the local pediatrician often. Even at a young age, she peppered her physician with questions.

When she was 4, she remembers, "He said that if I wanted to become a nurse, he would hire me." While presumably meant as a compliment, this did not sit well with the preschooler. "I told him that I would become a doctor and hire him."

When James turned 12, an osteopath who regularly made house calls around the Pond Creek area invited her to tag along. "These were very sick people who couldn't or wouldn't see the doctor," James recalls. They suffered from chronic health problems like diabetes, rheumatoid arthritis and congestive heart failure. Many never left their beds.

On and off through junior high and the early years of high school, James trailed the physician as he went from home to home. In between patients, she'd cross-examine him. Why is this diabetes patient improving while that one keeps getting sicker? How do you know which drug to give to which person? After four years, the osteopath offered her some frank career advice: You're never going to be happy just practicing medicine, he said. You're going to need to try research.

James took a job as a teller at a local bank so she'd have gas money to drive to an Enid hospital, where she volunteered as a candy striper. There, she spent time visiting with patients, some of whom were in the process of dying. From a young age, she'd played the organ at church—and also at many funerals. She'd already spent countless hours in the presence of the dead ("I didn't recognize how strange that was until I got to medical school"), so she understood that "death is just part of the process; it's just part of the circle of life."

At the hospital, she enjoyed interacting with the staff. But what really cemented her decision to become a physician was the realization that she loved the patient contact, regardless of the outcome. "I felt comfortable with people who were sick or even dying." Of course, she says, it was always more gratifying to see a baby born. "But for some who had suffered so much, death brought peace."

On the heels of an all-everything four years at Pond Creek High—cheerleader, a cappella singer, all-state pianist, prize-winning livestock exhibitor, valedictorian—James enrolled in the pre-med program at Oklahoma Baptist University. She came to OMRF the summer after her junior year as a Fleming Scholar. She'd told the selection committee she wanted to do research on asthma, a condition that not only afflicted her but also many members of her family. She was assigned to the laboratory of Dr. John Harley, a physician-researcher who was an allergist and rheumatologist.

At the time, scientists believed asthma might have a so-called autoimmune component. Autoimmune disorders are a family of more than 80 illnesses that include rheumatoid arthritis, type 1 diabetes and multiple sclerosis. In all of these conditions, the body's immune system loses the ability to distinguish between its own healthy tissues and those of foreign invaders like bacteria and viruses. As a result, the immune system creates proteins that attack and destroy healthy tissue. These cellular assaults can cause inflammation, pain and damage to various parts of the body.

THE PRIDE OF POND CREEK Growing up, James made her mark in music, 4-H and the classroom.

Harley assigned James a pair of projects to study different aspects of lupus, an autoimmune disease. Lupus primarily strikes women of childbearing age, and it most often affects the skin, joints and kidneys. Cases can range from mild to life-threatening. According to the Lupus Foundation of America, lupus is believed to affect 1.5 million Americans.

James thought her research on lupus would represent a brief scientific detour. "I figured I'd learn some autoimmunity, then apply it to asthma," she says. But as she delved into the depths of the disease, investigating the molecular targets and the immune cells that mistakenly attack them, the work struck a chord with her. "I really liked the detective work. I enjoyed trying to figure out something that no one had figured out before."

James returned to OBU for her senior year, but she kept working with Harley in OMRF's labs. The University of Oklahoma Health Sciences Center launched an M.D./Ph.D. program, and on the strength of her undergraduate career and work in Harley's lab, James was one of two students accepted into the inaugural class. This enabled her to simultaneously pursue a medical degree as well as a doctorate in microbiology and immunology.

In medical school, she initially had designs on becoming a pediatrician. But time and again, she found herself drawn to the rheumatology clinic. There, she saw people suffering from autoimmune diseases like lupus and rheumatoid arthritis, another condition that afflicted many in her family. "I was intrigued by the concept of autoimmunity, and I really liked the patients." In particular, she saw an opportunity to improve the lives of those patients. "There were significant gaps in our knowledge of autoimmune diseases, and there were tremendous unmet treatment needs. Much of what we knew about these conditions—and the therapies we were using to treat them—were simply being borrowed from other fields."

She did the research necessary to earn her Ph.D. in OMRF's labs, publishing a variety of papers on lupus and securing grant funding while still a graduate student. Her doctoral thesis devised a way to identify abnormal immune responses in autoimmune diseases.

During her internal medicine and clinical training, she worked on OMRF's scientific staff as a post-doctoral researcher. Working with Harley, she made major research strides. First, following up on her doctoral thesis, she was lead author of a research study on "epitope mapping," the process of identifying the pieces of molecules that are targeted in autoimmune disease. Two years later, in a paper published in the *Journal of Clinical Investigation,* she showed lupus patients were more likely than the general population to have been exposed to a common childhood virus.

The research, all conducted while James continued to see patients, cast new light on autoimmune disorders, which, collectively, affect between 5 and 8 percent of the U.S. population. By the time OMRF promoted James to the role of principal investigator—meaning that she'd lead her own lab and independently map the course of her research projects—she'd also made a major finding about how immune responses in lupus patients changed over time. That discovery would earn her the Presidential Early Career Award for Scientists and Engineers from then-President Bill Clinton and lead to a seven-year grant from the National Institutes of Health.

