2018 EDITION

SR INSIGHT

Agents of Change

The Toddler Who Beat the Odds

The Future of Chemistry Is Here

Pictured right: Elizabeth Scribner and her children. Scribner is just one of 28 community leaders who participated in Southern Research's inaugural Change Campaign as a Change Agent. Starting on page 28, learn more about the campaign and the community leaders whose passion for scientific discoveries helped make it a success.

Pictured on Cover, clockwise from left: Amit Goyal, Ph.D., Rebecca Boohaker, Ph.D., and Rita Cowell, Ph.D. These Southern Research scientists are working on new discoveries and technologies that will impact the world.

contents

SR SOUTHERN RESEARCH

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A Time of Change

The concept of change has defined much of what Southern Research accomplished in 2018. As I look back on the past year, I'm struck by the changes that have come to our organization and the changes we make in the world every day. The lives we touch, the corners of the universe we explore and even the innovative ways we find to perform research all leave an indelible mark that is unique to Southern Research.

When I think about lives that have been changed, I think about Lilianna Thompson. Lilianna's battle with leukemia began when she was just two years old. A drug developed at SR helped prepare her for a life-saving bone marrow transplant, but it was the fierce determination of this little girl—only a toddler—and her family that got her through. She is now a thriving 9-year-old. This past fall, she and her mother visited our campus to see where her life-saving drug was made. I consider it an honor to be a part of the organization that helped her get there.

Of course, Southern Research itself is constantly changing and growing. Our Southside campus changed this year by adding a new STEM lab. This lab is equipped to help budding scientists explore their passion and, through our SIPSE program, help high school STEM teachers bring research and discovery to their students in a way they might not have thought possible.

In this publication, you'll also meet the great leaders we have added to our team, who bring new talent, new focus and new energy to our groundbreaking work. And, of course, we can't forget the much-deserving recipient of the President's Award, Judy Britt—not a new addition to Southern Research but a dedicated member of our team for 30 years. The foundation Britt has helped lay and the contributions our new team members are already making will help us take great strides in pursuit of our mission.

Another leader driving our mission is Dr. Susan Schader, who is changing not only the way HIV is treated but the way HIV treatments are researched. Her work is crossing borders and redefining the very concept of "cure." We also owe much of our success in treatments for infectious disease—along with cancer, neurodegenerative disease and other conditions—to some of the rising stars in our Chemistry Department. They contribute new innovative ideas, a collaborative spirit and a staggering degree of dedication to their field. The work of scientists like these will help create the next groundbreaking medication that will treat patients like Lilianna and contribute to inventive research like Schader's.

This expansion and discovery has been catalyzed by the support of the community we serve. This publication also celebrates our Change Agents—generous individuals who have committed to raising both awareness and funds for Southern Research. Through our Change Campaign, they strove to promote our mission and to bring in resources that support our work. The campaign wouldn't have been possible without their dedication to SR and their willingness to give of themselves in order to inspire others to give. We thank them for their role in helping us accomplish so much in 2018. Thanks to our dedicated teams, we are positioned for more great accomplishments in the year to come. ■

Arthur J. Tipton, Ph.D.
President and CEO, Southern Research

SR President and CEO Art Tipton, Ph.D., at the organization's Life Sciences campus in Birmingham, Alabama.

The STEM Teachers Become the Students

Summer internships aren't just for college students. Southern Research's Summer Internship Program for STEM Educators (SIPSE) offers paid internships for high school STEM teachers, giving them six weeks of hands-on experience in the organization's research laboratories at the elbow of SR scientists and engineers. The teachers go home with professional learning credits, an action plan for improving the way STEM subjects are taught in their classroom and even financial support to help carry out their plan.

Samantha Davis, who teaches biology, chemistry and physical science at Russell County High School, attended SIPSE to find ways to bring science back to her students three hours from Birmingham in rural Seale, Alabama.

"These kids are underserved," she said. "They're amazing kids, but they're lacking, educationally, without anyone who will push them or expect anything from them. They can rise to the challenge, but they don't get pushed."

Her interactions both with SR scientists and with her fellow STEM teachers have given her ideas and opportunities to take back to her students. She's even spoken with other teachers about arranging Skype sessions between their classes so students can interact with kids their own age in other parts of the state. And with guidance from the SR scientists, Davis is also developing easy labs she can perform with the limited resources available. "I've made connections with scientists here who will run samples my students take in class at Russell County, and then they can do a Skype or a video to see the results being done and sent back," she said.

Candyce Monroe teaches anatomy and physiology and biology at Tarrant High School, and she enrolled in the program in hopes of reconnecting to scientific research after years away from the bench. "It can be kind of isolating in education," she said. "Getting back in the lab required me to stretch, to dig deep, to learn a lot."

But amid her research, she gathered some unexpected data.

> "Being the student in this situation gives me a perspective into how my students feel day to day," Monroe said. "How I present information, how I require them to tackle a problem and find a solution to it. I have empathy. I think I'll approach lesson planning differently, because I know how it felt to be in their shoes."

Hoover High School environmental science teacher Janet Ort had a short drive and an extremely long flight to get to SR. After developing an environmental sensor as part of her SIPSE project, she traveled to Peru with Amazon Teachers Workshop to visit with local researchers and discuss sensor placement and data collection.

"I have a whole portion of my room dedicated to the Peruvian Amazon, because teaching environmental science, it's integral to people understanding the importance of complete ecosystems and how we're all connected," Ort said. "I've been able to show my students a textbook and say, 'There's a hectare in Peru that has the highest tree biodiversity, and I've been there, and this is what it looks like.' Now I can say, 'These are parameters about it. This is data collected from the sensor I made. This is how local people can understand what they have.'"

"It's incredibly exciting that Southern Research, Dr. Lanier [SR STEM Education Outreach director] and all the other people involved were willing to step out there and say, 'We think this is important for Alabama teachers and Alabama students,'" Ort said. "That's the most important part of this. It's not just us who will be impacted by this—it's the students, the administrators, everyone will be impacted by this kind of fellowship." ■

Southern Research is grateful to the funding partners who have made the STEM Education Outreach Center and programming possible.

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◂ Teacher Jacqueline Thomas-Edwards of McAdory High School participated in the inaugural class of the SIPSE program.

CUTTING THE RIBBON

In July, Southern Research officially cut the ribbon on the new STEM Education Outreach Center at the Southside campus. The 2,443-square-foot space (pictured above) is currently outfitted with equipment and supplies for physical and life sciences, 3D printers and robotics equipment, and more are scheduled to follow.

"It looks amazing," said Kathryn Lanier, Ph.D., SR's first STEM Education Outreach director. "It's an inspirational place to be, a fun place that will inspire creativity and innovation."

▸ Teacher Joy LeCroy of Chilton County High School, a member of the SIPSE inaugural class, works in the SR STEM lab.

> "It's not just us who will be impacted by this—it's the students, the administrators—everyone will be impacted by this kind of fellowship." Janet Ort, Hoover High School

▸ Samantha Davis of Russell County High School (pictured right) works with a student in the STEM lab. Davis was an inaugural SIPSE class member.

The Evening of Change

On October 11, supporters of Southern Research gathered in the courtyard at Quinlan Castle to celebrate change—the changes SR makes in the world every day and the month-long Change Campaign that raised awareness and funds for SR's groundbreaking work.

Throughout the month, numerous Change Agents—fundraisers, representing the campaign's pillars of Body, Earth and Mind—campaigned for donations in support of their chosen cause. At the Evening of Change, the top-earning and top-social Change Agents were named, as well as the top-performing research pillar. The Body pillar received $87,605 of the campaign's total $205,861 that will go directly to research.

"Our passion at Southern Research is driven by hope," said Art Tipton, Southern Research president and CEO. "Hope for a cure, for a cleaner, greener earth and for lives to be changed—and ultimately saved. Change Campaign funds will allow us to continue to explore important scientific breakthroughs with high-risk, high-reward endeavors that are often difficult to fund through traditional grants."

