

FINDINGS

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BOUNCES BACK

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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 Alzheimer's disease, cancer, lupus and cardiovascular disease.



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An OMRF discovery helped bring Rayna DuBose back from death. Then Rayna had to learn to live again.

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The Limits of Medical Research

What if I told you that medical research has done all that it needs to do for heart disease?

That we know enough about the causes of heart attacks that we could virtually eliminate them? That it's time to focus our research resources on other diseases?

You might call me crazy. After all, heart disease is this country's leading killer. Nearly 16 million Americans are living with coronary heart disease. Last year, it accounted for approximately half a million deaths in the U.S.

Yet unlike many of the other leading causes of illness and death (think Alzheimer's and most forms of cancer), researchers already know a great deal about how to prevent heart disease. Even when an individual suffers a heart attack, we have developed quite effective ways to save that person's life and prevent disability.

Unfortunately, much of what we have learned about heart disease is ignored. As a result, although age-adjusted death rates for heart disease have declined in the past few decades, we have not made the progress we could—and should—have made.

If you look closely, there are explanations for the disconnect between what we know and how we're doing. Like so much of what is wrong with health care today, it boils down to a pair of factors: money and human behavior.

For example, fewer than one-quarter of the country's acute care hospitals offer angioplasty, the preferred method of opening blocked arteries. Still, many hospitals will not divert heart attack patients because doing so will reduce their overall Medicare reimbursement rates.

If a patient gets proper treatment within the "golden hour" after the heart attack begins, cardiologists can prevent most, if not all, heart damage. However, only 10 percent of patients even get to a hospital that soon. The single biggest delay? Calling 911,



which doesn't happen until almost two hours after the average heart attack begins.

In the end, only half the people who should be receiving treatment to prevent heart attacks were actually receiving that treatment. Of those receiving treatment, many are not receiving proper treatments; a recent study found that up to 40 percent of heart-attack patients receiving blood thinners were getting the wrong dose. Even among those whose prescriptions were exactly right, as many as half of all patients stop taking many or all of their drugs.

It's enough to make a medical researcher contemplate a career change.

The simple truth is that we can prevent the overwhelming majority of heart disease by controlling three factors: blood pressure, cholesterol and smoking. Eliminating these risk factors eliminates 85 percent of heart attacks.

And even when heart attacks occur, we have the means to treat them effectively and prevent them from recurring.

At OMRF, we will, of course, continue to develop a deeper understanding of heart disease. We also will work to find even more effective ways to predict, prevent and treat this killer.

But if we are to make real headway against heart disease, we also need to confront complacency, denial and ignorance. We need to look at the way health care is paid for. We need to change the way we live. Because at the end of the day, it's not just about learning the secrets of human disease. It's about putting that knowledge to use.

Stephen M. Prescott



Live Long and Prosper

I THINK IT'S EXTREMELY important to show how people from “small town beginnings” can impact the world. I genuinely believe that the youth in these small communities have to have role models to emulate, and having examples such as Dr. Judith James (“Live Long and Prosper,” Summer 2007) is very important. As a newspaper reporter, I find her accomplishments also make my job much easier!

KEN KISER
MEDFORD

THE PROGRESS AND OUTSTANDING achievements of OMRF’s scientists will surely continue to help make Oklahoma one of the top states in the country when it comes to biomedical research. I am so proud to be an OMRF graduate student. And Oklahoma is lucky to have OMRF as a premier jewel of its centennial history, as well. It makes me even prouder to be an Okie—a real Sooner, born and bred!

JANE YACIUK
MOORE

YOU GUYS ARE DOING great work – we appreciate you.

ROLLANN ABBOTT
ALTUS

write to us!

Send your letters to *Findings*, 825 Northeast 13th Street, Oklahoma City, OK 73104 or e-mail us at findings@omrf.org. Please include your name and address. If we publish your letter, you’ll receive an OMRF T-shirt.

MR. SPOCK, I PRESUME

WELL, IT IS LEONARD NIMOY on the back cover of the summer issue of *Findings*. I had long been aware of his reshaped ears, but now—thanks to your photo—I see that the makeup artists added a lot of alien with the diagonal eyebrows. Nothing diagonal about Dr. Tang’s work. I don’t understand why our local TV health stories in Ohio don’t pick up on it. Maybe I can get this whole issue of *Findings* into the hands of the local news anchor who reports almost daily on medical breakthroughs.

WILLIAM R. BROWN
WORTHINGTON, OHIO

The Downside of DNA?

In the “Live Long and Prosper” article (Summer 2007), there is a statement that was discussed in a continuing education class for my health insurance license. If someone has a genetic test for a disease, the result may eventually become part of the Medical Insurance Bureau files and shared with participating carriers. This poses quite a dilemma for applicants. So what does one do?

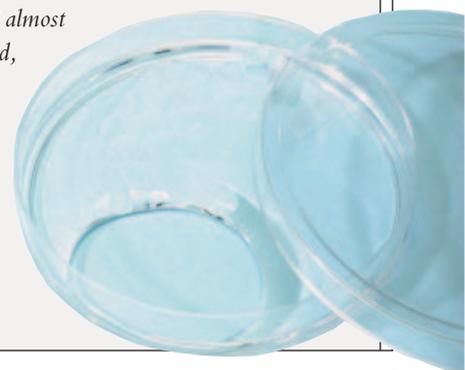
CHERYL HIATT
BRAMAN

Findings editor (and OMRF general counsel) Adam Cohen responds:

The federal Health Insurance Portability and Accountability Act of 1996 offers some protections, limiting the collection of genetic information by insurers and prohibiting them from requiring an individual to undergo a genetic test. The act also forbids insurers from using genetic information to charge groups higher rates for health insurance and curbs insurers’ ability to disclose any genetic information in their possession.

For over ten years, Congress has considered additional legislation to ensure comprehensive protection for all Americans.

Although such efforts have received almost unanimous support, they have failed, as of yet, to become law. Currently, three different congressional committees are considering the bill. In the meantime, numerous state legislatures have enacted genetic nondiscrimination laws. Oklahoma, however, has not.



