THE HARDROCK™

WINTER/SPRING 2020

SOUTH DAKOTA
SCHOOL OF MINES
& TECHNOLOGY

THE HARDROCK™

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About the Cover
Mines student researchers explore killing cancer with cold plasma.
More on page 10.

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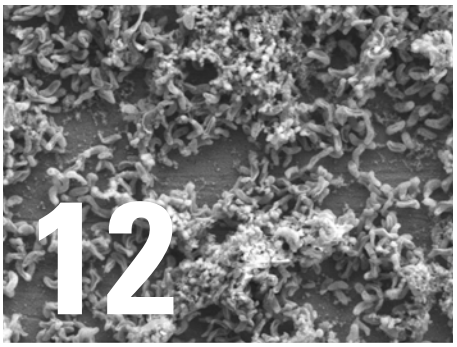

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Greetings, fellow alumni!

We are extremely pleased and honored to serve as co-presidents of your Alumni Association. It's already been a very active start to the year—Rocker Days, Outstanding Recent Grads awards, winter commencement, Distinguished Alumni awards, lots of committee meetings—and there are a number of exciting events yet to come.

Of course, the biggest one of all is *Reunion 2020,* our five-year all-school reunion set for July 8-12. Led by reunion committee chairpersons **Scott (EE 75) and Linda (ChemE 75) Rausch**, we're planning on the largest ever reunion. They were able to secure funds from some very generous donors to reduce the registration fee to an amazingly low price of just $25 per person. Yes, that's all! That includes all activities and meals except the golf tournament at Red Rocks and drink the Black Hills brewery tour (both on Friday, July 10). Other new offerings include organized hiking, biking, and rock climbing in the Black Hills. We will also enjoy the traditional events such as Tunnel Activities, M Hill climb, picnic, banquet, department open houses, and all that catching-up with friends from your days on campus. Registration is open online on the AA website. Please sign up the whole family now and plan to enjoy the biggest and best reunion ever!

Another big event we're looking forward to is the awarding of the March Medal at spring commencement. Many of our alumni make impressive, impactful contributions to South Dakota Mines and to society; this is one way to acknowledge them. Find the nominating form on the AA website and introduce us to a worthy grad in your circle. Take a look at the other awards presented by the AA, too. Perhaps you have candidates in mind for more than one.