With the success of the Change Campaign—and the Evening of Change—Southern Research plans to make it an annual appeal, collecting funds to support SR's ongoing research and then gathering to celebrate the generosity of our community. ■

CHANGE CAMPAIGN SPONSORS

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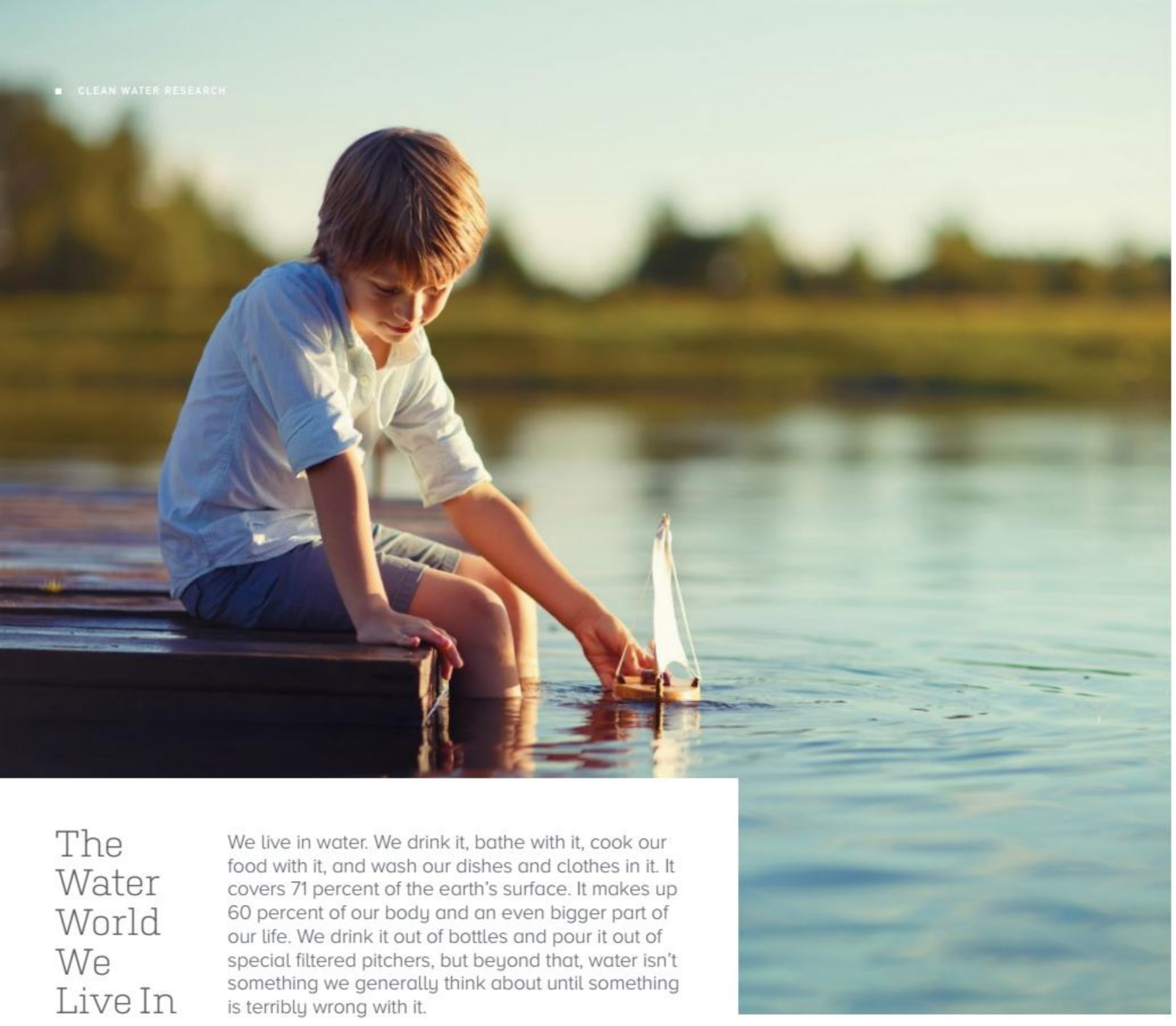


The Water World We Live In

We live in water. We drink it, bathe with it, cook our food with it, and wash our dishes and clothes in it. It covers 71 percent of the earth's surface. It makes up 60 percent of our body and an even bigger part of our life. We drink it out of bottles and pour it out of special filtered pitchers, but beyond that, water isn't something we generally think about until something is terribly wrong with it.

“The goal is to uncover technologies that can be implemented to solve current problems... something that can be put into use now.”

YOUNG CHUL CHOI, PH.D., ASSOCIATE DIRECTOR, INDUSTRIAL WATER PRACTICE

"We're all affected by it," said Young Chul Choi, Ph.D., associate director of the Industrial Water Practice at Southern Research's Water Research Center. "Look at the Mississippi River—there are so many small streams and rivers that are connected to it, as far north as Minnesota. If industrial wastewater is discharged into a small lake or reservoir, it has to be treated to more stringent standards. But if the discharge point flows right into the Mississippi, standards are slightly less stringent."

That's why Choi's work starts at the source. The Industrial Water Practice works with companies to help them reduce water contamination and to more effectively treat contaminated water before it's released into public waterways.

KNOWLEDGE FROM EXPERIENCE

It takes experience, expertise and state-of-the-art equipment to make clean water that is really clean. SR's Industrial Water Practice is staffed with knowledgeable engineers and chemists who have understanding gained over multiple years, and it is equipped with industry-leading instrumentation that can measure and analyze chemical species of concern down to the tiniest concentration. That allows SR scientists to detect chemicals at levels that the EPA might not be concerned about, but that the public might be worried about as they cook dinner or put a child in the bathtub. Southern Research is able to advise companies about the best way to remediate contamination—and check back afterward to make sure the remediation worked, making the water clean again and safe to be released into the environment.

"We've been able to do this as a service to the industry," Choi said. "Any industry that works with fossil fuel, for instance, has issues with selenium, and we can help them measure that. And even if a company already has a solution, we can do that analysis to see how good a job they've done with their treatment." The lab's Agilent 8800 Triple Quad ICP-MS, Choi said, can measure and analyze selenium concentrations below one part per billion—the difference between water that is clean and water that only appears clean.

TECHNOLOGY FROM THE FUTURE

But the Industrial Water Practice doesn't only focus on assessing and improving water quality. It also focuses on ways to improve the methods and tools we use to assess and improve water quality.

SR has the unique ability to bridge the space between academia and industry, Choi said, working from a starting point in basic science in search of solutions that may be more advanced than most industrial interests are ready to explore. The goal is to uncover technologies that can be implemented to solve current problems—"not something that will be a viable industrial process in 20 years, but something that can be put into use now," Choi said.

Many of those solutions are developed in-house, using SR's own resources and extensive knowledge base. But much of the practice's work also involves identifying existing technologies that can be adapted, or emerging technologies that can be nurtured, to address ongoing environmental challenges. SR partners with academic institutions and startup companies to find ways to use their early-stage solutions on a larger scale (or, on occasion, perform a frank assessment and recommend that the technology be taken in a different direction).

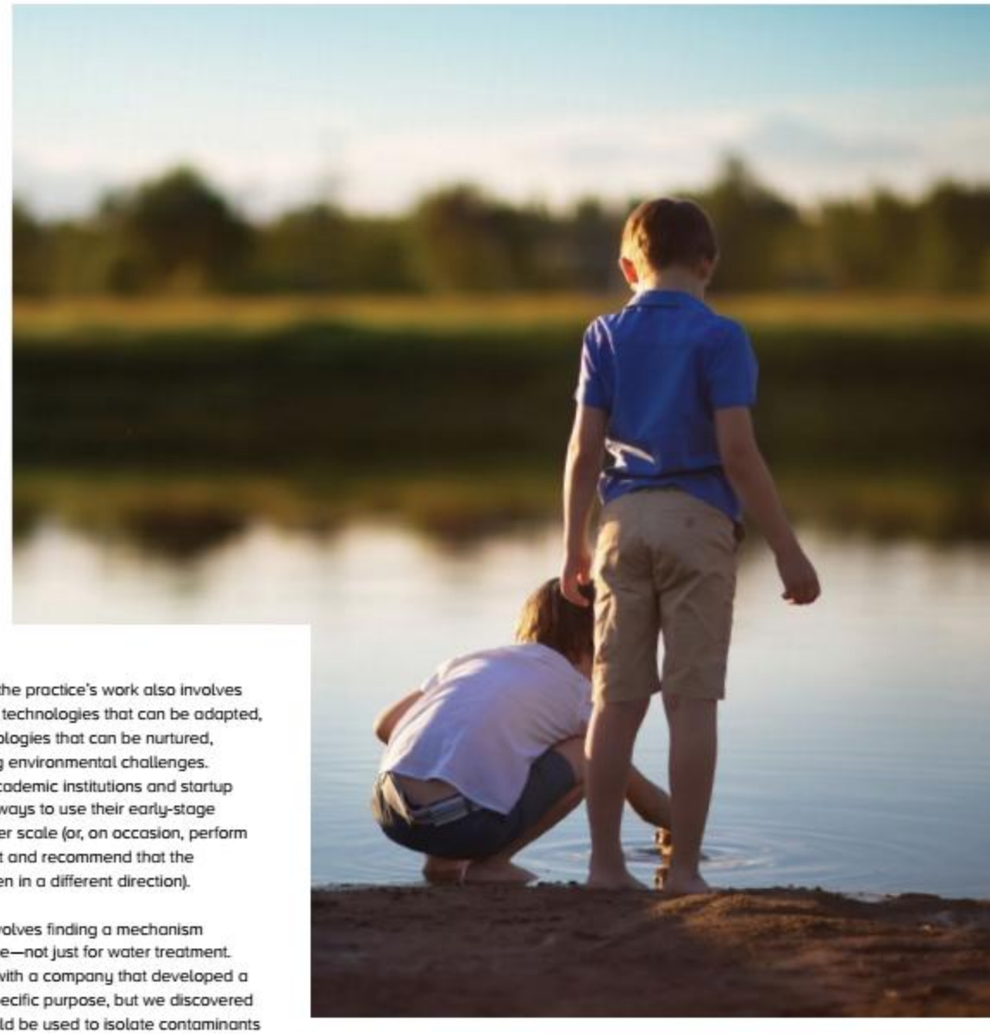
Frequently, that involves finding a mechanism that's already in use—not just for water treatment. "We're partnering with a company that developed a membrane for a specific purpose, but we discovered the membrane could be used to isolate contaminants in wastewater. The manufacturer hadn't realized this was a possibility," Choi said. "We've done preliminary testing, and it seems to be working."