A Lesson in Philanthropy



Lois Thomas (right) at the 2004 Putnam City North Cancer Carnival with student chair Jamia Rowland

Lois Thomas couldn't have stood much more than five feet tall. But when she passed away in August, a month shy of her 89th birthday, Oklahoma philanthropy lost a giant.

In the mid-1970s, cancer took a heavy toll on Thomas' fellow teachers at Putnam City High, killing four in a single year. "I remember as a kid when FDR asked us to collect nickels and dimes for polio," Thomas told *Findings* in 2004. "So I thought, let's do the same thing with cancer." Thus began the Putnam City Cancer Drive.

With the help of fellow journalism teachers throughout the district, Lois organized a change drive. Soon, an army of Putnam City students was going door-to-door, fighting cancer one cup of change at a time. At the end of the year, Thomas and the students donated all the funds they had collected to support cancer research to OMRF.

That was 32 years ago. With Thomas at the helm, the effort evolved from a simple change drive to a multifaceted, district-wide extravaganza that now involves bake sales, garage sales, car washes, volleyball marathons, battles of the bands, dances and just about any other fundraising method young minds can dream up.

Last year, Putnam City students donated \$116,000 to cancer research at OMRF. That brought their donations since 1975 to an eye-popping total of \$2.6 million, all of it helping OMRF scientists to make important inroads in understanding, diagnosing and treating a deadly disease.

Thomas retired from teaching in the 1980s and survived a bout with cancer herself. Still, she remained deeply involved with the cancer drive until her final days. "It thrills me to see the dedication these young people display year after year," said Thomas. "These students want to leave their mark on a cure for cancer, and they are succeeding."

Like all good teachers, Thomas imparted lessons that went well beyond the classroom.

"She taught her students to give without the promise of anything in return," says OMRF Vice President of Development Penny Voss. "That lesson alone is priceless."

LIKE ALL GOOD TEACHERS, LOIS THOMAS IMPARTED LESSONS THAT
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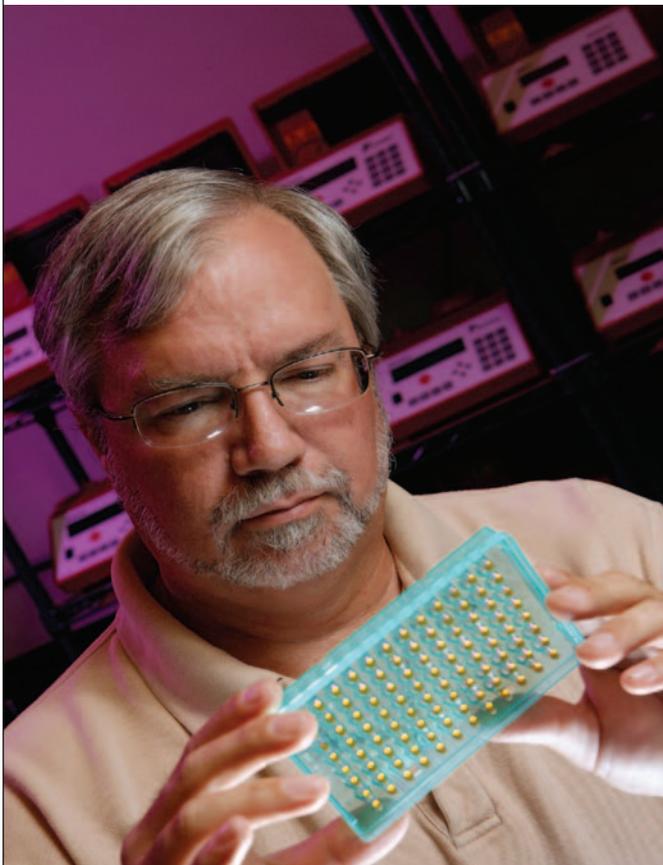
With a Little Bit of Luck

A dash of serendipity and a lot of dying worms may open new treatment doors for a dizzying array of deadly illnesses.

Studying tiny roundworms, researchers at OMRF, the University of British Columbia and the University of Pittsburgh School of Medicine have discovered a protein that may play a key role in the cell and tissue death process known as necrosis. That process, long thought to be chaotic and irreversible, is associated with illnesses ranging from heart disease and stroke to Alzheimer's.

The new findings, published in the scientific journal *Cell*, show that necrosis might, in fact, be controlled by a protein known as SRP-6. If researchers can harness SRP-6, the protein could hold the key to halting cell death in neurological illnesses like Alzheimer's, Parkinson's and Huntington's and also to new treatment paths for cancer, heart disease and various bacterial illnesses.

Researchers made the discovery in studies of a microscopic worm called *C. elegans*. With a tiny, translucent body and only 959 cells, the worms are frequently used for medical research.



In the new research study, using a complex process to isolate and then remove certain genes, OMRF's **Dr. Robert Barstead** and Gary Moulder generated genetically modified "knock-out" worms that lacked the SRP-6 protein. When a collaborator at the University of Pittsburgh was collecting specimens of the worms—by chance using water instead of the more commonly used saline—he noticed that the genetically modified worms were dying in droves, while their normal counterparts remained healthy.

After additional investigation, the scientists determined that necrosis spurred by shock from the water was killing the worms that lacked the SRP-6 protein. The normal worms survived because the protein protected their cells.

"This discovery could translate into treatments for human disease," says Barstead, who holds the G.T. Blankenship Chair in Alzheimer's and Aging Research at OMRF.

Armed with the knowledge that SRP-6 protects against cell death, physicians could manipulate the levels in patients with certain diseases. For example, physicians could boost levels of the protein in patients suffering from neurological or cardiovascular disease to halt the process of necrosis. Conversely, in cancer patients, doctors could deprive cancer cells of SRP-6, making those cells easier to kill.

"The next piece of this puzzle will be to find compounds that either activate or block SRP-6," says Barstead. "If researchers can identify compounds that target this protein, it will put us a step closer to effective therapies for many life-threatening human illnesses."

Soldiering on

As a soldier in World War II Italy, Clifford Hansen earned a Silver Star, a Bronze Star and a coveted Purple Heart for his bravery on the battlefield. But in the end, the war hero turned his zeal toward the fight against disease.