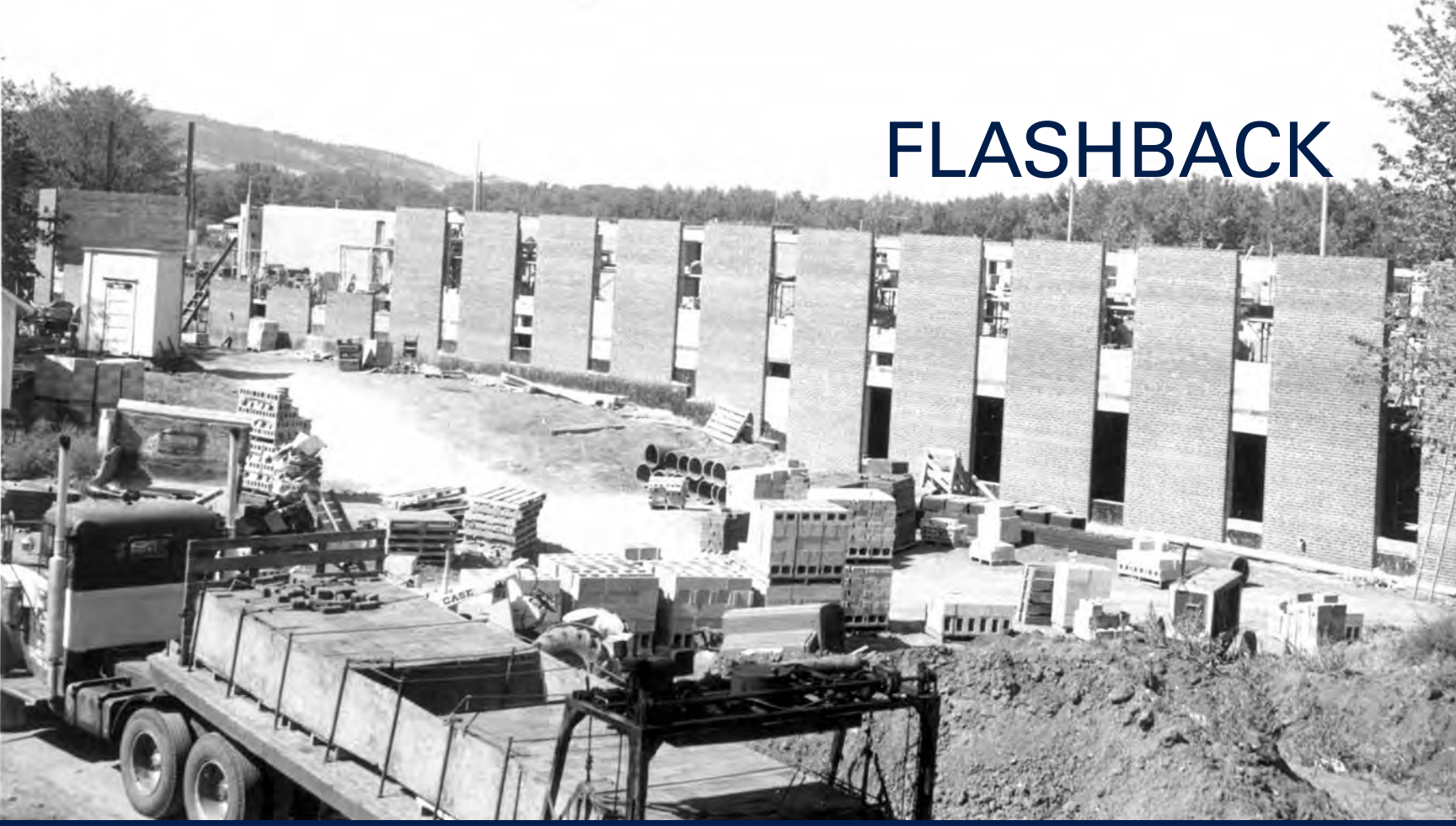
We are pleased to report that new AA chapters are being added each year, most recently one in Ridgewood, California, and one in Cedar Rapids, Iowa. Congratulations and welcome! We strongly encourage your involvement and participation in any/all events or committee work—you will find it very rewarding. Support for the chapters is provided by the AA staff and by the Alumni Engagement Committee who facilitate leadership training and peer support.

It is truly a privilege to serve with our enthusiastic and talented board members from all across the US. This includes our current past president, **Susan "Booty" Kuhns (MinE 75).** She launched an effort last year that we want to continue: ONE ALUM, ONE CONTACT, ONE WORLD OF DIFFERENCE, an effort to support the university in recruiting new Hardrockers. Please contact one potential student and introduce them to Mines. Check the alumni e-news to obtain a copy of admission's recruitment brochure. Thanks so much for your willingness to make a difference in a young person's life and South Dakota Mines.

Go Hardrockers!

Lorin L. Brass Mary H. Brass

Lorin & Mary Brass



FLASHBACK

125 years ago
1895

South Dakota Mines first intercollegiate football game is played against Black Hills College.

90 years ago
1930

The Washington sculpture on Mt. Rushmore is dedicated on July 4th and Mines President C.C. O'Harra gives the main address.

60 years ago
1960

Work on the new Mineral Industries Building begins. Today an effort is underway to replace and upgrade the aging facility.

10 years ago
2010

Ribbon-cutting ceremony for the new James Martin Paleontology Research Laboratory.