James' work to that point had studied how genetic and environmental factors work together to contribute to the development of lupus. In her short career, she'd already made key contributions to understanding how lupus progresses. Yet as she delved deeper into various aspects of the disease, she had a "What if?" moment.

"When I looked at the literature and all the studies being done on lupus, I realized the vast majority of the publications were based on data obtained after people had been diagnosed," she says. Was there some way, she wondered, to predict who would ultimately develop lupus?

"With this kind of information, we could begin fighting disease before symptoms ever appear," says James. Give physicians a diagnostic crystal ball, she thought, and they might be able to delay the onset of lupus. Perhaps they could even craft approaches that would lessen the brunt of the illness when it eventually reared its head.

The idea seemed like a reach—yet also a logical extension of the work James had already done. And if it proved successful, the payoff to patients could be huge. So she decided to give it a go.

COULD JAMES FIND A WAY TO PREDICT WHO WOULD ULTIMATELY DEVELOP AUTOIMMUNE DISEASE?

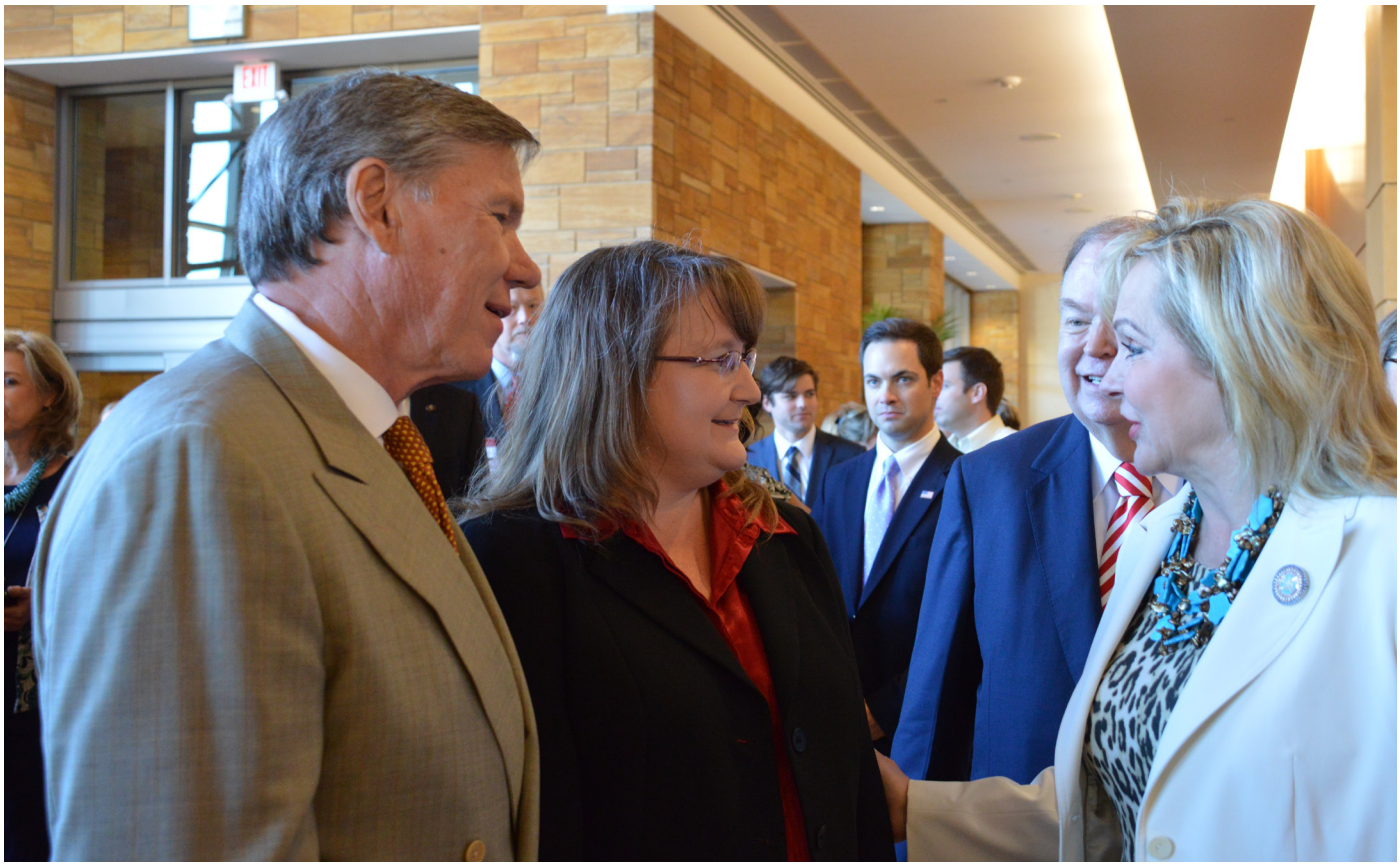
A CRYSTAL BALL FOR LUPUS

Normally, the immune system relies on Y-shaped proteins known as antibodies to identify and neutralize foreign pathogens to the body. But in autoimmune diseases, certain rogue antibodies (known as "autoantibodies") attack the body's own cells.

Researchers had long known that these abnormal proteins could be found in people suffering from lupus and other autoimmune illnesses. Indeed, Dr. Morris Reichlin, James' rheumatology mentor and colleague at OMRF, had done pioneering work in demonstrating how and why certain people's bodies produce autoantibodies. But, James asked, when do they first show up? Is it possible they actually appear in the body before the first symptoms of disease?