When Hansen, 88, died in 2006, his will stipulated that his entire estate go to support medical research at OMRF. In September, after wrapping up Hansen's affairs, the trustee of his estate presented OMRF with a check for \$259,000—as well as Hansen's beloved collection of toy soldiers.

"That was his long-term plan," says Donna Hansen, whose late husband was Hansen's cousin. "Cliff had always felt that research was important and should be supported, and he made it known that his estate would be designated in that way."

Maribeth Ford Pate, Hansen's niece, says the gift reflected her uncle's affection for his lifelong home. "He so loved and believed in Oklahoma and Oklahoma City. He wanted Oklahoma to thrive, so he gave to OMRF to keep his money here."

Born in 1918 in Elgin, Hansen enlisted in the U.S. Army in 1941. Following his return to the states, he married the former Mattie Ford in 1949. They settled in Oklahoma City, where he forged a career

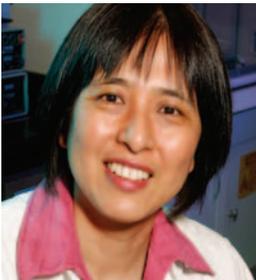
as a graphic artist. The couple, who had no children, remained married until Mrs. Hansen's death in 2003.

One of Hansen's loves was collecting tiny military replicas and accessories, and over his lifetime he amassed more than 1,200 lead soldier figurines. The collection, valued at approximately \$40,000, became part of the estate gift to OMRF.

"This is a wonderful, one-of-a-kind gift," says Laura Lang, OMRF's director of planned giving. "We're touched not only by Mr. Hansen's generosity but also by the way in which this gift speaks of the unique character of the person who gave it."



OF NOTE



Dr. Xiao-Hong Sun

In the Oct. 1 issue of *Blood*, Sun detailed the discovery of how a certain protein regulates adult stem cells in the body. The work, says Sun, "holds a great deal of therapeutic potential for cancer patients who undergo chemotherapy and those with immune diseases and leukemias."



Dr. Melissa Alcorn

OKC Business honored Alcorn as one of its "Forty Under 40." A patent attorney in OMRF's technology transfer office, Alcorn earned her Ph.D. in immunology at OMRF before obtaining her law degree from the University of Oklahoma.



At the Public Relations Society of America's Upper Case Awards, *Findings* took home top prize in the magazine category. OMRF also won a blue ribbon for its annual report, which garnered the Best in Print Category award for all publications.



Dr. Stephen Prescott

The Greater Oklahoma City Chamber of Commerce has elected Prescott to its board of directors. OMRF's president will serve a three-year term that begins on Jan. 1, 2008. The chamber counts approximately 4,000 members.



Ann Alspaugh

An OMRF director since 1982, Alspaugh was inducted into the Oklahoma Commerce and Industry Hall of Honor at Oklahoma City University on Oct. 22. At the ceremony, she received the Paul Strasbaugh Lifetime Achievement Award, which is named after her fellow OMRF director.

Dr. Robert Barstead, *A Gene Knockout Resource for C. Elegans*, National Human Genome Research Institute

Dr. Dean Dawson, *The Role of SLK19 in Mitotic Cell Cycle Progression*, Oklahoma Center for the Advancement of Science and Technology

Dr. Michael Dresser, *Mechanism of Force Generation at Telomeres*, Oklahoma Center for the Advancement of Science and Technology

Dr. Darryll Dudley, *Role of E Proteins in Thymocyte Selection and Beyond*, National Institute of Allergy and Infectious Diseases

Dr. Patrick Gaffney, *Genetic and Functional Studies of the CD40 P227A Polymorphism*, National Institute of Arthritis and Musculoskeletal and Skin Diseases

Dr. John Harley, *Molecular Mechanisms and Genetics of Autoimmunity*, National Center for Research Resources

Dr. Kenneth Hensley, *Tocopherol Metabolites in Diabetic Hypertension*, American Diabetes Association

Dr. Ute Hochgeschwender, *Genetic Analysis of Pro-opiomelanocortin Peptides*, National Science Foundation

Dr. Judith James, *Science in a Culture of Mentoring*, National Center for Research Resources

Dr. Corey Johnson, *Lipid Raft Regulation of PIP2 Signaling in T Cells*, American Heart Association

Dr. Chandrashekhar Kamat, *Tocopherols in Cardioprotection*, Oklahoma Center for the Advancement of Science and Technology

Dr. Susan Kovats, *Estrogen Regulates Dendritic Cell Differentiation*, Oklahoma Center for the Advancement of Science and Technology

Dr. Cristina Lupu, *Functional Regulation of TFPI in Membrane Lipid Raft/Caveolae*, American Heart Association

Dr. Florea Lupu, *Blocking Nuclear Import of HIF1 Alpha as Therapy for Sepsis-Associated Vascular Thrombosis*, American Heart Association

Dr. Satoshi Matsuzaki, *Mechanisms and Consequences of Mitochondrial Complex I Inhibition During Cardiac Ischemia and Reperfusion*, American Heart Association

Dr. Rodger McEver, *Post-Translational Modifications in Host Defense*, National Center for Research Resources; *Protein-Glycan Interactions in the Vascular System*, National Heart, Lung and Blood Institute

Dr. Kenneth Miller, *Identification of Synaptic DAG Effectors and Regulators*, Oklahoma Center for the Advancement of Science and Technology

Dr. Kevin Moore, *Mechanism for Hypothyroidism in TPST-2 Deficient Mice*, Oklahoma Center for the Advancement of Science and Technology

Dr. Kathy Moser, *Gene Mapping in Women with Systemic Lupus Erythematosus*, National Institute of Arthritis and Musculoskeletal and Skin Diseases; *Gene Expression Profiling in Sjögren's Syndrome*, National Institute of Arthritis and Musculoskeletal and Skin Diseases; *Isolating the Human SLE Susceptibility Gene on Chromosome 16Q13*, Arthritis Foundation

Dr. Susannah Rankin, *Sororin, Chromosome Cohesion and Cell Cycle*, Oklahoma Center for the Advancement of Science and Technology

Dr. William Rodgers, *GEM Domains and T Cell Signaling*, National Institute of General Medical Sciences