This page is thanks to the Devereaux Library

Buffalo at Custer State Park in the Black Hills

Dear Hardrocker Friends,

Hardrockers are highly successful underdogs. Our alma mater, South Dakota Mines, is a relatively small university when compared to larger schools. Yet, we have built a strong reputation for producing top-tier scientists and engineers. We recently celebrated our 20,000th graduate; these alumni have led the way in innovation, entrepreneurship, and major science and engineering projects around world for the past 135 years.

As we move into a new decade, we're working to find ways to extend the legacy of this institution. We must continue advancing the hands-on science and engineering education that inspires the next generation of STEM leaders. We also want to build our research potential to meet industry demand, capitalize opportunities, and extend human knowledge.

If you have not yet seen it, the university has unveiled a new campus master plan and a new strategic plan. These documents, along with our updated Mission, Vision, and Values, guide our progress in the coming years. These plans include new buildings that will house laboratory and teaching spaces needed to foster the next generation of innovative problem solvers.

This issue of the *Hardrock* delves into our effort to tackle challenging problems in the field of medicine. This includes profiles of faculty and alumni startups that are making waves in the pharmaceutical and medical device fields, research into using cold plasma to attack cancer cells, and a look at some of our graduates who have successful careers in healthcare.

I hope you plan to celebrate our legacy at Reunion 2020, July 8-12. Pages 20-21 go into more detail, but it is bound to be a wonderful time of connecting with old friends and making new ones while taking in the sights of the Black Hills and Badlands. I look forward to seeing you this summer.

Warm Regards,

James Rankin

Jim Rankin, PhD PE (EE 78)
President
South Dakota School of Mines & Technology

Ask the Mines Expert

Dr. Johnica J. Morrow

Pre-Health Pathways Advisor

What does the future job market for healthcare professionals look like and how does SD Mines prepare students for careers in healthcare?

The healthcare industry has a great job outlook. By the end of 2018, there were 16.2 million people working in the healthcare sector, accounting for about 11% of all jobs in the United States. It's also one of the fastest growing industries in the country, with around 346,000 jobs created in 2018, which equates to about 29,000 new jobs every month. Much of this anticipated growth stems from having a population that is getting older as the last of the baby boomers become senior citizens. But right now, we have a major shortfall in the number of healthcare professionals needed to address this growing need for health care services. The American Association of Medical Colleges (AAMC) estimates that there could be a shortage of over 120,000 physicians through 2030.

Here at SD Mines, we are working hard to prepare our pre-health students to enter health professions and address these needs both here in South Dakota and across the country. Our pre-health students are pursuing degrees in traditional fields such as biology, chemistry, and pre-professional health sciences, as well as in engineering fields such as mechanical, industrial, and biomedical.

Between the academic rigor, the many opportunities for developing leadership skills by being involved in campus organizations and events, and the dedicated staff in various student services at SD Mines, pre-health students have everything that they need to grow professionally and be prepared for a career in healthcare.

ROCKER DAYS
REVAMPED

Since 1912, South Dakota Mines students have climbed to the top of M Hill to whitewash and care for the iconic "M" every year during homecoming week.

The longstanding homecoming traditions at Mines are not just for students. Rocker Days (M Week) is also a great time for alumni to visit the Black Hills.

If the homecoming festivities aren't enough to entice you to return to your alma mater, fall is also a wonderful time to reconnect with the beauty of western South Dakota. Bring your family and take in the changing colors of Spearfish Canyon. Visit the Badlands, Mt. Rushmore, or any of the other national parks in the area.

The university has recently expanded Rocker Days activities to include more alumni events. Come reconnect with old friends and meet current students in the new Pearson Alumni & Conference Center. Let your kids (or grandkids) play in the children's area while you enjoy a local brew underneath the alumni tent on the top ramp at O'Harra Stadium during the homecoming football game.

While you're on campus, you'll be able to see some of the recent changes and ongoing construction in the neighborhood. You can also take a tour of your department to catch up with former professors and meet current faculty.