HOPE FLOATS

SR's work through the Industrial Water Practice is particularly important because it's a problem that compounds as it flows downstream—if each facility that uses the water source leaves just a few more harmful chemicals in it, the resulting contamination can quickly grow to dangerous levels.

"A plant may have a wastewater treatment discharge point just upstream from them, so when the plant brings in water to use, it already has contaminants in it. Then more substances may be added to make it more effective as part of a cleaning or cooling system," Choi said. "All of that needs strict controlling and monitoring to make sure there won't be any heavy metals or other contaminants discharged back into the river."

"Ten miles down the river, there's a drinking water system that's going to have to clean that water and give it to the residents," he said. "These days, there isn't anywhere that isn't affected." That is why Southern Research is constantly working toward innovative methods for detecting, treating and preventing water contamination, for the sake of the 71 percent of the earth covered by water and the billions of people who rely on it. ■



▲ SR works with companies to help them reduce water contamination and to more effectively treat contaminated water before it's released into public waterways.

▼ Pictured below: Young Chul Choi, Ph.D., associate director of the Industrial Water Practice at SR's Water Research Center.

Southern Research is constantly working toward innovative methods for detecting, treating and preventing water contamination, for the sake of the 71 percent of the earth covered by water and the billions of people who rely on it.

Printed in Space

Could 3-D printers transform the International Space Station into a manufacturing hub and one day function as the heart of an on-demand machine shop in space that enables NASA to mount crewed missions deep into the solar system?

Engineers at Southern Research are helping NASA's Marshall Space Flight Center explore the capabilities of additive manufacturing technologies that have major logistics implications for the nation's ambitious future space missions.

"When NASA sends a crew to Mars, there can't be a resupply mission. There is just no way to send them replacement parts if equipment breaks or a part fails in deep space," said Madison Parks, an advanced mechanical engineer in Southern Research's Engineering division.

"On a mission to Mars, a 3-D printer will have to go with the crew. A part failing in orbit can be replaced after a resupply mission, but a resupply mission to a craft on the way to Mars would be too costly and may result in a loss of the mission. The crew will need to be entirely self-sufficient," he added.

Parks is working with Marshall's engineers to come up with an answer to a critical question facing NASA's plans for space-borne three-dimensional printing: Are parts manufactured in zero-gravity going to behave just like those produced on Earth-bound 3-D printers?

The International Space Station, or ISS, is already equipped with a 3-D printer. In 2014, California-based Made In Space sent a polymer printer to the station, followed two years later by a more advanced device. It's been used to print plastic tools used around the station, along with other non mission-critical items.

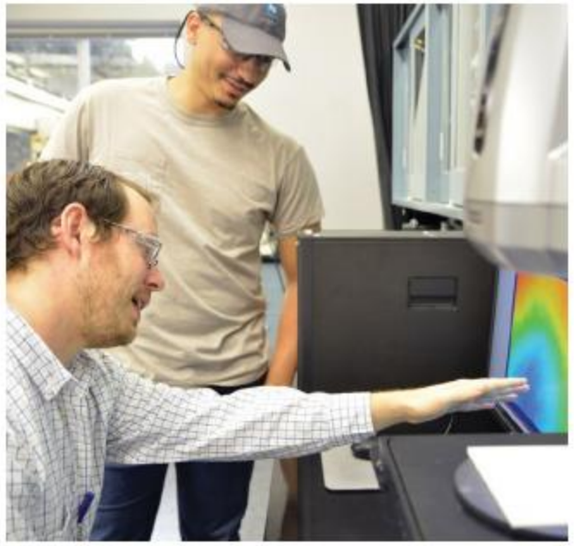
To help NASA understand the properties of materials printed in an in-space 3-D polymer printer, Parks and his team are testing specimens of materials printed in space and comparing them to similar specimens produced on Earth.

Along with tension and compression tests on these materials, Southern Research will be performing digital image correlation (DIC). DIC is a non-contact optical method that employs tracking and image registration techniques for accurate 3-D measurements of changes on the surface during a mechanical or thermal loading.

▼ SR engineer Madison Parks (left) and engineering tech Samson Lawson are comparing specimens created from 3-D printers both in space and on Earth.

Measuring full-field displacements and strains during the mechanical tests will help engineers understand the material behavior and overall effect of print passes and how they relate to zero-gravity 3-D printing versus Earth 3-D printing.

"For safety reasons, NASA has to understand the materials before they use them," Parks said. "You have to understand where and how these parts, which are manufactured in space, can be used. Doing otherwise could lead to parts and systems failing prematurely."



Southern Research Engineering, which specializes in analyzing how materials perform in extreme environments, has collaborated with NASA for decades.

Its engineers analyzed the thermal and mechanical properties of potential heat shield materials for the Apollo program and provided crucial support for the Space Shuttle, particularly in the "Return to Flight" missions after the Columbia accident.

Today, Southern Research is involved in the Space Launch System, or SLS, the massive rocket NASA is developing for planned Mars missions.

For NASA, three-dimensional printing offers a fast and inexpensive way to manufacture parts on a spacecraft, exactly when they're needed. That's a huge benefit to long-term missions and has the potential to fundamentally change how NASA plans logistics operations for human spaceflight.

"Right now, there are thousands of parts for the International Space Station sitting in NASA storage, and most of them will never be used," Parks said. "But they have to have all these parts on hand to launch to the ISS in case something breaks or fails."

"What Southern Research and NASA are working together on is a foundational effort with the goal of the ISS crew being able to print the parts they need as they need them, which will help the astronauts accomplish their missions," he added. ■

▲ Pictured: On Nov. 5, 2018, the Parker Solar Probe achieved its first close approach to the Sun, called perihelion, a maneuver that exposed the spacecraft to intense heat and solar radiation.

SOUTHERN RESEARCH CONTRIBUTES TO A UNIQUE SOLAR PROBE MISSION

When a NASA probe launched in mid-2018 approaches its final destination—the roiling upper atmosphere of the Sun—the spacecraft's heat shield will encounter temperatures hot enough to melt steel.

Testing conducted by Southern Research engineers demonstrated that the carbon composite materials selected for the Parker Solar Probe's thermal protection system will protect the craft and its instruments from the relentlessly brutal conditions.

"The probe is going to be getting pretty hot, pretty toasty, and it's going to be hot for a while," said Jacques Cuneo, a member of Southern Research's engineering team who worked on the project.

The Johns Hopkins Applied Physics Laboratory in Maryland built the spacecraft and is managing the mission. The lab brought in the Southern Research team to conduct high-temperature evaluations of the heat shield materials—a task the Birmingham nonprofit organization has been performing since the early days of NASA.

"The talented engineers and technicians at Southern Research have made many important contributions to the nation's space program over several decades," said Michael D. Johns, vice president of Engineering. "This is an exciting mission, and we're proud to have been part of an endeavor that will advance scientific knowledge about the Sun."

Data collected by the Parker Solar Probe will yield important new insights about the Sun's atmosphere and its role in producing fierce solar winds. Its first pass in October of 2018 broke the former record of 26.6 million miles from the Sun's surface, but that's only the beginning—the probe's elliptical orbit will ultimately carry it as close as 3.8 million miles as it hurtles past the star at 428,000 miles per hour. The spacecraft and its instruments are protected from the heat by a 4.5-inch-thick carbon composite shield capable of withstanding temperatures greater than 2,000 degrees Fahrenheit, according to the Applied Physics Laboratory.

The Southern Research engineers generated a database of the carbon foam properties, and the material passed muster. "The foam fit what they thought it was going to do, particularly at high temperatures, which is what they were concerned about," Cuneo said. The integrity of the foam had its first real test during the probe's first solar fly-by—and it passed with flying colors. ■

Susan M. Schader, Ph.D., HIV/AIDS principal investigator and senior scientist, SR Drug Development

The Big Picture

Prolific, dedicated HIV researcher Susan Schader, Ph.D., believes that a cure for HIV cannot be pursued without first defining the concept of "cure."

There are many things that go into 'curing.' Are we curing the world, or are we curing the human? And that's where I challenge the scientists I work with.

SUSAN M. SCHADER, PH.D., PRINCIPAL INVESTIGATOR AND SENIOR SCIENTIST

"There are many things that go into 'curing,'" she said. "Are we curing the world, or are we curing the human? And that's where I challenge the scientists I work with. You're telling me that you're working toward a cure? How are you curing HIV? In an individual, let's just start there, or even a cell. Tell me how you're curing it."