Dr. Hal Scofield, *Genetics of Severe SLE Defined by Thrombocytopenia*, National Institute of Arthritis and Musculoskeletal and Skin Diseases



Dr. Deborah Stearns-Kurosawa, *In Vivo Localization of Anthrax Toxins by MRI*, Oklahoma Center for the Advancement of Science and Technology

Dr. Luke Szweda, *Pro-Oxidant Activation of Lon Protease: Removal of Oxidatively Modified Mitochondrial Protein During Cardiac Reperfusion*, American Heart Association; *Modulation of Mitochondrial Function by Pro-Oxidants*, National Institute on Aging

Dr. Jordan Tang, *Beta Secretase Inhibition for Treating Alzheimer's Disease*, National Institute on Aging

Dr. Rheel Towner, *Inhibition of INOS in Malignant Gliomas*, Oklahoma Center for the Advancement of Science and Technology

Dr. Andrew Westmuckett, *The Role of Tyrosine Sulfation in Atherosclerosis*, Oklahoma Center for the Advancement of Science and Technology

Dr. Lijun Xia, *Role of Intestinal O-Glycans in the Pathogenesis of Ulcerative Colitis*, Crohn's and Colitis Foundation of America

Grants Awarded May-August, 2007



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come b

**An OMRF discovery helped
save Rayna DuBose from death.
Then it was up to
Rayna to rebuild her life.**

By Adam Cohen

Backkid

Rayna DuBose never was afraid of the boys. Even back when she was nine years old, she'd get out on the basketball court and mix it up with them. Sure, she had a pony tail. And, yes, most were older than she was. But she stood half a head taller than most of them. And she had those moves.

You might not expect it from looking at her—the height, the powerful frame—but on the court, Rayna leaped and spun and darted between defenders like a ballerina. Like the ballerina she'd been until she traded in her tutus and toe shoes for a pair of Air Jordans. Just like her big brother, Quinton.

Maybe it had been watching Quinton, who'd gone off to Providence College on a basketball scholarship, that had fueled Rayna's hoop dreams. After all, as Rayna's pediatrician would remind her each time she came for a visit, "There's not a whole lot of hollering and screaming in ballet."

At first, those boys wouldn't pass her the ball. But in her second game, she snagged a loose ball and put it through the hoop. A moment later, she did it again. Her last basket that day was the game winner. After that, the boys couldn't get the ball to Rayna enough.

You could almost trace a straight line from that first basket to a decade later, when she came off the bench for Virginia Tech to score 13 points against the University of Vermont in the National Invitational Tournament. She was only a freshman, but she was beginning to shine. She was starting to show her coach, who called Rayna her “little ballerina,” what she could do. Soon, those passes would be coming her way again. Just like in those youth leagues. Just like when she led Oakland Mills High to the Maryland state championship.

But those next passes took a long time coming. They waited for Rayna to battle bacterial meningitis and sepsis within an inch of her life. They waited for her to spend three weeks in a coma, ninety-seven days in an intensive care unit. To endure months upon months of grueling, painful rehabilitation.

Still, Rayna would not be denied. A year and a half later, she'd be back at practice. Grabbing rebounds. Working with the post players. Even catching passes. Only thing was, with the prosthetic legs, there would be no more pirouettes. And those passes, they were much tougher to catch with her new pair of hands.

sepsis

SEPSIS IS LIKE THE SIXTH MAN of human disease. It never starts *the* game. Instead, it waits for some other malady—pneumonia, a bacterial infection—to take hold, then it comes off the bench and finishes the job.

Most of the time, a person is able to fight the infection and keep it from spreading. But in sepsis, for reasons still not fully understood, the infection moves into the bloodstream.

The body responds by calling in its heaviest artillery: an overwhelming, system-wide counterattack. Blood vessels become inflamed, and their cell walls leak fluid. The clotting system goes awry, simultaneously causing bleeding and throwing clots that block the tiny blood vessels that feed organs. In trying to beat back infection, the body's explosive response often proves at least as devastating as the bug itself, causing tissue death and multiple organ failures. All told, a third of the 750,000 Americans per year who develop sepsis die, a toll that equals that of heart attacks, or of all deaths from breast, colon, prostate and pancreatic cancers combined.

Perhaps most frightening is the swiftness with which sepsis can move. In hours or a few days, the illness can kill. Doctors have a saying for it: “Fine in the morning, dead in the evening.”

FOR RAYNA, LIKE MOST VICTIMS of sepsis, the nightmare began routinely enough. It was April of 2002, near the end of her freshman year at Virginia Tech. After classes one Monday, she headed to the weight room, where she launched into a typical off-season workout.

Except by the time she was finished, Rayna was wiped out. In the locker room, she lay down on a couch and fell asleep. With her friends' help, she eventually dragged herself to study hall, propping herself up against the wall the whole way. When an academic adviser found Rayna sprawled on the floor of study hall, sweating buckets, she called a doctor. Minutes later, an ambulance rushed Rayna to the Montgomery Regional Hospital.

Rayna had no idea of the ordeal that would follow. But to this day, she says, “That was my scariest moment. That first night when I collapsed in study hall and was taken to a hospital.” One morning, she was a healthy, strong Division I scholarship basketball player. By that evening, she was lying in a hospital bed, an IV drip in her arm. And she had no idea what was wrong with her.

At first, the IV seemed to do the trick, and the hospital discharged Rayna that night. But by the next morning, she'd gone downhill again. It was team picture day, but Rayna was too weak to dress herself. She sweated through her uniform. By Tuesday night, she was back in Montgomery Regional Hospital.

At 2:00 that morning, a doctor called Rayna's parents, Willie and Andrea DuBose. Your daughter's white blood cell count is off the charts, he told them. It looks like she has bacterial meningitis.

Meningitis is an infection of the fluid of the spinal cord and the fluid surrounding the brain. With symptoms that include drowsiness, headache and fever, it appears for all the world like the flu. Even if left untreated, most people will recover from the viral form of meningitis in a week or so. But a second, rarer strain of the illness can kill its victims in hours. That type is caused by a bacteria rather than a virus. And that's the form of meningitis Rayna had contracted.