Mark your calendar for Rocker Days 2020, September 12-19. Also, don't forget to join us at Reunion 2020, which is just around the corner July 8-10!

An unlikely chance took Lee Solid's life from a family farm near Martin, South Dakota to a career in rocket science—and a direct hand in the success of Apollo 11.

Farm families have traditionally passed their businesses down through the generations, and Solid's was no different—his father expected him to take over. However, his mother was a teacher and encouraged him to get a college degree.

Solid started at the University of South Dakota where he majored in applied science. Two years in, his father unexpectedly changed his trajectory.

"My father gave me a challenge, and I took his challenge and transferred to Mines," he said. He enrolled as a mechanical engineering major in 1956. He felt drawn to the architectural field, so he took civil engineering electives, and graduated in December 1958.

Solid noted that some of his peers at Mines felt inspired to get into the space exploration industry after the Russians launched Sputnik in 1957. However, he was not similarly inspired. He interviewed with several companies but didn't have any job offers upon graduation, so he visited a few architectural firms in Sioux Falls in person. The second one he walked into hired him.

He didn't know he was about to play a part in one of the greatest achievements in human history.

Two months later, a company called RocketDyne, which later became part of Rockwell International and Boeing, offered him a job as a test engineer. He moved to the Los Angeles area and started a training program to test rocket engines in the Santa Susanna Mountains.

"I didn't even know what a rocket engine was," he said. "I jokingly say they gave me a headset and a procedure and said 'go test that engine.' I have to admit it was exciting."

A little more than a year and a few promotions later, Solid accepted an assignment in Cape Canaveral working on Atlas missiles, which used the engines he'd been testing. He was promoted to lead engineer about a year and a half later, when the US space program was in full swing with Mercury, Gemini, and Apollo.

> I sort of stumbled into the rocket engine business, but once I was in it, it was exciting.

"We had so much to do and such a short time to do it in," he said. "We were all very sensitive to the fact that we were going to put those feet on the moon by the end of the decade."

By the mid-1960s, he had earned a unique title: space manager. He and his team not only worked on the engine that would propel Apollo 11, they also worked on the smaller lunar module engine.

"If it didn't work, you'd have two guys stuck on the moon," he said. "This wasn't your run-of-the-mill, routine working environment."

Tensions and anxiety ran high. Everyone involved in the moon mission wanted to succeed, and safety was paramount.

"If I was going to check something twice, on Apollo I probably checked it four times," Solid said. "We had this goal hanging over us and we didn't want to be the ones that would cause us to not make it."

On launch day—July 16, 1969—Solid was working in one of the four firing rooms in Cape Canaveral's launch control center, along with program managers from Boeing, McDonnel Douglas, and IBM, to name a few.

Solid said Charles Lindbergh, the first person to complete a solo transatlantic flight, was also in the room as an observer.

He has no personal photos of that day. Much of his work was classified.

After the success of Apollo 11, he worked on Apollo 12 and 13, and later helped design the main engine for the space shuttle program. He retired in 1998.

Solid credits his career success to the support of his wife, Shirley, as well as his Mines degree and Midwestern upbringing.

"It was amazing how many of my peers in that company as well as others were farm boys from the Midwest," he said. "I can only assume that's because of the work ethic that you associate with growing up on a farm."

As 2019 was the 50-year anniversary of the Apollo 11 launch, Solid reflected on his career and the unexpected path his life took.

"I sort of stumbled into the rocket engine business, but once I was in it, it was exciting," he said. "I can't think of having done anything else with my life than being a rocket engine guy."

ROCKET SCIENTIST

Lee Solid (ME 58) reflects on his time in the Apollo Program

Photo courtesy SD Public Broadcasting

Cold CURE

Mines research team explores killing cancer with cold plasma

While using cold plasma to kill cancer cells isn't an entirely novel concept, a team of researchers and students at South Dakota School of Mines & Technology are exploring new ways to regulate cold plasma technology to target and kill cancer cells while leaving healthy cells alive.