That big-picture view—what are you working toward? What are you working for?—has largely defined Susan M. Schader's career as a scientist. Recently promoted to principle investigator, she guides a project focused on new viral targets and novel therapeutics in the face of this constantly mutating virus. When she joined Southern Research three years ago, she immediately felt at home at the institution that has touched nearly every HIV drug that's come to market since the epidemic began in the 1980s, turning a death sentence into a treatable disease.

RETROSPECTIVE

Schader's mindset goes back to her early work in the lab of Dr. Robin Shattock at St. George's Hospital Medical School, studying the effect of TMC120 (later dapivirine) and tenofovir on HIV replication. "He was the perfect mentor. We called him the Prince of Microbicides," Schader said. "He was always big picture-focused. Although he didn't say, 'Susan, you must be big picture-focused,' he was. And you saw this side of humanity, and what you were doing in the lab meant something."

That broad perspective would prove to be a common thread among the other mentors who had the most impact on her during her early career. Dr. John Moore, who reminded her, when she got caught up in the technical details, to "keep the big picture in mind." Dr. Mark Wainberg, under whom she received her doctorate and who recognized her knowledge and experience and gave her the freedom to work, to lead, even to sit in his place on steering committees and at conferences—gave her a new perspective on where her work fit into the global effort against HIV.

Schader recounts a story from a visit to the International AIDS Symposium after she'd left Shattock's lab. The TMC120 she'd been studying was in testing as part of a silicone vaginal ring that women would be able to use for protection from HIV—an important advancement for women in developing countries who might have neither access to medical treatment nor the personal agency to negotiate sexual contact.

Both researchers and workers on the front line of the AIDS epidemic attended the symposium, and it was a group of the latter, healthcare workers in Africa, who approached Schader. "They said, 'We've heard about this ring. Can we see it? Can we touch it?'" she said. "And it was an *aha moment* for me. It's the human connection—this is a good concept, but if you really want to get it adopted, you have to be able to say, 'Here. Touch it. Feel it. What are your thoughts on it?' We could have done a better job as scientists to help the people on the front lines understand where we were going. And it was those women who brought it to my attention, who said, 'We really want this product.'"

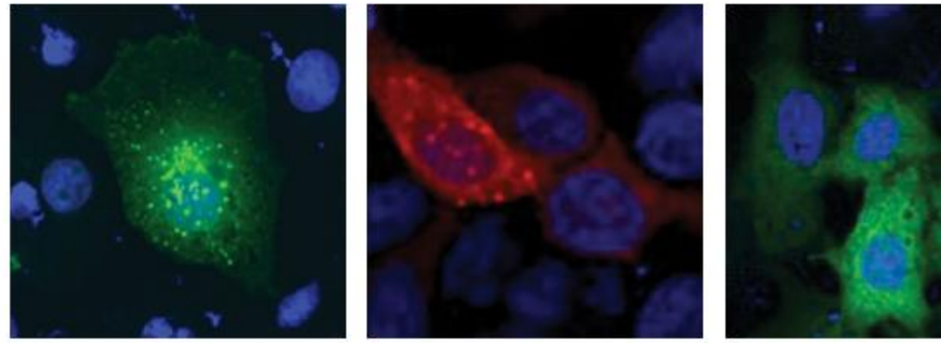
SMALL SCALE, BIG DISCOVERIES

Over a decade later, Schader is working in a world facing a $7 billion funding gap, per the UN, between our current reality and the goal of eradicating HIV by 2030. "That to me just says, it's got to stop being about a country," she said. "It's got to stop being about the person. You can treat an individual, but we also have to look longer term."

"What I can do in the lab is on a very small scale," Schader said. "But I know by bringing everyone together at Southern Research, it's the biggest gift I've ever been given in my career, because the scientists I work with have the capacity to do what no other research lab can do or would attempt. The scientists here are dedicated, and they want to stay here. I learn something new every day here, and we've already discovered things that, hopefully by the end of the year, we can get some funding to help us carry on research."

Schader believes the biggest thing standing between science and a cure—a cure by any definition—is funding. A constant struggle for a share of limited grant money pits scientists against each other, she said, and impedes collaboration. That, combined with lack of access to new technology, resources and brainpower, hinders potential advances.

Teams have had to innovate new technology using their own research funds, or just go without. "Struggling for two days with something when you can buy a piece of equipment that will let you do it in 30 seconds or less—just those processes can make us less frustrated and more productive," she said. "What we've accomplished over the past year, we could have accomplished a lot faster."



Cells expressing HIV-1 antisense protein facilitate the discovery and development of novel anti-HIV/AIDS therapeutics. Green = HIV-1 ASP in monkey cells, Red = HIV-1 ASP in human cells, Blue = cell nuclei.

Photo Credit: Yang Xiao, Zhenlong Liu & Benoit Barbeau. Département des Science Biologiques and Centre de Recherche BioMed, Université du Québec à Montréal, Montréal, Canada

Those accomplishments are significant. What other labs are unable to do, Schader's team specializes in doing—developing ways to detect HIV in active replication, to test drugs, to design novel, clinically relevant assays. Her lab is the first in the world to produce protein from HIV in a particular bacteria. That discovery can mean the difference between the therapies that were effective decades ago and the ones that are changing the world now. "We just need the funding to be able to sit down and say, 'OK, let's work together.'"

THE BIG PICTURE, FULL CIRCLE

While her team works toward the future, a project from Schader's past has reappeared. While pursuing her doctorate, Schader was awarded nearly a quarter of a million dollars from the International Partnership of Microbicides to study the drugs they wanted to test in combination—research that led to the silicone ring that had made waves at the IAS. Now, she's been approached directly—this time to supply preclinical data because the dapivirine ring is a reality, has been tested in Africa and is up for regulatory approval in Europe. "I was involved at the beginning, and now I get to see and help bring it to people under the European regulatory agency," she said. "And it's at Southern Research that we're doing it."

Seeing it come full circle isn't just a thrill for Schader—it's also educational and encouraging for her team, she said. "To actually say we're helping women on a worldwide scale, it really makes people look up from their bench and go, 'Yeah, what I do means something.'"

"I think we can do it," Schader said. "I think we can cure HIV. We just need to know what a cure looks like." ■

Her lab is the first in the world to produce protein from HIV in E. coli. That can mean the difference between the therapies that were effective decades ago and the ones that are changing the world now.

Lilianna Thompson: The Toddler Who Beat the Odds

Many parents look back with a certain level of affection on their child's "terrible twos." Anna Thompson wishes she could be so lucky—her daughter Lilianna's twos were terrible, but not because of classic toddler behavior. Lilianna spent her twos in the hospital undergoing intensive treatment for acute myeloid leukemia. →

◀ Pictured previous page: Lilianna Thompson at her home in Clanton, Alabama. Lilianna's treatment for leukemia included a bone marrow transplant and a drug discovered by Southern Research, fludarabine.

Lilianna endured numerous rounds of chemo during her 16 months of treatment, including treatment with the anticancer drug fludarabine. Today, after a bone marrow transplant, Lilianna's terrible twos are behind her, and she's now a happy, healthy third-grader at a school in Chilton County, Alabama—seemingly miraculous after a very different life five years ago.

"We would have gone to the ends of the earth to make Lilianna better," said Mrs. Thompson. "And the treatment that saved her life was just down the road."

TERRIBLE

It started on a family vacation with a persistent fever and a lack of appetite. Her family thought she had a virus, something she'd just get over as is so frequently the case with toddlers. But it didn't break. A doctor at an urgent-care clinic there at the beach diagnosed her with strep throat, but with Lilianna in such discomfort, they returned home—home to her familiar house and home to her regular pediatrician.

It wasn't strep. It was something that required testing and re-testing, and testing at a nearby hospital, until finally the truth was undeniable: Lilianna had acute myeloid leukemia, AML, which is a blood cancer that is difficult to treat and kills more than 10,000 people in the U.S. every year. "The pediatrician came in with tears in her eyes, and I knew that something was wrong," Mrs. Thompson said.

RESOLUTE

Lilianna was admitted to Children's Hospital in Birmingham that same day, and she would stay there for six weeks—six weeks of minor victories and great frustrations, and when she finally was able to leave the hospital, the cancer was still raging inside her. AML is aggressive, hard to treat and exceedingly uncommon in children—the average age of an AML patient is 67. The first round of chemo slowed the rapidly-progressing disease but didn't stop it. An attempt at a stem-cell transplant was rejected, and an attempt at a cord blood transplant taunted them with what looked like success until the AML returned.

Lilianna's doctors were baffled but resolute. "They said there was not much else they could do, but they were not giving up," said Mrs. Thompson. "They said, 'If you're willing to keep going, we'll keep going with you.'"

The Thompsons were willing to keep going, and the doctors kept their promise, despite more setbacks and frustrations. Another round of chemo was ordered for the now 3-year-old, and after she seemed to be in remission for a few months, she relapsed. And then there was a spark of hope: Lilianna's doctors found a bone marrow match.