The notion was striking. But there was one big hurdle: You can't reverse time to test the blood of lupus patients before their first symptoms arose. James decided, she says, "to find a way to work backward."

She knew that the U.S. military collected biological samples from enlisted personnel and kept those samples, along with the individuals' medical records, for many years. If she and her research team could comb through tens of thousands of medical records and identify soldiers and sailors who



FEELING THE LOVE OMRF President Stephen Prescott, University of Oklahoma President David Boren and Governor Mary Fallin congratulate James following the announcement that she'd received a major federal grant to help improve patient outcomes in medically underserved communities in Oklahoma.

eventually developed the disease, they could then request blood samples, taken before the onset of symptoms, and test them for autoantibodies.

Working with the then-chief of rheumatology at the Walter Reed Medical Center in Washington, D.C., James and the OMRF team—which also consisted of Harley and Dr. Hal Scofield—gained access to the U.S. Department of Defense serum repository. When they conducted their own testing on blood samples gathered from military personnel, the results were definitive: Of 130 servicemen and women who developed lupus, 88 percent had telltale autoantibodies before they showed clinical symptoms. Some of these markers appeared up to a decade before people became ill.

When James and her colleagues published the results of their research in the prestigious *New England Journal of Medicine,* "It made a very big splash in the lupus world," says Dr. Jill Buyon, director of the division of rheumatology at New York University. "The idea that you could identify people who might later develop clinical autoimmunity was quite powerful."

Indeed, the work held exciting potential for helping patients. Tests to detect these abnormal proteins could become a part of routine checkups for high-risk individuals, and a positive test could signal the need to take preventive action. *The New York Times* ran a story about the research, and *Scientific American* also featured it in a cover story entitled "New Predictors of Disease."

But perhaps the highest compliment to the work came from her fellow autoimmune disease researchers. When scientists believe a paper has made important findings, they'll cite it in their own publications. Think of prior research as a sort of building block upon which future findings are constructed.

A good paper may get cited a few dozen times. An influential one might hit the century mark. James' *New England Journal* study has now been cited more than 1,000 times.

A NEW FOCUS

Since that watershed discovery, James has continued to build on the work. But as she peeled away the molecular layers, she found new subtleties. And those insights caused her to adjust the focus of her research.

"It turns out that just having certain antibodies doesn't mean you'll get sick," she says. James and her research team found other events in the immune system, when coupled with the appearance of certain antibodies in the blood, signaled lupus would soon rear its head. Yet that knowledge was only useful to a point. "Even if you know it's coming, that knowledge is only useful if you can do something to stop the disease. So what could we do to prevent lupus?"

Not surprisingly, James came up with an answer—or at least part of one—to her own question.

Using the biological samples and medical records she and her research team had gathered from the Department of Defense, James again decided she'd take a "backward" look

at the 130 service members who ultimately developed lupus. This time, she centered her analysis on how quickly they went from showing early symptoms of the disease to full-blown lupus. Specifically, she was looking to see if there was any factor that might separate those who showed rapid disease onset from those whose illness progressed more slowly. And, eventually, she turned up an intriguing clue.

Some of the service members had been assigned to areas in which the mosquitoes carried malaria, a potentially deadly infectious disease. Twenty-six of them had received hydroxychloroquine, a medication used both to prevent and treat the mosquito-borne illness. When James examined their medical records and blood samples more closely, she realized they showed a longer time between the appearance of the first clinical symptom and the onset of full-blown lupus than those service members who had not been treated with the anti-malarial drug.

In other words, hydroxychloroquine appeared to delay the onset of lupus.

When James published her research in the journal *Lupus*, "It quite literally changed the way we practice medicine," says Dr. Eliza Chakravarty, a rheumatologist who specializes in the treatment of pregnant women and was then a clinical faculty member at Stanford University. Based on the results of James' study, when Chakravarty saw a patient who "had something that was not quite lupus, we'd immediately start treatment with hydroxychloroquine." For the first time, says Chakravarty, physicians had a way to delay and possibly even halt the progression of lupus.

Subsequent scientific investigation has supported and expanded upon James' initial findings on hydroxychloroquine. Rheumatologists now routinely prescribe it not only for patients displaying early symptoms but also as an ongoing therapy for those who've been diagnosed with lupus, with research showing the drug can reduce the frequency of disease flares and limit organ damage.

James is now helping to spearhead an "interventional" trial to find out whether hydroxychloroquine can prove similarly effective against rheumatoid arthritis, another autoimmune disease. Building on the approach pioneered in James' *New England Journal* study, researchers have identified certain blood markers that predict—with 80 percent certainty—that a person will later develop RA. Together with physician-scientists at the University of Colorado, James and her team of OMRF rheumatologists are now enrolling patients who test positive for the biomarkers. They'll give hydroxychloroquine to some, then compare their progress to untreated patients.

In addition, working with OMRF's Drs. Melissa Munroe and Joel Guthridge, James has identified a number of biomarkers in the blood that predict when lupus patients

HEAD OF THE CLASS James has trained nearly 100 students in her lab and still relishes the chance to mentor aspiring scientists, as she did here at the Oklahoma School of Science and Mathematics in the spring of 2016.