If successful, the technique would prove to be a drug-free, minimally invasive cancer treatment that would affect the lives of millions of patients around the world.

Plasma is ionized gas – an energetic state of matter where some of the electrons in the outer atomic orbitals have become separated from the atom. In other words, it's a collection of ions and electrons no longer bound to each other. Cold plasma is a partially ionized gas where particles possess much higher energy.

SD Mines assistant professors Prasoon Diwakar, PhD, of the mechanical engineering department, and Timothy Brenza, PhD, of the chemical and biological engineering department, oversee the research with undergraduate mechanical engineering students Nicole Miller and **Kristen Haller (ME 19)**. Chemical and biological engineering PhD student Jordan Hoops and applied biological sciences undergraduate student Taylor Bright are also contributing to the work. Bright will be continuing the research in this area in place of Haller as an accelerated master's student in biomedical engineering.


Dr. Prasoon Diwakar

Diwakar began researching cold plasma cancer treatments as a postdoctoral research associate at Purdue University in West Lafayette, Indiana. While there, he helped to develop PLASMAT, or Plasma Technologies for a Healthier Tomorrow. The PLASMAT technique combines cold atmospheric plasma (CAP) with electroporation and/or photoporation in order to kill cancer cells without destroying healthy cells.

When he arrived at SD Mines in 2018, Diwakar began collaborating with Brenza, whose lab works with cancer cells in drug delivery research, including lung cancer.


Jordan Hoops

Together, the researchers turned their eye toward using cold plasma to treat lung cancers, but with a specific goal of improving the plasma's capability of targeting cancer cells only.

Diwakar says cold atmospheric plasma is not cold, but room temperature. Applying it to a finger causes no damage. However, a specific level applied to cancer cells destroys them.

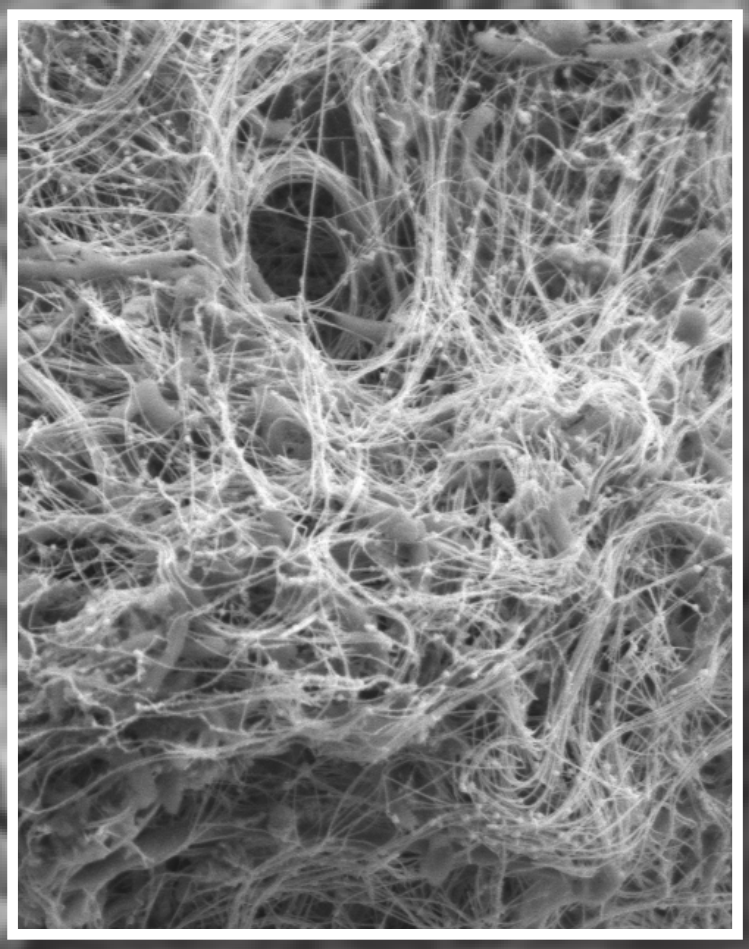
In order to kill cancer cells, however, the pores of the cells must be opened to allow the cold plasma to be "shot" into the interior of the cell. Electroporation opens the cell pores. Haller demonstrates this by placing the cells, which have been suspended in a conductive solution, into an electroporation system. An electrical pulse lasting just milliseconds is discharged through the cells, disturbing the outer membrane, and creating temporary pores. Once the pores are opened, Haller shoots cold plasma into the interior of the cell. The cold plasma introduces reactive oxygen and nitrogen into the cancerous cells, which leads to apoptosis or death of the cancer cells.