Unfortunately, that meant that treatment would have to get harder for Lilianna, not easier, as they prepared her for the transplant. The process necessary to stabilize her meant a still-stronger round of chemo and full-body radiation that left the toddler unwilling to eat, drink or even get out of bed. She relied on a feeding tube to eat and on her mother's insistence to get up and get dressed.

But it worked.

"She's thriving. She's alive and well," Mrs. Thompson said. "She's an absolute miracle."

ESSENTIAL

In August, Mrs. Thompson and a thriving 9-year-old Lilianna made a special trip to Birmingham to visit the institution responsible for one of the drugs that helped save Lilianna's life. Mrs. Thompson was surprised to learn that fludarabine, the drug that kept Lilianna in remission before the cord blood transplant, was developed in Birmingham at Southern Research.

Fludarabine was discovered by organic chemists John Montgomery and Kathleen Hewson in 1968, and it was approved by the FDA for medical use in 1991. Effective against chronic lymphocytic leukemia, lymphoma and AML as part of a combination therapy called the FLAG regimen, the drug is included on the World Health Organization's Model List of Essential Medicines.

But in 2012, to the Thompsons, it was just one of the drugs that helped Lilianna stay on the road to recovery. And in 2018, the Thompsons were able to see the birthplace of that drug and talk with Rebecca Boohaker, Ph.D., a research scientist in Southern Research Drug Discovery who is conducting research into the disease that tried, and failed, to take Lilianna's life. "I called my mom when we left and said, 'Lilianna and I got to meet a real-life scientist,'" Mrs. Thompson said. "It's just great that they are doing cancer research and helping to save lives."

"It is very motivating, as a scientist, to see patients' lives extended by therapies developed at Southern Research. A cancer diagnosis can be devastating, especially when the patient is a child," Boohaker said. "Meeting such a resilient and positive kid like Lilianna only underscores the importance of the work that we do here—constantly pursuing new therapeutic avenues for treatment of cancers in general, but particularly those that are rare and difficult to treat."

"We would have gone to the ends of the earth to make Lilianna better," said Mrs. Thompson. "And the treatment that saved her life was just down the road." ■

▲ Lilianna plays with her siblings at their family home.

When your mission is solving the world's hardest problems, you're "driven by hope," said Southern Research President and CEO Art Tipton, Ph.D. "Hope for a cure, for a cleaner, greener Earth and for lives to be changed—and ultimately saved." Hope can get you far—but it can get you further with the support of a generous community dedicated to raising awareness of and funds for the groundbreaking work you do.

The Capital 'C' in Change

In September of 2018, Southern Research launched its four-week Change Campaign, calling on 28 Change Agents committed to growing SR's public profile and bringing in funds to support three research pillars—Mind (neuroscience), Earth (green chemistry) and Body (cancer). These community leaders reached out to their personal networks, made their case to professional colleagues and promoted Southern Research's discoveries and economic impact.

The campaign's target of $200,000 is earmarked for early-stage research, where brilliant ideas are nurtured. The money will help to fill funding gaps for scientists like Dr. Rita Cowell, Dr. Amit Goyal and Dr. Rebecca Boohaker, carrying them to levels of discovery that can ultimately earn federal grants. In the following pages, you will meet Change Agents who helped Southern Research meet—and exceed—its campaign goal to help turn hope into a brighter world.

▸ Pictured right: Researchers Amit Goyal, Ph.D. (top) and Rebecca Boohaker, Ph.D.

◂ Pictured left: Researcher Rita Cowell, Ph.D.

An Eye on the Mind

Change Agent // David Powell

When, during the leadup to the Change Campaign, David Powell was asked if he knew anything about what Southern Research does, his answer was no. "I've driven past it a million times and had no idea what was really going on here," he said. When he was invited to tour the campus instead of just driving past, he was amazed at the discoveries being made right in the middle of Birmingham.

SR's focus on neurodegenerative disease, in particular, stood out sharply to him because of the harsh introduction he'd had to the subject the previous year. Last December, Powell's mother died of ovarian cancer. But her cancer diagnosis came nine months after her Alzheimer's diagnosis—and he was shocked to learn that she saw the cancer as a blessing. "Her mother had a protracted battle with Alzheimer's," he said. "And to my mom, cancer seemed like the better option." SR's research, he realized, had the potential to make the disease less terrifying.

"Southern Research is a part of Birmingham that needs to be told," he said. "There weren't enough people spreading that message."

Powell was happy to do that, sharing his enthusiasm not just with old friends in Birmingham but with new friends made on dozens of business trips. "By the time you get to dinner, people are tired of talking about business," he said. "You're looking for interesting things to talk about."

He even has a surefire opening line. "I'll say, 'Tell me about your city. What's going on here?' And that usually invites the question, 'Well, what about where you're from? What's going on there?'" What's going on in Birmingham is groundbreaking discovery at Southern Research.

That kind of awareness is crucial, he said, when working with diseases like Alzheimer's and Parkinson's. "Unfortunately, I think the neurodegenerative things are something people see and just say, 'Aw, that's sad,' as opposed to, 'Aw, that's something we should do something about,'" he said. The diseases are lengthy and devastating for both the patient and family, "but they aren't necessarily as attractive for investment. Or they've been forgotten while we spend money on something that seems more current." Or, he said, less insurmountable.

"Insurmountable" isn't a concept Powell believes in. He prefers the tech industry concept of "zero to one"—"Something didn't exist, then it exists," he said. He wants to see that kind of energy directed toward medical discovery. "How can we take a disease that was incurable and make it curable? How do we take something that was an impossible problem to solve and then solve that problem?"

Powell noted that in 1900, the two leading causes of death were flu and gastrointestinal distress. "We'd laugh," he said. "'People in 1900 died of flu and diarrhea? Who dies like that?' I'd like to think that in 2018, we could flash forward 40 years and people would say, 'People died of ovarian cancer? Who dies of ovarian cancer? Who dies of Alzheimer's? That's ridiculous!'" ■

▲ Pictured: David Powell, a Change Agent supporting Team Mind.

PILLAR OF DISCOVERY

Mind | Neuroscience

PRIMARY GOAL

Many of us have watched as a loved one loses memory or physical abilities to neurodegenerative disease. With research, those diseases could cease to be a death sentence.

INITIATIVES

Newly developed compounds to protect cell death from ALS, investigation into how alterations in brain chemistry lead to depression, exploration of the function of brain circuits and cells in schizophrenia, understanding alterations that occur in the aging brain to cause dementia

LEAD SCIENTIST

Rita Cowell, Ph.D.

HOPE FOR THE FUTURE

A way to stop neuronal loss and impact the progress of neurological disease

EARTH

Looking Toward a Greener Tomorrow

Change Agent // Elizabeth Scribner

Elizabeth Scribner thought she knew what was going on at Southern Research. Her father's solar company helped Southern Research install solar panels at its Solar Research Center, and she's on the board of a local foundation that has donated money to SR. But last year, when she was invited to serve on SR's Advisory Board, she realized how much she had yet to learn.

"I didn't know the half of what Southern Research is doing, as far as scientific research and engineering go," she said. She was amazed to hear about the telescopes SR designed to photograph the eclipse from NASA's high-altitude research aircraft and the advances in cancer research she hadn't known about.

"What really grabbed me was when Dr. Amit Goyal came to speak about some of his green energy research," Scribner said. "I was amazed to hear that he's developed technology that turns sugar into acrylonitrile, which is used in cars and planes, and I had to smile when I heard about Legos," said the mother of three. Learning that SR could replace a product that relied on oil refinery with one that used renewable resources, "I got very excited about that," she said. "Knowing that, and getting a little more energized about everything Southern Research is doing, inspired me to be a Change Agent."

SR wasn't her first introduction to green science. "Before I was a mathematician, or a mom, or a wife, I was an environmentalist," Scribner said. "As an undergraduate at Princeton, I had a minor in environmental studies. And I started learning about all the damage we've done to our planet. But on the other side, I also started learning about all the promise that science holds in terms of helping solve those problems."

Scribner appreciates the platform the Change Campaign provides to talk about Southern Research. "When I tell people, they're amazed," she said. "They say, 'I had no idea this is here in Birmingham.' And here Southern Research is creating scientific change to improve the world, but they're also creating jobs and attracting amazing intellectual talent to our city." She sees great potential in the acrylonitrile technology to create jobs in poorer regions of Alabama. "If we could use this technology to not only improve the condition of our planet but also improve the economic situation in our state, that would be amazing," she said.

"I've got a lot going on. My life is pretty busy. But I feel like it's a gift for me to be able to volunteer for a group like Southern Research," Scribner said. "It helps me to step above the day-to-day 'What am I going to fix for dinner? Oh, no, we're out of diapers' and see the bigger picture. We're not going to be here forever. But my kids' kids will have kids who will be here a hundred years from now. It's important to me that they have the ability to eat fresh food, breathe clean air and drink clean water. There's a lot of work to be done. And here in Birmingham, I feel like we have someone to advocate for that." ■

◀ Pictured: Elizabeth Scribner, a Change Agent supporting Team Earth.