The doctor told the DuBoses that their daughter was being flown to Virginia for emergency treatment. And that she might not make it through the night.



Rayna DuBose leads her high school team to the 1998 Maryland state championship.

KARL MERTON FERRON

Rayna

For weeks, Rayna didn't even know that her friends and family were there, keeping vigil by her hospital bed. Hoping against hope that she'd open her eyes.

THE NEXT THREE WEEKS of her life are nothing but empty pages to Rayna. Dr. Adam Katz, though, will remember that time for the rest of his days.

Katz had become an attending physician in the University of Virginia Hospital's department of plastic surgery only a week before. When he was called in to consult on Rayna's case, he found a situation that makes a young doctor wish he'd chosen to go to law school.

Rayna had slipped into a coma. She was on a breathing tube, and sepsis had taken hold. Bacterial toxins had flooded her circulatory system. Her blood pressure was dangerously low, and the blood vessels in the peripheral areas of her body—the arms and legs, the bones, muscles and tendons—were shutting down to maintain blood flow to vital organs like the brain, heart and lungs. Her brain had swelled, her kidneys had failed and she'd suffered a heart attack. Plus, gangrene had set in, turning her extremities completely black.

"As a surgeon, I was torn," says Katz. "Of course, I wanted her to survive. But I knew that if she did live, I was going to have to remove all of her fingers and toes." Katz had never before performed an amputation, and it was not a prospect he relished. He worried about the quality of life that Rayna would enjoy following the surgery, especially with a heart, brain and kidneys that may already have suffered irreparable damage. For the time being, though, the young surgeon decided, there was nothing much he could do. "If she survived, she'd be facing a lot of surgery." But, he says, "I didn't think she was going to survive."

IF YOU ASK RAYNA what saved her life, she'll tell you she doesn't know. She was in a coma, after all. But when traditional sepsis treatments—antibiotics, fluids, a ventilator—failed to stem the illness, her physicians turned to a new medication: Xigris. It was the last, best chance to save her young life.

During the previous two decades, more than 20 experimental drugs in more than 30 studies failed to show any benefit against sepsis. But in the fall of 2001, the Food and Drug Administration approved Xigris, a synthetic version of a human protein. The drug, biologically engineered and manufactured by Eli Lilly and Company, has its roots in the work of a pair of OMRF scientists, Drs. Charles Esmon and Fletcher Taylor.

Through more than a decade's worth of research at OMRF, Esmon and Taylor discovered a method of controlling the body's clotting cascade through the use of an activated protein. Eli Lilly built on this research to create Xigris, which works by helping to normalize the body's clotting system and calming inflammation.

Eight years of clinical trials culminated in a large, multi-center study that found the drug reduced mortality among the most severe sepsis patients by 24 percent.

After Rayna's physicians treated her with Xigris, nothing at first seemed to change. She still lay motionless, surrounded by flowers and teddy bears sent by her friends and teammates. Her family—her father, her mother, her brother, Quinton—continued to keep a vigil by her bedside. They waited. They hoped. Still, as time passed, they began to prepare themselves for the worst.

But then something unexpected happened. Rayna blinked. And then she blinked again. Her eyes were so bloodshot, she hardly looked like herself. With the breathing tube deep in her



NANINE HARTZENBUSCH

throat, she couldn't speak. Soon, though, she was opening and closing her eyes—once for yes, twice for no—in response to questions. She even stuck her tongue out at her coach.

Rayna was back. Her brain function appeared normal. Smiles lit a room that had seen more than its fair share of tears.

"It was a great moment, and we were full of joy," says Andrea DuBose. "But the next moment, we were afraid again."

They had good reason to be frightened. Because Dr. Katz had told Andrea and Willie what was coming next.

"WILL I BE ABLE TO PLAY BASKETBALL AGAIN?"

That was the first question Rayna asked Dr. Katz when he told her that he'd have to amputate her hands and feet.

He explained that the prolonged loss of circulation to her extremities had caused the tissue in her hands and feet to die.

Hands and fingers that once had arced effortless jump shots had become withered and useless. Feet that had sprung her skyward, where she'd tear rebound after rebound from the backboard, now made an empty, thudding sound when her doctors rapped their knuckles against them.

"Her tissues," says Katz, "had literally mummified."

Rayna refused to look her surgeon in the eye as he walked her through the procedure she'd soon undergo. Her head swam, and she tried to tune him out. What about her exams? And the next year, the Virginia Tech basketball team was traveling to Australia for a tournament. She had to go.

She heard the surgeon saying something about prosthetics. Prosthetics? It was all too much. She dissolved in sobs.

How had it come to this?

WHEN RAYNA AWOKE FROM surgery, both of her hands and both of her feet were gone. The tissue death had been so extensive that they'd been forced to amputate just below her knees and elbows. To this day, it is the only quadruple amputation Katz has ever performed.

Yet Rayna was far from done.

Katz performed a series of follow-up surgeries to reconstruct the patchwork of tissue that remained in her forearms and lower legs. Rayna also underwent a series of skin grafts. One of her elbow joints became infected with an antibiotic-resistant infection, and it looked like the surgeon would have to amputate the elbow. But another operation—this one temporarily

grafting her elbow to her chest wall to form new blood vessel connections—saved the elbow.

Those were dark days. Rayna mourned for the loss of her limbs and her life as she knew it. And the pain could be excruciating. Sometimes, it all seemed like too much to bear.

One night, Willie and Andrea DuBose were awakened by a phone call to their hotel room. When Willie picked up the receiver, he heard shrieking. It was Rayna, screaming uncontrollably. The physical pain, the anguish—it had overcome her.

Willie and Andrea rushed to the hospital. They tried to talk to their daughter, but she wouldn't calm down. She wouldn't stop thrashing and wailing. Finally, Willie climbed into Rayna's bed and held her still. He patted her hair, rubbed her shoulder. Eventually, she grew quiet.

starting over

NINETY-SEVEN DAYS AFTER she came to the University of Virginia Hospital, the unthinkable happened: Rayna left. Against all odds, she had survived. And then she had to re-learn everything.

It took months for her new prosthetics, custom-fit and built of a soft plastic that mimics human flesh, to arrive. In the meantime, Rayna had to make do with a wheelchair and a pair of arms that, in place of hands, had hooks that she opened and closed by rolling her shoulders.