Diwakar says researchers have used cold plasma to "push cancer cells over the limit so they die." But this new research is focusing on finding the "right limit" – the level of cold plasma dosage needed to only kill the strain of cancer cells without damaging healthy cells nearby.

Eventually, this cold plasma process could be introduced into cancerous tissues and/or tumors in a person's body to kill cancer cells. And, unlike chemotherapy or even radiation, it would so precisely target the cancer cells that patients would not suffer the side effects caused by traditional treatments, including loss of hair, burned skin, nausea, etc.

Electroporation and cold plasma treatment would be most feasible for cancers that are easily reached in the body, such as skin cancer or cancers that cause accessible localized tumors. If successful, the next step will be application of the treatment to less accessible cancers, Diwakar says. Obviously, cancer inside the body would have to be exposed for electroporation to occur followed by cold plasma application. "If it's proven it can work, we'll have to change how it's applied. The cancer-affected area must be exposed. But we have some ideas," Diwakar says, including accessing the cancer laparoscopically.

The team has shown preliminary results that the combination of cold plasma and electroporation is effective in killing lung cancer cells. Haller and Miller were chosen from undergraduates around the country to present the results at SCIX 2019, the Great Scientific Exchange Conference, in Palm Springs in October 2019. Diwakar says the next step is to study the exact mechanism which leads to cell death.



BREAKTHROUGHS IN THE

SCIENCE OF SLIME

South Dakota Mines Researchers work on two-dimensional coatings that corral biofilms

Innovation is sometimes sparked by the ability to realize opportunity in failure.

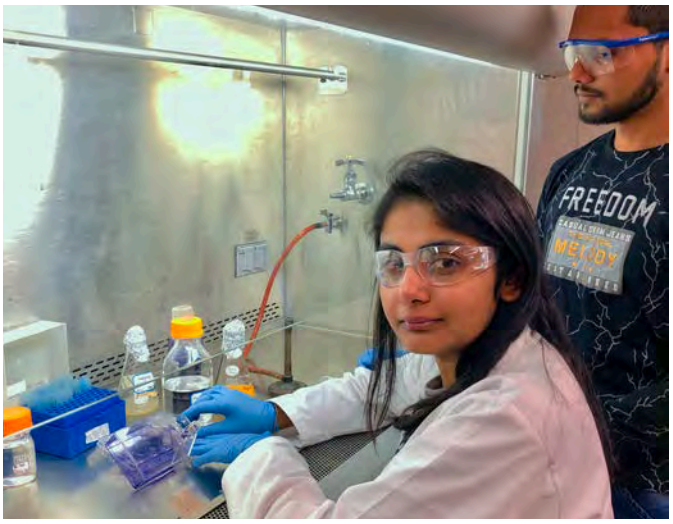
In 2010, some of Venkata Gadhamshetty's research failed to successfully develop graphene electrodes for microbial fuel cells. This is when Gadhamshetty observed a previously unreported phenomena. While the microbes completely disintegrated uncoated nickel foam, the coated nickel retained its physical integrity. This observation sparked an idea that two-dimensional (2D) materials, like graphene, could yield ultra-thin coatings for protecting materials against microbial attack.