PILLAR OF DISCOVERY

Earth | Green Chemistry

PRIMARY GOAL

Most products we use every day are made from raw materials linked to crude oil. New processes are necessary that use other, sustainable raw materials to create the same products.

INITIATIVES

Technology that uses carbon dioxide from coal-fired plants to turn ethylene into ethane; a reliable process that turns sugar into acrylonitrile, a gasifier that converts low-grade coal into syngas and technology to capture the carbon dioxide produced by that syngas

LEAD SCIENTIST

Amit Goyal, Ph.D.

HOPE FOR THE FUTURE

Cost-effective, environmentally friendly production techniques for industry

BODY

Nurturing Bright Ideas

Change Agent // Key Foster

Key Foster wasn't unaware of Southern Research's decades-long focus on cancer and the numerous life-saving drugs to SR's credit. But that wasn't the main reason he chose to support cancer research as part of the Change Campaign. "Cancer is very meaningful to me," he said. "My wife is a breast cancer survivor, and my father lost his battle with kidney cancer in May. It's a very personal issue."

He found out that it was a very personal issue for a lot of people. "Cancer is a topic that, if you intersect with it, it's a big deal," Foster said. "And it's shocking how many people have, either personally or through their families, intersected with it." When he opened up to others in the community about his experiences with cancer, he was surprised at the number of people who were inspired to share not only their money but their own personal stories. "Hearing all that, it's not surprising that people are so willing to participate," he said.

One thing Foster appreciated was the significance of the funds he was raising through the Change Campaign—funds that would go directly to research scientists just down the street who had the potential to move mountains, if given the right resources. The money will support earlier-stage, higher-risk research that hasn't progressed enough to qualify for federal grants. "It's like venture capital for scientists," he said.

"It gives ideas a chance," Foster said. "I assume there's a good number of really bright ideas that never make it to the surface, never get a chance to come to fruition or evolve into something, because of that funding gap. This money gives these scientists a chance to incubate those ideas and get them to the point where they can get those government grants to continue the research that could one day birth new drugs and therapies for cancer."

"It can truly move the needle with smaller amounts of money. It just makes the whole thing make sense," Foster said. "It would be thrilling to contribute, even in our small way, in support of a major breakthrough by one of these brilliant scientists."

Because those ideas are being created and nurtured here in Birmingham, Foster was able to meet—and be amazed by—the research scientists who would be turning those donations into discoveries. He was particularly inspired by the work of oncology researcher Rebecca Boohaker, Ph.D., much of whose research focuses on immunotherapy.

"These are therapies that enable the immune system to recognize, target and eliminate cancer cells wherever they are in the body," he said. "This is potentially a universal answer to cancer." Boohaker's research could one day mean happy endings for all the stories he heard during the Change Campaign, "and I get to know the real players who have dedicated their careers and lives to solving these really tough problems," he said. ■

◀ Pictured: Key Foster, a Change Agent supporting Team Body.

PILLAR OF DISCOVERY

Body | Cancer

PRIMARY GOAL

One mutated cell out of 37 trillion in the body is enough to cause cancer. More than 600,000 people are expected to die from it in the U.S. this year. Research is needed to find ways to cure—and prevent—this disease that strikes across lines of gender, race and age.

INITIATIVES

A new immunotherapy drug with therapeutic possibilities for a broad spectrum of cancer types, first-in-class novel therapies for prostate and colorectal cancers

LEAD SCIENTIST

Rebecca Boohaker, Ph.D.

HOPE FOR THE FUTURE

A cure for all types of cancer

2018 Change Agents

These 28 leaders in the Birmingham community committed their time and resources to build awareness and raise funds for scientific discoveries at Southern Research.

From left to right:

BODY
Turner Burton
James Childs
Key Foster
Raymond Harbert Jr.
Rosa Hooper
Blair King
Robert Maddox
Virginia Markstein
Chris McCauley
Shon Thurman

EARTH
Marcus Chatterton
Jonathan Geisen
Miller Girvin
Natalie Kelly
Michael Stone
Elizabeth Scribner
Beeland Nielsen
Will Wright

MIND
Bart Crawford
William Culpepper
Lynn Darty
John Fallis
David Perry
David Powell
Mitesh Shah
India Vincent
Jon Vogel
Taylor Peake

The Rising Stars of Chemistry

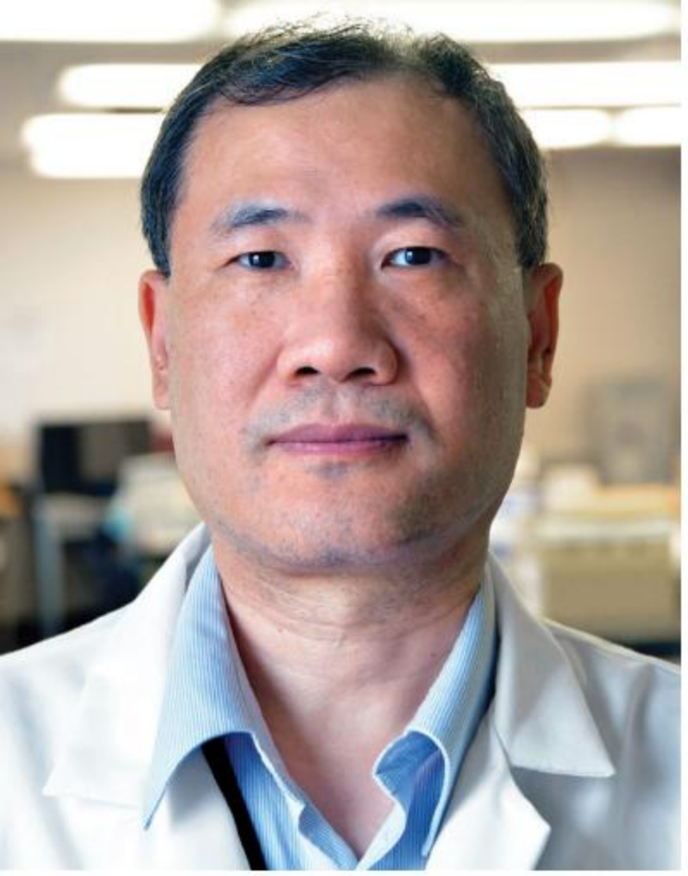
Corinne Augelli-Szafran, Ph.D., leads the Chemistry Department at Southern Research.

Omar Moukha-Chafiq, Ph.D., is one of four rising stars in the Chemistry Department.

"The goal for Southern Research's Drug Discovery division is to discover drugs," said Corinne Augelli-Szafran, Ph.D., senior director of the Chemistry Department in that division. It might seem like an obvious statement, but it's an important one for a department that relies on the brilliance of numerous scientists in numerous disciplines pursuing the same goal.

"Our ultimate goal here in Chemistry and Drug Discovery is to get compounds in clinical trials to help so many people," she expanded. "We're bringing therapies closer to patients in need."

Augelli-Szafran kept that in mind when she joined SR in August of 2014. The Chemistry Department houses disciplines ranging from computational chemistry to bioanalytics, which "I think makes us quite unique," she said. "When you're doing drug discovery, to be able to do all of those things in a chemistry department is quite unique, particularly in a nonprofit organization." It depends on coordination, access to resources and "having the right people in place," she said. Augelli-Szafran is proud to have those people in place—and among them, a few rising stars are making themselves known for their work and their leadership.



Donghui Bao, Ph.D.

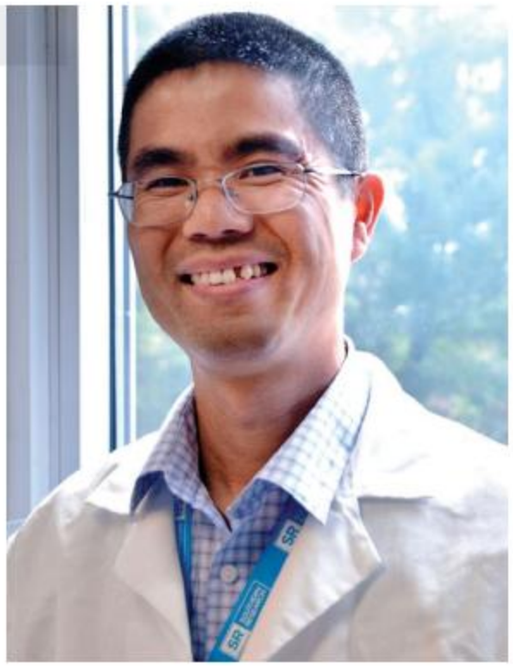
Donghui Bao, Ph.D., was first drawn to chemistry by the opportunity to make molecules. Now, he gets to help make molecules better. As a bioanalytical chemist at Southern Research, he's responsible for the assays that evaluate the drug-like properties of compounds that are, ideally, destined for pharmacological greatness. With his help, medicinal chemists are able to optimize their compounds and move forward into in vivo testing.