It takes Rayna about an hour to get up, wash herself, put on her prosthetics and fix her hair each morning.

Her twice-weekly therapy sessions were punishing, making her days as a Virginia Tech athlete pale in comparison. She struggled to build the muscles and the coordination she needed to do tasks that had once seemed so simple—things like brushing her teeth, taking a shower, feeding herself.

Frustration was her constant companion in those days. “I was helpless,” Rayna remembers, “but I didn’t want others to think that.” She raged against her condition. And no matter how often it was offered, she refused help.

When Rayna’s new arms finally came, they were, well, mismatched. You see, Rayna is African-American, and the arms were Caucasian. Everybody had a good laugh about that one, and a new pair soon came.

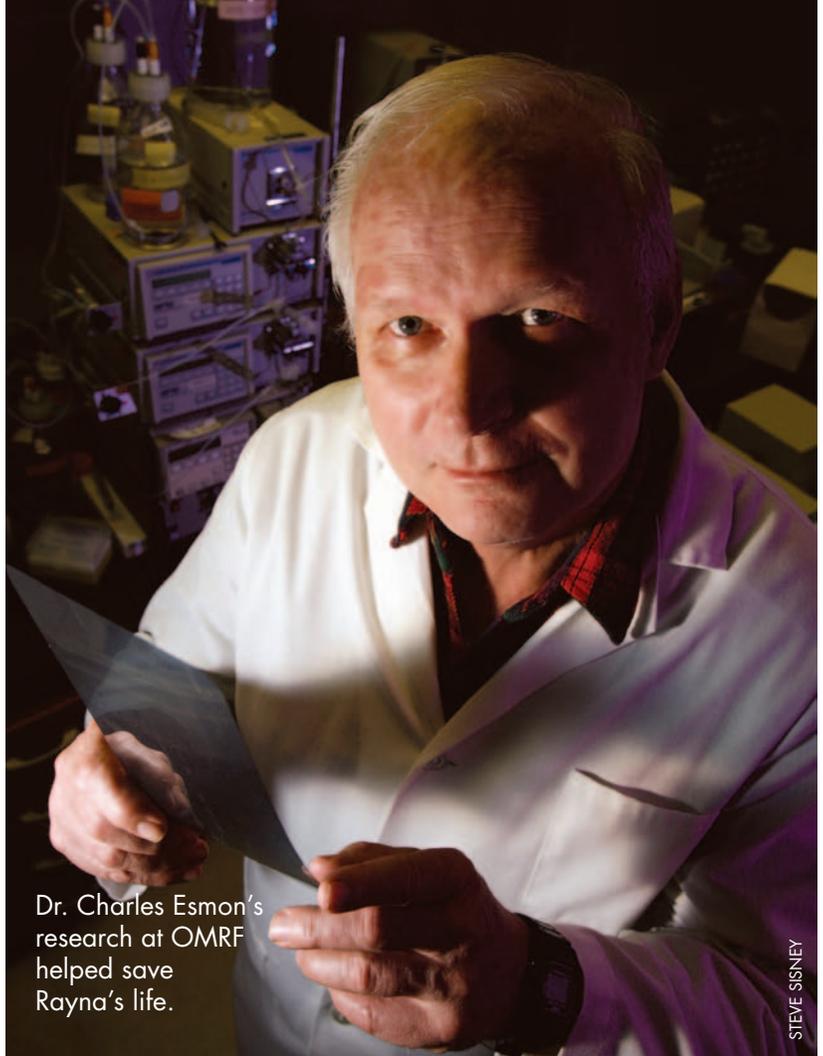
Yet the moment that brought tears to everyone’s eyes was when Rayna set out to take her first, wobbly steps on her new legs. The prosthetics were mis-sized, adding three inches to her former height of six-foot-three. Still, that didn’t stop her. Sweat pouring from her brow, she looked like she’d fall forward with each baby step. But she didn’t. Instead, she inched across the room, her dad supporting her for balance.

For the first time in almost a year, Rayna was walking.

IF YOU ASK RAYNA, not much has changed in her life since meningitis and sepsis stole her hands and feet five years ago. “I can do everything on my own,” she says. And that’s pretty much true.

Every night, she takes off her prostheses and sets them on the edge of her bed. When she gets up, she just slides into them. It’s pretty simple—there’s a suspension sleeve that she rolls up to suction the prosthetic to her leg, just below the knee. Then she straps on a pair of “body-powered” arms for her morning shower. They’re not electrical, which is good when you’re drenched in water, and she can control them by flexing the muscles in her back.

Once she’s dried off, she switches to her myoelectric arms, which attach at the bones on her elbows. Rayna controls these electrically powered prostheses with the muscles in her forearms, allowing her to pinch, grip, and release objects. At first, she couldn’t do much of anything with them. Couldn’t brush her teeth or make a sandwich or even push her glasses up her nose. But with focus and hard work, she mastered all those tasks and many more. Today, she dresses herself and makes her own meals. Most mornings, it takes her about an hour to get ready. Which is okay, she says, “because I’m not a morning person anyway.”



Dr. Charles Esmon’s research at OMRF helped save Rayna’s life.

STEVE SISNEY

She got a pair of prosthetic legs that fit properly, and those first baby steps quickly became regular strides. Now, she says, “Most people can’t even tell I have prosthetics.”

Rayna loved the special pair of feet that she could adjust with the push of a button to wear heels. She used that feature so much she wore it out. Now she’s on her second set of adjustable feet.

She still loves to go out, “to dress up all girlie,” as her mom says. Put on a cute skirt, heels and earrings, then head out with her friends to listen to music and dance. At first, doing her hair was a problem—the prosthetic hands lacked the necessary dexterity to put together the intricate hairstyles Rayna favored. But with time, she found a style she could do herself.

She dates occasionally. “Just nothing serious,” she giggles.

For a while, when folks would ask her whether she could drive, she’d tell them yes. Then she’d give a big grin and say, “just not legally.” But now, she’s legal. She has a license and a Saturn Vue, and most of the time she keeps it under the speed limit.