WHEN JAMES PUBLISHED THE RESULTS OF HER RESEARCH, "IT QUITE LITERALLY CHANGED THE WAY WE PRACTICE MEDICINE."

are going to experience disease flares, which can range in severity from skin rashes to life-threatening fluid build-up around the heart or kidney failure. The pair is now working with a biotechnology company, Progentec Diagnostics, to transform the work into a test that will signal lupus flares even months in advance. "Even if patients aren't feeling too bad, their immune systems are warning us a flare is coming," says James. Armed with that knowledge, physicians can use a toolkit that consists of a variety of medications—including hydroxychloroquine—to prevent, or at least dampen the effects of, the coming disease storm.

It's all, she says, part of an effort to deliver a course of therapy tailored to each lupus patient's unique needs. "Unfortunately, there's not a universal course of treatment for every lupus patient, and there are no perfect drugs." Medications can help suppress symptoms, "but none of them actually stop the disease." And many come with significant side effects. "So we want to pick the right drug for the right patient at the right time."

Bringing relief to patients—hundreds of whom she still sees regularly as a rheumatologist in OMRF's clinic—drives her research. And it animates the ultimate aim of all she does in the lab: to halt autoimmune diseases from ever taking hold. "Our goal," she says, "is prevention."

"THE BEST IN THE ENTIRE COUNTRY"

Dr. Stephen Prescott is a cardiologist by training. For three decades, his research centered on vascular biology and the molecular genetics of disease. He'd never worked in the field of autoimmunity. But when he became OMRF's president in 2006, he immediately saw James was, in his words, "a scientific superstar."

Within a year of Prescott's arrival, James took the reins of a major program grant at OMRF. The grant's goal was to mentor junior scientists and enable them to establish successful independent research programs. And under James' guidance, the junior investigators made impressive scientific strides. "Dr. James is driven, she's organized, and she has the ability to motivate others," says Prescott. In other words, "She has all the traits of a great leader."

In 2008, Prescott named James the Lou C. Kerr Endowed Chair in Biomedical Research and head of a new department at OMRF, the Clinical Immunology Research Program. The program would study autoimmune diseases, but like James' work, it would specialize in "translational" research, which is aimed at improving patient outcomes. Within a year, James successfully secured a $7 million grant from the National Institutes of Health to construct a new patient clinic and a massive biorepository, a state-of-the-art freezer facility where she and other OMRF physician-scientists could store biological samples donated by patient volunteers. When coupled with the carefully documented medical records they'd assemble in the clinic, these samples would—much like the serum repository at the Department of Defense that James had tapped for her earlier lupus studies—become an invaluable resource for OMRF researchers.

"Judith was years ahead of the curve in this area," says Dr. P.J. Utz, a professor of medicine at Stanford University who studies autoimmune disease and also serves on OMRF's external scientific advisory board. "When the scientific advisory board saw what she'd done—huge rooms filled with freezers and samples, plus great clinical data to go with those samples—we were just blown away." With the significant investment of time, effort and funds required to build such a collection, few other institutions have done so. As a result, says Utz, "OMRF has cornered the market when it comes to clinical samples in autoimmune disease."

Those samples and data have facilitated hundreds of research studies in lupus and other autoimmune disorders, including rheumatoid arthritis and multiple sclerosis, as well as less well-known conditions like Sjögren's syndrome, scleroderma and sarcoidosis. They also proved a major asset in helping James to secure another major program grant for OMRF from the National Institutes of Health—an Autoimmunity Center of Excellence award. That designation, one of fewer than a dozen given nationwide, placed OMRF in elite company. Along with Stanford, Yale, Duke and a handful of other institutions, OMRF shared in an award of more than $50 million to fund laboratory and clinical research aimed at developing treatments for lupus, rheumatoid arthritis and other autoimmune disorders.

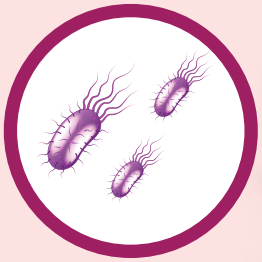
A year after the Autoimmunity Center of Excellence award, Prescott made the decision to merge James' department with OMRF's Arthritis and Immunology department. With more than 150 staff members, the newly combined Arthritis and Clinical Immunology Research Program would focus on both laboratory and translational studies of rheumatologic and autoimmune diseases. And James would lead it.

In the half-dozen years since, the clinical and laboratory researchers in the program have thrived. They've published more than 400 new research studies in peer-reviewed scientific journals. They've opened the Multiple Sclerosis Center of Excellence, which now treats 2,500 MS patients, oversees clinical trials of more than a dozen investigational new drugs, and enrolls patient volunteers in a wide range of research studies. In 2014, OMRF was again designated as an Autoimmunity Center of Excellence. And scientists in this group secured a series of new grants that have helped the program grow, by the addition of both new laboratory projects and researchers.

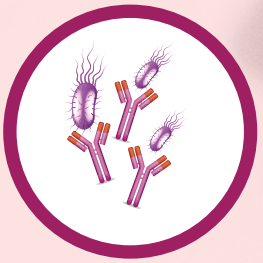
UNDERSTANDING AUTOIMMUNE DISEASE

Lupus, rheumatoid arthritis and other autoimmune disorders develop when the body's defenses go haywire. According to the National Institutes of Health, autoimmune diseases strike an estimated 5 to 8 percent of the population, or up to 25 million Americans. Most autoimmune diseases disproportionately affect women.