An expert in his field, Bao led the setup of his lab for optimal capabilities and operations. It gives him opportunities to work with medicinal chemists on a wide array of programs. "I enjoy working with different people on different projects," he said. "Here, we have access to multiple drug discovery projects in many areas"—providing plenty of opportunities to help perfect compounds that could one day turn into life-saving drugs for patients with a wide variety of conditions.

Mason Wu, Ph.D.

Mason Wu, Ph.D., is not actually a chemist—he's a biologist—but his work in the structural biology lab is essential to the discoveries made in the Chemistry Department. He works with proteins at an atomic level, using complex 3-D imaging to explore the structure and find formations that could help improve inhibitor binding potency—or, in simpler terms, "I help chemists design better compounds," he said.

Wu was excited to bring his training in biology and biochemistry to the Drug Discovery division at SR. "Southern Research is unique in the region," he said. "Here, we have every component. Chemists, biologists, all working together for drug discovery. That's how I knew this was the right place for me. I can apply my knowledge of protein structure, and I can help."



Ashish Pathak, Ph.D.

Ashish Pathak, Ph.D., works on some of the scariest infectious diseases in the news—West Nile, Zika, SARS, influenza and many others, in his group as part of a larger collaboration of institutions—on top of drug discovery in TB and HIV. "I forget how many grants I'm sending, how many programs I'm working on," Pathak joked. "But we have a nice network here." He has four chemists helping him in his group, with support from nearly every other scientist in his department. "I work pretty closely with most of the people here," he said.

Of all his ongoing programs, his work in infectious disease is closest to his heart. "I have a preference for infectious disease because these are mostly neglected by the industry," he said. "These drugs are not profitable for them. But people need them, particularly in developing countries. We need to focus on these drugs for our people and for the rest of the world."

Omar Moukha-Chafiq, Ph.D.

Omar Moukha-Chafiq, Ph.D., has seen a lot of new developments over his 15 years at Southern Research, but the recent changes in his department have stood out. "I can see the difference, recently, especially with Corinne," he said. "We have the tools, we have the expertise that's needed."

Moukha-Chafiq is at an advanced stage with programs in neurodegenerative diseases, diabetes and oncology, and he said the ability to interact with other scientists has been essential—meeting with teammates, asking questions. "I cannot say I've done what I've done because of my intellect or my hard work. It's teamwork."

And in a way, that's what drew him to medicinal chemistry in the first place. "Medicinal chemistry is like the interface between biology and medicine. You get to be in the middle and work with the biologist to deliver the compounds to the pharmacologist. It's like you're doing this really critical step," he said. "But it's teamwork. Any drug you see on the market, it's the work of a team."

New Team Members at Southern Research

BABU L. TEKWANI, PH.D.
Accomplished researcher Babu L. Tekwani, Ph.D., joined Southern Research as distinguished fellow and chair of the Infectious Disease Department in Drug Discovery. Armed with more than 30 years of experience researching tropical diseases and global health threats, Tekwani leads a department that focuses on therapeutic and vaccine approaches to prevent and treat infectious disease throughout the world. Some of his recent work has focused on a new drug delivery approach for a safer, more effective antimalarial therapeutic.

"Because infectious diseases represent a major global health problem, there are critical unmet needs for novel, safe and effective therapies," said Mark J. Suto, Ph.D., vice president of Drug Discovery. "Tekwani brings a wealth of experience and adds a new dimension to Southern Research's infectious diseases drug discovery program."

KAZUTOSHI NAKAZAWA, M.D., PH.D.
Kazutoshi Nakazawa, M.D., Ph.D., whose work has explored how abnormalities in brain circuitry can trigger complex mental disorders, joined Southern Research's Neuroscience Department as a fellow. His new laboratory is investigating neuronal dysfunction in key portions of the brain and how malfunctions in these systems lead to mental disorders.

Nakazawa arrives at a time when SR is substantially expanding the resources and capabilities of his department, which focuses on improving the understanding of the mechanisms underlying complex neuropsychiatric and neurodegenerative diseases.

"Kazu has a unique understanding of animal models and how brain circuits are organized and affected in schizophrenia and related disorders, so he is a great addition to our staff," said Rita Cowell, Ph.D., fellow and chair of the Neuroscience Department.

STACEY S. KELPKE, PH.D.
Biomedical/bioengineering researcher Stacey S. Kelpke, Ph.D., joined Southern Research to head up its medical technology development initiative. The program aims to accelerate the development of early-stage medical device technologies as potential commercial products. With her experience both benchside and deskside, Kelpke has the background and hard-earned knowledge to guide this initiative and pursue opportunities for growth and advancement.

"Our goal is to harness the power of Birmingham's world-class medical knowledge, precision engineering and manufacturing expertise to move ideas toward the medical device marketplace," said Mark J. Suto, Ph.D., vice president of Drug Discovery at Southern Research. "Stacey has a strong background in biomedical engineering, and she possesses the talents to move this program forward."

JIM BAUM
Jim Baum joined Southern Research as chief financial officer. His career of over 30 years includes experience in industries ranging from real estate to gaming. Baum has held leadership roles in construction management, greenfield opportunities, disaster recovery, major rehab projects and other significant projects. He comes to Southern Research with a reputation for initiative and financial discipline.

Southern Research President and CEO Art Tipton, Ph.D., anticipates Baum applying those qualities to the organization's diverse financial needs. "Jim has such an extensive resume, including work in numerous industries and experience in areas like profit and loss, government and regulatory compliance and contract maintenance," he said. "It's exactly the experience we need managing the finances that support the work we do here at Southern Research."

YOUNG CHUL CHOI, PH.D., P.E.
Pictured on page 12
Environmental engineer Young Chul Choi, Ph.D., P.E., joined Southern Research to lead its Industrial Water Practice. In his role as associate director, Choi is responsible for the many business operations of the practice, including engineering services, technology development and analytical testing. He comes to SR with more than 15 years of experience in industrial wastewater treatment, reuse, process engineering and project management.

SR Energy & Environment both develops proprietary technology and performs technology evaluations to help clients comply with regulations.

"Young Chul is innovative and practical. He's developed new concepts in research environments and worked on mega-scale water treatment projects," said Corey Tyree, Ph.D., senior director of Energy & Environment.

"That great combination of experience makes him an expert resource for clients and a quality mentor to our staff." ■

◀ Babu Tekwani, Ph.D. (back)

"Tekwani brings a wealth of experience and adds a new dimension to Southern Research's infectious diseases drug discovery program," said Mark J. Suto, Ph.D., vice president of Drug Discovery.

▲ Pictured above: Kazutoshi Nakazawa, M.D., Ph.D.

▶ Pictured right: Stacey Kelpke, Ph.D.

▶ Pictured right: Judy Britt

▼ Pictured below: Jim Baum

JUDY BRITT RECEIVES THE PRESIDENT'S AWARD

Each year, the president and CEO awards an employee who demonstrates Southern Research's core values and goes above and beyond to help advance the organization's mission. This year, Art Tipton presented Judy Britt with the President's Award in recognition of her contributions and dedication to Southern Research.

Over her 30-year career at Southern Research, Judy Britt has set a shining example of customer service and dedication. The organization's core values of integrity and excellence are at the heart of all her efforts, and it shows in everything she does.

Since starting her career as a secretary of contracts in 1988, Britt has held numerous roles and remained a loyal employee. She is a prolific producer of contracts and related documents with a reputation for doing whatever it takes to get the job done. This year alone, Britt has led a team that has submitted 211 proposals and processed 105 contract awards. She is a valuable asset to the contracts team and to Southern Research as a whole. Her distinct qualities assist SR in being the extraordinary organization that it is.

Britt currently serves as contracts manager, where her deep experience with both government and commercial proposals and contracts has been invaluable to SR. In this role, she manages some of SR's largest and most complicated agreements. She freely shares her wealth of knowledge with her colleagues, and she is never too busy to answer a question. The impact of this institutional knowledge is felt across the organization.

Most notably, Britt's work and dedication to Southern Research's contracts efforts has furthered the organizational mission to solve the world's hardest problems, particularly in the areas of space flight, national defense, energy, the environment, and new therapeutics to treat various diseases. ■

Growing Prosperity

In the wake of the coal industry downturn in four Alabama counties, the Prosperity Fund was established to support entrepreneurship and cultivate an economic recovery in that region. To date, the fund has helped create 30 new businesses, assist 32 existing businesses and create and sustain 70 jobs. Here are some success stories.

▼ Pictured: Jessica S. Walker, the chief operating officer of Sanders Aviation. Jessica said the Prosperity Fund's assistance has been beneficial as it plans for future growth.

SANDERS AVIATION

With the help of the Prosperity Fund, Sanders Aviation is working to capitalize on growth in Alabama's aviation industry to fill the hole left by the coal industry. The family-owned company, which operates a flight training center at Walker County Airport, has established a partnership with Delta to develop a training program for Delta pilots. Sanders has also launched a course called "Theory of Aviation" at the Walker County Center of Technology to expose high school students to career opportunities in the field. The next planned step is an extension to the airport runway to accommodate larger aircraft and new economic opportunities.