“The only thing fancy about my new legs is a button that lets me change the angle of the feet. I was just so excited I could wear heels again.”

Fearless

“I learned more from Rayna than from any patient I’ve ever worked with. **She taught me about courage. About inspiration. About having the spirit to fight.**”

RAYNA FIRST RETURNED TO VIRGINIA TECH for a weekend in the fall of 2002. At the homecoming football game, she got a standing ovation from the crowd of 65,000 at halftime. Students wearing tee shirts bearing her jersey number—15—raised \$50,000 to help with her medical expenses, and an anonymous donor later kicked in another \$50,000.

A month later, she was in Blacksburg again, this time sitting on the bench as her women’s basketball teammates battled the University of North Carolina-Greensboro. During a timeout, Rayna tried to stand up, lost her balance and teetered backwards into her chair. A moment later, she was up again, walking to the huddle. “Did you see that?” Willie DuBose asked his wife. “She’s fearless.”

Her friends, her teammates, her family—all quickly learned to treat her just like when her arms and legs were made of human flesh. Not to show her any pity. Rayna made it crystal clear that she didn’t want any help unless she asked for it. So, no matter how much they’d want to lend a hand, they wouldn’t. They’d watch her grow tense and struggle for 5, 10, 15 minutes

as she tried to get her shoes on over her rubber feet. Finally, sweating and frustrated, she’d say, “Well, aren’t you going to help?”

And they’d say, “Not unless you ask.”

Then everyone would have a good laugh.

IN MAY 2003, ONLY A YEAR after her amputations, Rayna came back to Virginia Tech for good. Refusing to live in the handicapped-accessible dorm room on the ground floor as her parents urged, she instead took an off-campus apartment with a pair of teammates. The place wouldn’t be ready for another month, so she spent the first month at a temporary apartment at the bottom of a steep hill. The bus stop that Rayna would use was a half-mile away, straight up the hill. When Willie first saw that hill, he just shook his head. “I don’t see how she can do this,” he said at the time. “She’s going to fall down, and we’re never even going to hear about it.”

Maybe she fell down. Maybe she didn’t. But Willie and Andrea DuBose never did hear about it.



In 2003, Rayna rejoined the Virginia Tech women’s basketball team as a student assistant coach.

NANINE HARTZENBUSCH



NANINE HARTZENBUSCH

Rayna and her friend Monique Cook share a laugh after Rayna's return to Virginia Tech.

Those next four years went fast. Rayna kept her scholarship, and she rejoined the basketball team as a student assistant coach. Whatever the team did, she did. She helped out in the low post, playing defense like the dominating center she'd once been. She'd grab rebounds, run the floor with her teammates. She'd work out with them in the weight room. And when they were doing drills she couldn't, she'd cheer.

She attended the games, traveled with the team on road trips. She still felt like part of the team. And she was.

RAYNA GRADUATED FROM VIRGINIA TECH in May with a degree in consumer studies. Of course, her mother wanted her to come back home to Maryland. But Rayna did what most 23-year-olds do in that situation: She refused.

Instead, she decided to stay in Blacksburg. She got an apartment with a friend and a part-time job as a study-hall monitor to generate some cash. She hits the gym three times a week, riding a stationary bike or working out with a personal trainer. She travels a lot, to West Virginia, North Carolina, Maryland and Atlanta, mostly to visit friends and family. And she's been working on her website (raynadubose.net) and building toward a longer-term goal—a career as a motivational speaker.

"I want to tell people about surviving meningitis. About living with prosthetics. I want to help inspire new people."

She's already had a few gigs, speaking to high schools and middle schools, to a group of physicians. And whenever her doctor has an amputee who's not doing too well, Rayna's there to give a pep talk.

"I stay busy trying to make other people happy," she says.

But can't that get to be a burden, trying to keep up a brave face when you've been through so much?

Rayna gets quiet for a moment. "I don't want to say that it puts a lot of pressure on me, but it does."

She still sees her doctors regularly, and she says that her overall health shows no lingering effects from her bouts with meningitis and sepsis. Miraculously, her heart and her kidneys are fine.

The phantom pains, the ones that struck where her arms no longer were, they've passed, too. Or maybe Rayna just doesn't talk about them any more. With someone as stubborn and strong as she is, it's hard to tell.

THOSE BOYS WHO WOULDN'T PASS her the ball all those years ago, they learned that Rayna wouldn't take no for an answer. That there was no quit in her. And the day that she walked back onto the Virginia Tech court, told her coach that she was ready to go, Rayna's teammates learned that, too.

These days, Rayna still finds her way down to the hardwood at Cassell Coliseum every once in a while. She'll stride onto the court on those legs made of rubber and titanium, pick up a ball. No longer can she feel the little bumps on the surface, no longer do her fingers sense the smooth rubber creases that break up its orange face.

Yet even with those unfeeling prosthetic fingers, she's taught herself to dribble again. To make her way up the floor, like she used to when thousands of Blacksburg faithful would empty their lungs, crying for another Hokie hoop. Except now, save for the plomp, plomp, plomp of Rayna's bouncing ball, the arena is silent.

At the foul line, she'll stop. She'll spread her feet, swing the ball down below her waist, then launch it. "A granny shot," she calls her underhand release. It's a far cry from the finger rolls she once laid in, from the jumpers she used to fire from beyond the three-point line. But you know what? No matter how it's launched, the ball still makes that same soft swish through the cotton of the net when it falls through the hoop.

And, says Rayna, "My granny shot will go in all day." 

MIGHTY MICE



How do you study humans without studying humans? With mice, of course! These living test tubes closely mimic the genetic makeup of humans—95 percent close, in fact. And their small size and short gestation period make them ideal models for studying human disease.

But in research, the garden-variety rodent doesn't make the cut. Technological advances have made it possible for scientists to actually design mice with very specific genetic codes. In October, the 2007 Nobel Prize in medicine was awarded to a trio of scientists who developed the immensely powerful “knockout” technology, which allows researchers to create animal models of human disease in mice by removing genes. Scientists also have since developed the capacity to add genes. The outcome is a mouse that exhibits traits of human disease, generation after generation.