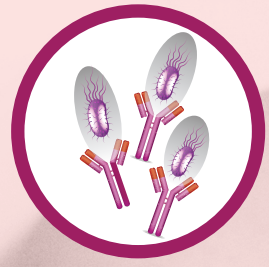
Normal Immune Response



1 Viruses, bacteria and fungi invade

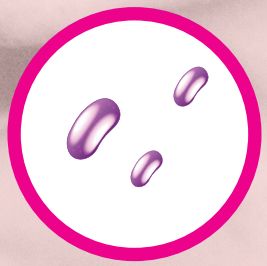


2 Immune system forms antibodies against invaders

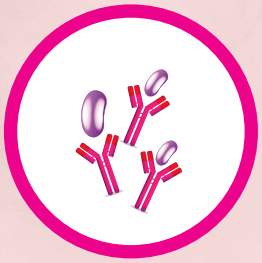


3 Antibodies neutralize invaders

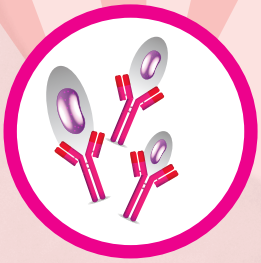
Autoimmune Disease



1 Immune system mistakes its own cells for invaders



2 Immune system creates autoantibodies to ward off (false) invaders



3 Autoantibodies attack body's own tissues

4 Causing damage to...

Central Nervous System

Internal Organs

Connective Tissue

One of those who made the decision to relocate to OMRF was Stanford's Chakravarty. "I wasn't looking to leave Palo Alto, but I met Judith at a small lupus conference," she says. "I'd always followed her work, so when she asked me to get together, I said, 'Sure.'" James, who Chakravarty describes as one of her 'heroes,' surprised Chakravarty over lunch by inquiring if she'd be interested in moving from California to Oklahoma City.

To be, in her words, "polite," Chakravarty agreed to visit OMRF, but she had no real intention of moving—until she arrived at the foundation. "After the first two interviews, I was sold." Five years later, she couldn't be happier about her decision to join OMRF. "Under Judith's mentorship, I have been able to transform my career from clinical to translational research. And I got my first National Institutes of Health grant"—a major milestone in the career of any researcher—"largely because of her. She's amazing at reviewing grants before you submit them. She knows the field so well, and she gives incredible constructive criticism."

Indeed, this well-honed skill for "grantsmanship" has been one of the cornerstones of James' success as a leader. In particular, she's continued to lead efforts to secure new collaborative federal grants that have helped OMRF researchers form partnerships with scientists and clinicians at other institutions. Those initiatives have included a Native American Research Centers for Health grant, where she and OMRF physician-scientists teamed with a network of Oklahoma tribes to improve outcomes for tribal members suffering from autoimmune disease. She also led the effort to create the Oklahoma Shared Clinical and Translational Resource, a partnership with the University of Oklahoma Health Sciences Center (where she holds appointments as a professor of medicine and associate vice provost) and more than a dozen other state and tribal organizations. Funded by a $20 million National Institutes of Health grant, the initiative aims to improve clinical and translational medicine in the state, with a focus on underserved rural populations.

Finally, teaming with Stanford's Utz and physician-scientists at the University of Colorado, she helped secure one of the first of the so-called AMP grants. AMP (which stands for Accelerating Medicines Partnership) couples academic and nonprofit researchers with biopharmaceutical companies. Designed to speed the development and delivery of new diagnostics and therapies to the clinic, James is part of a team that's working on autoimmune disorders, one of three disease targets—along with Alzheimer's and diabetes—of the program, a joint initiative of the National Institutes of Health and the Food and Drug Administration.

If all of this sounds overwhelming, it is.

"Judith is the hardest worker I know," says New York University's Buyon. "I can't count the number of times I've gotten long, exquisitely detailed emails from her at 1 in the morning. She's indefatigable."

Still, says OMRF's Chakravarty, "For somebody who packs so much into her day, you always feel like she has time to mentor you. I don't know how she does it."

In the world of autoimmunity research, says Utz of Stanford, "Judith is viewed as an absolute superstar. But what separates her from everybody else is her selflessness." An avid Golden State Warriors fan, Utz likens James' scientific work to the on-court performance of a certain NBA player. "She was the Kevin Durant of autoimmunity research. But now she's evolved from being a fabulous player to being a great coach. I can honestly say that among rheumatology division chiefs, she's the best in the entire country."

FAMILY MATTERS

Every few months or so, James finds her way back to the family farm in Pond Creek. She'll also occasionally make her way down to Verden, where she sits with her grandmother and other members of her family in the front two rows of the local church. "I grew up on a farm outside of a small town, so these are the places where I'm comfortable."

James still likes to play the piano, but she no longer plays in front of people. She did have the chance a few years ago to fulfill a lifelong dream of singing at Carnegie Hall, where she performed as part of a choir. But mostly, she and her husband of 22 years, Glen Wood, who teaches history in Edmond Public Schools, devote any spare time to their daughter, Becca.

A senior at Piedmont High, Becca's high school career bears a striking resemblance to that of her mother: She's an honors student, a singer, and an all-state swimmer. Not surprisingly, it seems that Becca also hears the call of medicine and research. "She says she wants to complete an M.D./Ph.D. in infectious disease and run a clinic for difficult-to-diagnose diseases," says James.