CHONEX

Jefferson County startup CHONEX turns poop into plenty with the help of the black soldier fly. Technically known as an "agribusiness nutrient recycling company," CHONEX applies black soldier fly larvae to chicken manure, converting it into a certified organic protein feed, a component in cosmetics and a high-value organic fertilizer. CHONEX (an acronym of the four components of protein—carbon, hydrogen, oxygen and nitrogen, plus "ex" for extraction)—is the brainchild of entrepreneur Michael Lynch and farmer Harley Martin. The fund assisted with patent research, connected CHONEX with potential partners and helped assess equipment design and engineering challenges.

WALKER COUNTY TIMBER INDUSTRY

In a county battered by the coal downturn, University of Alabama students are working on strategies to strengthen the struggling forest products industry in its place. The Prosperity Fund activated students in UA's STEM Path to the MBA program for a year-long project investigating innovative uses for Walker County's vast timber resources. Strategies being explored range from more traditional uses like engineered wood panel systems for construction, to less conventional options like augmenting the county's pine tracts with fast-growing bamboo. Several area companies have already partnered with the students to explore these and other options more thoroughly.

ALABAMA BAMBOO

Largely dominated by dense pine forests, Alabama could soon be home to the growing bamboo fiber industry. The Prosperity Fund teamed up with bamboo fiber company Resource Fiber to connect with local businesses interested in exploring industrial benefits of bamboo or academics interested in research. Southern Research is providing services to Resource Fiber to assess important product characteristics and advance their development efforts. Bamboo grows rapidly—up to two feet per day—yields 20 times more fiber than trees, and requires little water, no pesticides and no replanting. Estimates show it could yield more revenue per acre than pine.

FAYETTE SMALL BUSINESSES

The tiny town of Fayette—population 4,500—was unlikely to attract any new big industries following the loss of all coal jobs in 2013. But local small business growth has the potential to provide a sustainable economic boost to the area. The Prosperity Fund has been working with small business owners and entrepreneurs to provide advice on funding sources, marketing services and suggestions of ways to trim expenses. With the fund's strategic guidance, Alabama Sunshine, maker of artisanal hot sauces and other products, has recently moved into a new, larger location to make room for recent business growth. ■

The Prosperity Fund is a public-private partnership funded through a grant from the Appalachian Regional Commission, BBVA Compass and the Walker Area Community Foundation.

2018'S PRINCIPAL SCIENTIFIC PRIORITIES

- Cancer
- ALS
- Parkinson's
- Mental Disorders
- HIV
- Zika Virus
- Influenza
- Energy Storage
- National Defense
- Space Flight
- Clean Water
- Sustainable Chemistry
- Medical Technology

16 **NUMBER OF COUNTRIES REPRESENTED BY EMPLOYEES**

- Bangladesh
- Bosnia
- Brazil
- Cameroon
- Canada
- China
- Cuba
- El Salvador
- Germany
- India
- Iran
- Japan
- Morocco
- Russia
- Ukraine
- USA

NUMBER OF EMPLOYEE ADVANCED DEGREES

04 DVM
05 JD
03 MD
70 PhD

NUMBER OF SOUTHERN RESEARCH EMPLOYEES

425

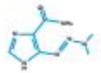
"The lives we touch, the corners of the universe we explore and even the innovative ways we find to perform scientific research all leave an indelible mark that is unique to Southern Research."

ARTHUR J. TIPTON, PH.D., PRESIDENT AND CEO OF SOUTHERN RESEARCH

Seven Cancer Treatment Drugs Developed by SR

- 1975

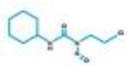
DACARBAZINE



Treats: Melanoma, Hodgkin's Disease and soft tissue sarcoma
How it works: Prevents cancer cells from dividing, triggering their death

- 1976

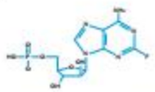
LOMUSTINE



Treats: Brain tumors
How it works: Damages the DNA of cancer cells, preventing them from dividing and causing their death

- 1991

FLUDARABINE



Treats: Adult leukemias and lymphomas
How it works: Interferes with cell division and causes cancer cells to die

- 1996

AMIFOSTINE

Treats: The harmful effects of radiation and chemotherapy
How it works: Promotes the repair of damaged tissue and binds to free radicals released by cells after exposure to cancer

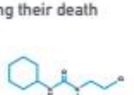
- 1997

CARMUSTINE

Treats: Brain tumors and multiple myeloma
How it works: Prevents the division of cancer cells by damaging their DNA

- 2004

CLOFARABINE



Treats: Leukemias and solid tumors
How it works: Interferes with cell division and causes cancer cells to die

- 2009

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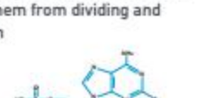

Treats: Lymphomas and solid tumors
How it works: Interferes with cell division and causes cancer cells to die

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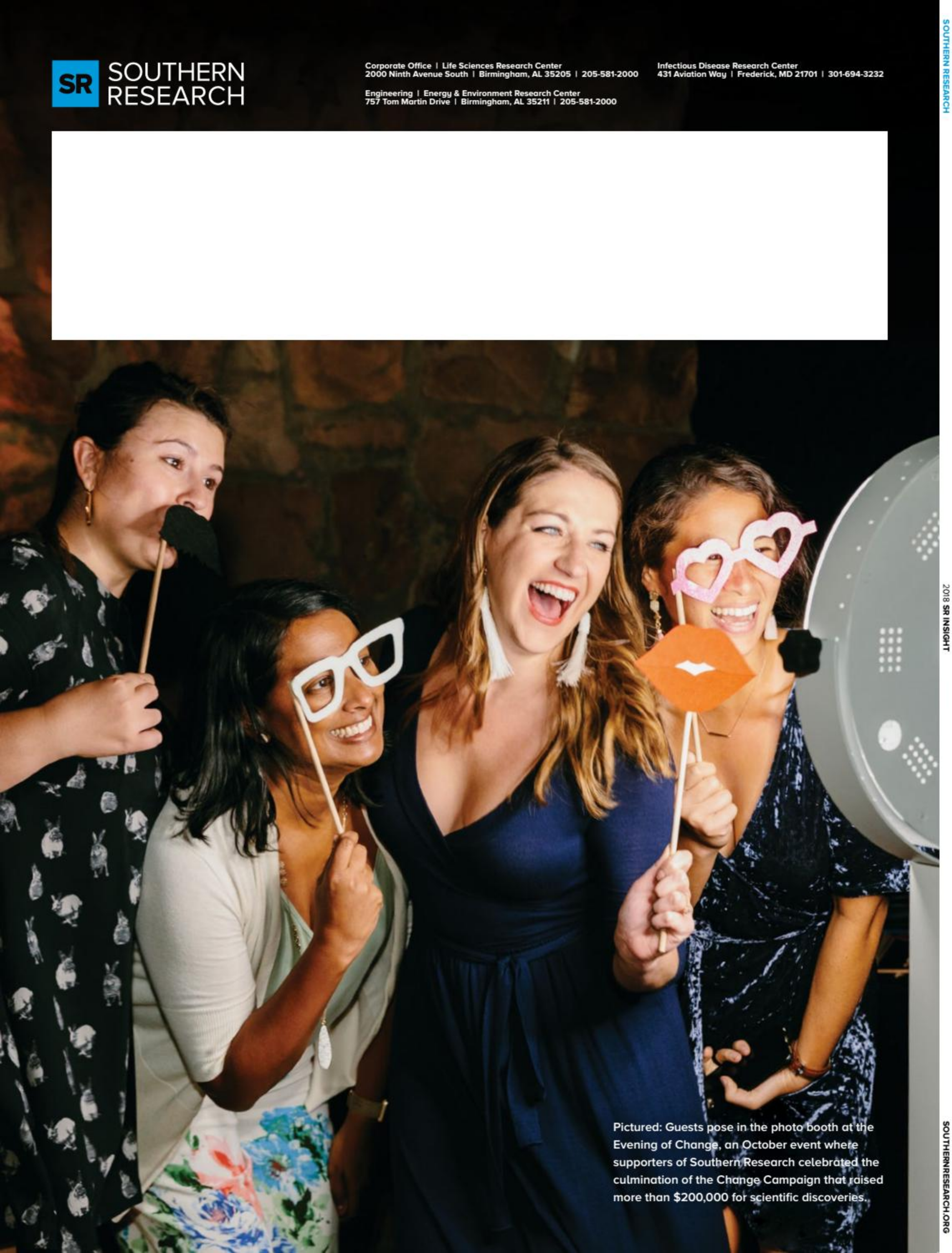

Pictured: Guests pose in the photo booth at the Evening of Change, an October event where supporters of Southern Research celebrated the culmination of the Change Campaign that raised more than $200,000 for scientific discoveries.