Researchers at OMRF have bred countless variations of these furry critters, including models of Alzheimer's, Huntington's disease and heart disease. Called “transgenic” mice, they're sent to labs in 26 states and 14 foreign countries to help researchers learn more about human illnesses and how they behave in a living creature.

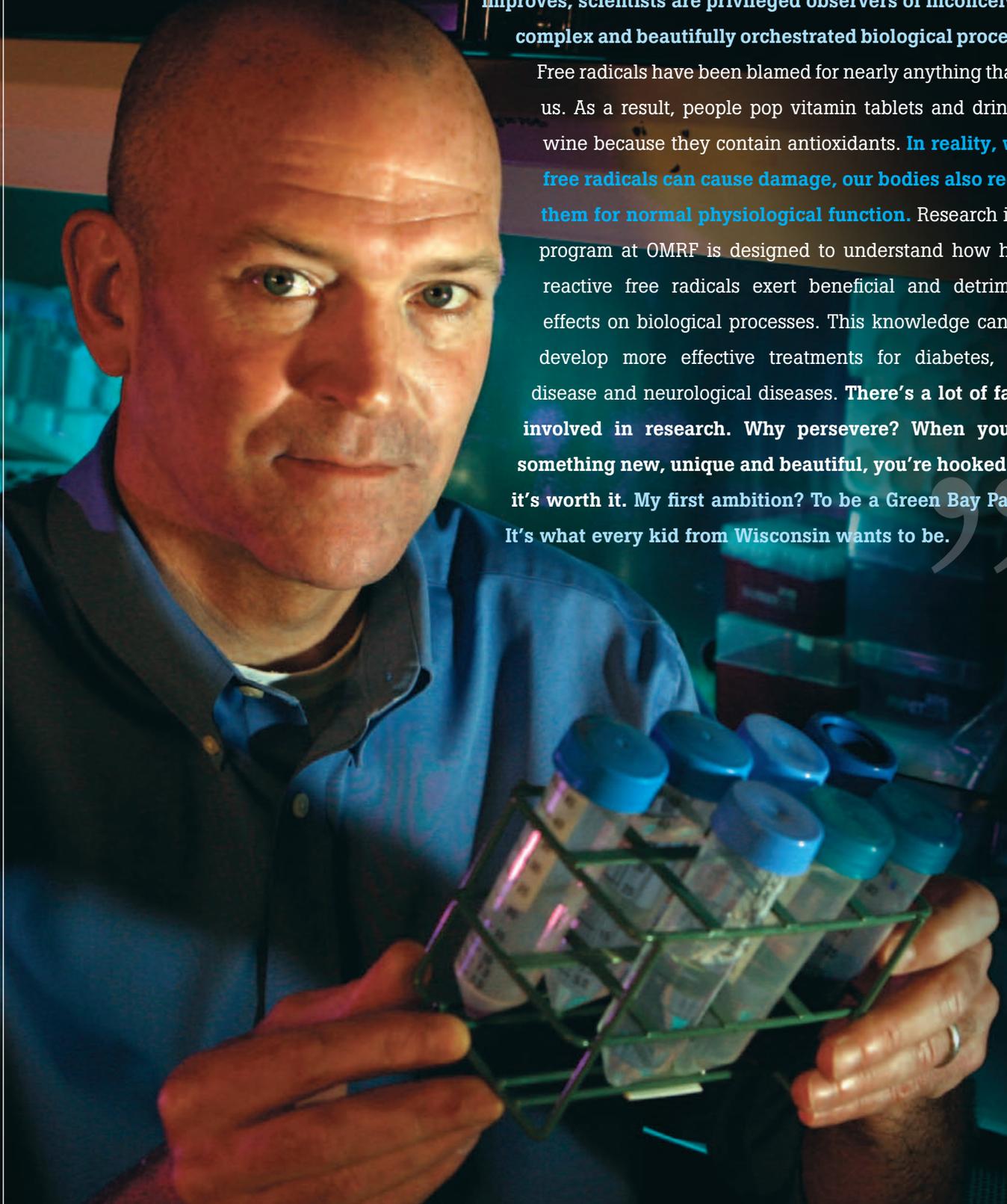
For example, OMRF's Dr. Linda Thompson spent nearly a decade and more than \$500,000 fashioning a knockout mouse lacking a particular enzyme. She used the mice for her own research, but soon, scientists at other institutions got wind of her mouse (which she named Hope). Those researchers found Hope's children to be perfect tools for studying multiple sclerosis, inflammation and a host of other biologic processes. Today, Hope's great-great-grandmice travel to labs as far away as Shanghai and Melbourne to help other scientists battle human disease. 

The Gospel According to Luke (Szweda)

Head, OMRF Free Radical Biology and Aging Research Program

“Science is essentially an attempt to observe and describe the things our limited senses can’t detect or predict. **As technology improves, scientists are privileged observers of inconceivably complex and beautifully orchestrated biological processes.**

Free radicals have been blamed for nearly anything that ails us. As a result, people pop vitamin tablets and drink red wine because they contain antioxidants. **In reality, while free radicals can cause damage, our bodies also require them for normal physiological function.** Research in our program at OMRF is designed to understand how highly reactive free radicals exert beneficial and detrimental effects on biological processes. This knowledge can help develop more effective treatments for diabetes, heart disease and neurological diseases. **There’s a lot of failure involved in research. Why persevere? When you see something new, unique and beautiful, you’re hooked. And it’s worth it. My first ambition? To be a Green Bay Packer. It’s what every kid from Wisconsin wants to be.**”



A LOOK BACK **back**

When Sir Alexander Fleming, the British Nobel laureate who discovered penicillin, made his only two trips to America, OMRF was on his itinerary. In 1949, he pronounced the future bright for what was, in his words, "just a big hole in the ground." Six years later, he was back at the research institute he'd dubbed "his baby."

Besides OMRF, there was another constant in Sir Alec's visits. Each time, he stayed in an elegant, old Oklahoma City hotel. Although this grande dame of downtown lodging eventually closed, it was renovated and reopened in the spring of 2007. Name this hotel, and you'll have a chance to win a free OMRF tee. Submit entries to findings@omrf.org or 405-271-7213.



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DISCOVERIES THAT MAKE A DIFFERENCE