Like so many parents, James feels a bit conflicted about her daughter's potential career choice. "It makes me excited, but at the same time it makes me nervous. Because I wish she would find an easier path." She thinks for a second. "But if this is what she's called to do, she needs to do it, whether it's hard or not."

With that, James must go. It's after 5 p.m., but her day is far from over. She's finished with meetings, managing lab and departmental operations, and seeing patients, but she still has a conference call with a collaborator, a grant to write and, of course, a 17-year-old to help raise.

Did she ever imagine this is where milking a tarantula would lead?

James smiles. Following the spider project, she was offered the chance, she says, "to spend the summer in Honduras as a great tarantula hunter." Perhaps that might have paved the way for her to become the arachnid world's Indiana Jones. Instead, she chose to come to OMRF.

Since then, she's mentored almost 100 students and trainees in her lab. She's treated thousands of patients suffering from lupus and other autoimmune diseases. In some cases, she's now taking care of the second and third generation of patients from the same families.

It's a gift, she knows, to be able to bring relief to people in pain. To nurture young people's careers. To cast light on scientific mysteries no one before had solved.

No, this isn't precisely the road she had imagined. But it's been a rewarding journey. And it's one, she hopes, that still has many intriguing destinations ahead.

OUT OF THIS WORLD

BY SHARI HAWKINS

ILLUSTRATION BY EVA VASQUEZ

The earth, Don Gibson realized, was shaking. He had traveled to Florida to watch the space shuttle Discovery take off. The shuttle stood 10 stories tall, roughly the size of George Washington's head at Mount Rushmore stacked atop Thomas Jefferson's. Still, as it stood on the launch pad at the Kennedy Space Center in Florida that morning in June 1985, it looked a bit like an outsized paper airplane.

The shuttle piggybacked on a silo-sized rocket, a hulking, bullet-shaped canister filled with liquid hydrogen and oxygen. Alongside the rocket, two smaller boosters stood in formation. Together, the troika would generate the massive amount of thrust necessary to escape the earth's gravitational pull and carry the Discovery into orbit.

When the rockets ignited, cones of flame poured forth from their bases. The early morning sky, still the color of a bruise, warmed to orange. As a river of fire and smoke poured out, Gibson could feel the ground beneath him begin to tremble.

"You wouldn't believe the rumble, the sound it makes," he says. "The ground shook. I tell you, it felt like even the sky around us shook. It was so, so impressive."

He watched the Discovery as it rose higher and higher. The shuttle and its flotilla of rockets shrank from view as they rose—from coin-sized, to fingernail, to a tiny fleck. And then they were gone.

Still, Gibson knew that soon, the shuttle would reach orbit. And he knew that somewhere out in that vast blue expanse, his former OMRF lab partner was living a dream that nearly every human being has had.

SHANNON LUCID WAS TRAVELING IN SPACE.

Born in 1943 in China to Baptist missionaries, Lucid was just 6 weeks old when Japanese soldiers took her family captive during World War II. After seven months in prison camp, they were released as part of a prisoner exchange. They left the country, only to return to China following the war. And it was in China that Lucid got her first taste of flying.

The plane was a converted army transport with no oxygen. As it bumped and lurched over Chinese mountain ranges, her siblings both became airsick. But not 5-year-old Lucid. "I loved it, just loved it," she recalls. "As we were coming in to land, I saw a tiny little person on the ground, and, to me, it was the most remarkable thing on the face of this earth. I decided right then that when I got older, I would learn to fly."

The family returned to the U.S. soon after, then moved to Bethany, Oklahoma, where Lucid would spend the balance of her childhood. It was also the place where she'd nurture her twin passions: science and flight.

As an eighth grader at Bethany Junior High, she penned an essay titled "How to be a space scientist." In it, she outlined what she thought it would take to be an astronaut. She was so taken with space that she sold her bicycle to purchase a telescope. "My best friend and I made our own map of the moon, like we were real astronomers."

In her senior year, she was selected for the national science fair. She then applied to spend the summer at OMRF as a Sir Alexander Fleming Scholar. Although she wasn't chosen, her science teacher, Mrs. Moon, nevertheless arranged for her come to OMRF. "That summer was a very, very good experience for me," she says. "I really felt like a grownup working in that lab."

After earning her B.S. in chemistry—and her pilot's license, which she paid for with part-time jobs—at the University of Oklahoma, Lucid really did come to work at OMRF, as a technician in the cancer research program. But not long after she felt financially secure enough to buy her first plane (a Piper Clipper that she used to fly her father to church revival meetings around the state), her boss' grant funding ran out, and she lost her job.

She found a position at Kerr-McGee and got married, but she lost that job when she became pregnant and her employer pronounced her unfit to work in a lab. After a bout of post-partum depression, she says, her husband helped nudge her forward. "He said, 'You can't just sit around and feel sorry for yourself. Why don't you go to grad school and get your Ph.D.?'"

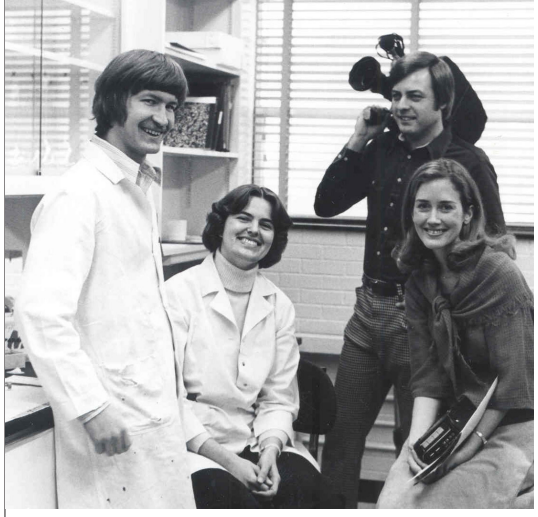
Yet even after receiving her doctorate in biochemistry from OU, opportunities were scarce, especially for women. After months of searching, Lucid found a job in 1974 at OMRF, where she'd eventually settle into a position as a post-doctoral fellow in the Biomembrane Research Section.

"Shannon hadn't been working in a field even close to what we did then," says Dr. Paul McCay, who headed the research program. "But she came highly recommended to us as someone who was very talented."

In the lab, she studied how chemicals cause cancerous changes in cells. Working closely with Don Gibson, a research assistant at OMRF, she examined how a particular cancer-causing agent was metabolized in the livers of laboratory rats. The work would ultimately provide a better understanding of liver cancer in humans.

"Shannon was very driven," Gibson remembers. "She was organized and task-oriented. When we worked together, if we bit off a chunk of work to do, we were going to get it done, come hell or high water."

Still, Gibson found Lucid to be "just real easy to work with." During the four years they spent elbow to elbow at the lab bench, they shared countless personal stories. Often, Lucid would talk about flying. She recounted to her labmate how she'd repaired and restored her plane. And then flew it everywhere. "I was enthralled," says Gibson. "When she'd tell me those stories, I'd immediately think of Amelia Earhart."



SPACE SCIENTIST Lucid (second from left) with Don Gibson and a news crew at OMRF and, opposite page, aboard the space station Mir

"AN ASTRONAUT?"

Gibson rolled his eyes when Lucid pulled him aside in 1978 to tell him she'd been chosen to go into space. "Yeah, right," he said to his labmate. "And what else are you doing next week, Shannon?"

But Lucid's selection to become part of the first class of woman astronauts in NASA's space shuttle program was no joke. Still, until that moment, only Lucid's husband had known she'd applied to the NASA program.

When the news broke that NASA had chosen Lucid among its class of 6 women and 29 men (from a total of 1,000 women and 6,000 men who'd applied), the media inundated Lucid with interview requests. Local, national and international news outlets, including crews from *Time*, *Life* and *People* magazines, beat a path to OMRF's door. Lucid even appeared on the CBS Evening News with Walter Cronkite.

Despite Lucid's newfound fame, Gibson says his labmate-turned-astronaut remained "very down to earth." She spent several months wrapping up her scientific projects at OMRF, determined not to leave any loose ends for her colleagues. Then she, her husband and three children moved to Houston, where she would begin astronaut training.

On the eve of Lucid's departure, her friends and coworkers threw her a party. "We were really thrilled for Shannon and proud of her," says McCay. "We knew that was what she really wanted to do."

As Lucid ended her time at OMRF—which totaled six years between her two stints—the OMRF employee newsletter ran a long article about their departing colleague. "Good luck and Godspeed, Dr. Shannon Wells Lucid," the story concluded. "Give our regards to the stars."

IT TOOK SEVEN YEARS for Lucid to deliver those greetings to the heavens. With her Discovery mission in 1985, she became the sixth American woman to reach space. And once she got up there, she found it suited her: She went on to fly another four missions aboard the space shuttles Atlantis and Columbia.

As mission specialist—essentially the "space scientist" she'd described in her junior high essay—Lucid performed experiments of all kinds. She conducted a student's project on the growth of ice crystals and studied the effects of space on wild wheat, which she cultivated in a tiny greenhouse. She observed quail embryos as they developed inside eggs. On one flight alone, she performed 32 separate experiments. And in a nod to her days at OMRF, she even did a project with lab rats.

"On the Columbia, we had 48 rats to tend, and I worked with them every day," says Lucid. "I had the experience of doing similar work in the lab at OMRF. No one else on the mission had ever done that sort of thing, so I was a natural for that task."

In 1996, she traveled to the Russian space station Mir, where she lived and worked for 188 days with a pair of Russian cosmonauts. "I had spent my grade school years living in terror of the Soviet Union," Lucid later wrote. "We practiced bomb drills in our classes, all of us crouching under our desks, never questioning why. Similarly, [the cosmonauts] had grown up with the knowledge that U.S. bombers or missiles might zero in on their villages."

The Russo-American trio, Lucid remembered, "marveled at what an unlikely scenario had unfolded. Here we were, from countries that were sworn enemies a few years earlier, living together on a space station in harmony and peace."

When not tending to mission-related tasks, Lucid passed time on the space station doing what she loved to do on earth: reading. When she'd exhausted her initial supply of books, her daughters—with the help of a supply ship—sent up new reading materials for their mother. Lucid particularly enjoyed one fantasy novel they'd picked. But the book ended in a cliffhanger.

The astronaut remembers digging through the bag of remaining books, frantically searching for the sequel. "Was there volume two in my book bag? No. Could I dash out to the bookstore? No." She'd have to wait until she returned to terra firma to find out the protagonist's fate. "Talk about a feeling of frustration."

Despite Mir's zero-gravity environment, Lucid maintained fitness using a treadmill she'd jury-rigged. After she pulled on a harness that tethered her to the four corners of the machine, she'd add resistance to simulate the earth's gravitational pull. Then she'd pound away on the machine. By the time she finished her daily run and stowed her equipment, two hours would have passed—and she would have circled the earth again.

Thanks to her extraterrestrial workout regimen, when she landed, she was strong enough—a rarity among astronauts, even those who'd spent far less time in orbit than Lucid—to walk across the tarmac under her own power. Upon her return to NASA's Johnson Space Center, she was greeted by a crowd of well-wishers. Among them was then-President Bill Clinton, who presented Lucid with a huge jar of her favorite treats, M&M's.

That mission would prove to be her last. All told, she'd circled the earth more than 3,000 times and logged 5,354 hours in space. The latter set a new mark for American astronauts, a standard that stood until 2007.

After she hung up her flight suit, Lucid served as NASA's chief scientist, helping to develop the agency's science and research objectives. She assisted astronauts as they prepared for long-duration space flights and served as a capsule communicator in Houston, where she was the voice of ground control for space shuttle and international space station crews. "It was such a fun job," she says. "If you can't be in space yourself, it's probably the next-best thing."

In 2012, following a 34-year career at NASA, Lucid retired to devote all of her attention to her husband, who'd been diagnosed with dementia. She cared for him at their home in Houston until he passed away two years later.

Now Lucid says she's gradually re-engaging with the world. Though she doesn't have any current plans to head back into space, she would leap at the chance. "Oh, yeah! Yes, yes!" she says with the enthusiasm of an avid fan watching her favorite team score. "But even if I never go again, I know I'm one of the most fortunate people around."

Doctor of Letters

After medical school, Fleming Scholar Rivka Galchen took the road less traveled

In its 60 years, OMRF's Sir Alexander Fleming Scholar program has launched the careers of lots of physicians. But as far as we know, Rivka Galchen is the only one who's also gone on to a career as an acclaimed novelist, short story author, essayist and regular contributor to *Harper's Magazine* and *The New Yorker*.

Galchen grew up in Norman, where her father was a professor of meteorology at OU and her mother a computer programmer at the National Severe Storms Laboratory. Following her graduation from Norman High, she spent the summer of 1994 as a Fleming Scholar in OMRF's labs, working on a lupus project under the tutelage of Dr. Darise Farris.

Farris remembers Galchen as "a character. She was just so full of life. And highly intelligent." Galchen completed all of her scientific projects, "which was key to me," says Farris, "but she had a good time doing it and kept everybody entertained."

Galchen recalls having an affection she describes as "weird" for the equipment and supplies that populated the lab. "I loved the pipets, the beakers, the gels. I only didn't like the radioactive nucleotides and the special lab space devoted to handling anything radioactive." She pauses for a moment, then laughs. "Oh, and I also wasn't a fan of the lab coats."

The summer's most memorable takeaway, Galchen says, was learning that she loved "being around people who really cared about their work." A close second was the geeky humor that permeated OMRF's labs. "We labeled some of the chemicals, 'Do not drink.' "

After graduating from Princeton University, Galchen earned her M.D. at the Mount Sinai School of Medicine in New York. She practiced psychiatry briefly until deciding to change career paths: She completed a master's degree in creative writing at Columbia University, then published her first book, "Atmospheric Disturbances."

OKLAHOMA DREAMING Galchen (blue t-shirt) in OMRF's courtyard with fellow Fleming Scholars in the summer of 1994 and, opposite page, today

In the novel, Galchen wrote from the perspective of a 51-year-old male psychiatrist who believes his beautiful, much younger wife had been replaced by a double. In its review, *The New York Times* called her work a "brainteasing... exploration of the mutability of romantic love" and praised her as a "cerebral, demanding, original new writer." The novel won the William Saroyan International Prize for Fiction. She followed with "American Innovations," a well-received collection of short stories.

> **"I was a fork and not a spoon."**

This past May, she published "Little Labors," which the *Times* described as a "highly original" book of essays and observations about motherhood and babies, topics of some familiarity to Galchen since giving birth to a daughter in 2013. "Having a child is like rereading your own childhood," Galchen wrote recently.

Although Galchen's family moved from Oklahoma following her father's death in 1994 she returned last year on assignment for *The New Yorker.* Her article, "Weather Underground: The arrival of man-made earthquakes," explored the recent rash of tremors in the Sooner State. For the story, she laid aside the distinctive voice (described by one critic as "fantastical, witty and lyrical") that characterizes her fiction and essays. "It was a much more straightforward piece than I'm accustomed to writing," she says. "But I loved going back to Oklahoma."

Although it's been more than a decade since she left medicine, Galchen still sounds a bit torn about her decision. "I used to think of it as finally admitting that I was a fork and not a spoon, and not so great for eating cereal with." But, she says brightly, a fork is "still useful for other things!"

Plus, her time in the lab and clinic helped pave the way for how she approaches her work today. "The writing process at its best resembles the scientific process at its best," says Galchen. "One tries to proceed carefully and with consideration, while also trying to remain open to being totally surprised by what turns up."

OMRF
825 N.E. 13th Street
Oklahoma City, OK 73104

Pioneer Woman

Dr. Mary Carpenter (right) joined OMRF in 1954 as the first female member of the foundation's scientific faculty. A biochemist, she used laboratory rats to study tumor development and the role certain vitamins and hormones played in cancer and other diseases. After more than three decades in the lab at OMRF, Dr. Carpenter retired in 1987.

Photo courtesy of the Oklahoma Historical Society