The observation reshaped the research career of Gadhamshetty, sparking a decade-long journey that today includes a wide range of scientists from South Dakota. Researchers are now studying how nanometer graphene coatings would influence attachment of microbes on technologically relevant materials, specifically the underlying mechanisms that enable the microbes to form a slimy biological film (called a biofilm) on underlying surfaces. Researchers at Mines are finding that the slimy, yet strong, layers of biofilm can be enhanced or reduced using the ultra-thin coatings.

The early research helped Gadhamshetty land a prestigious National Science Foundation (NSF) Career Award. His work has also played a role in a new major multimillion-dollar effort centered at Mines. The South Dakota Biofilm Science and Engineering Center, funded by a $20 million NSF grant, includes scientists from across the state.

The broad range of work on the thin coatings that control biofilms has potential for applications across many sectors of industry and society, including energy generation, new medicines, wastewater purification, corrosion resistance, new materials, reduction of greenhouse gas emissions, and agriculture.

But Gadhamshetty, PhD, PE, a professor of civil and environmental engineering at Mines, is reluctant to take all of the limelight. "Without the help of everyone on the team, none of this is possible," he says. He credits success to his colleagues and key graduate students like Govinda Chilkoor, PhD, who are undertaking the hard work in the lab for hours on end. "The grad students play an incredible role, they do all the hard work, they often sacrifice the comforts of personal life," he says. "It's very difficult for a single person to achieve this kind of research funding," he says. "My role was simply to share my vision for 2D materials with potential researchers and help bring people together. I am thankful to numerous people in South Dakota, and beyond who contributed to this project."



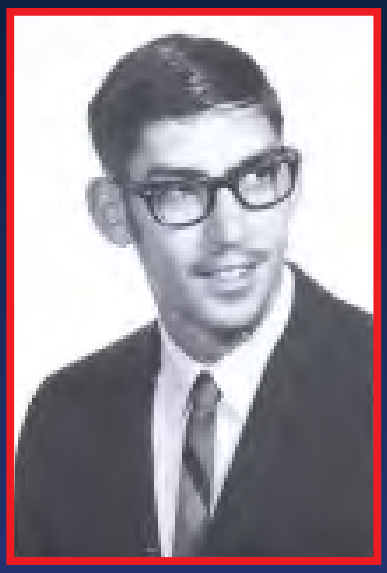
Robb Winter, PhD, department head and professor of chemical and biological engineering at Mines, is leading the the team of researchers in the 2D materials for the Biofilm Science and Engineering Center. Along with the research lead and co-principal investigator Gadhamshetty are Rajesh Sani, PhD, Bharat Jasthi, PhD, and Saurabh Dhiman, PhD.

In the past three years, the NSF has awarded a total of $32 million in funding for research led by faculty at Mines that expands human understanding of the microbial world. "This level of funding would be significant at any institution, even top tier research universities," says Winter.

Mines President Jim Rankin adds, "SD Mines is proud to lead this cutting-edge research which has huge potential benefits for the state and regional economy. This is an investment with the potential to pay itself back many times over in the creation of new startups and high-tech jobs that spin-off from the discoveries that are made."

HUGE Hearts

The Largest Estate Gift in University History



South Dakota Mines has received a $3.6 million donation, the largest gift in school history, for the Department of Civil and Environmental Engineering. The endowed gift comes from the estate of Willard and Billie Kaye Goodman.

The Goodmans' gift doubles the department's annual operating budget and provides opportunities for scholarships, graduate student stipends, faculty endowments, student activities, and lab facilities.

"This generous donation to civil and environmental engineering will have a huge impact on the faculty, staff, and students in that department. We are so pleased when alumni value their School of Mines education so much that they want to aid future scientists and engineers for decades to come. We're very grateful to the Goodmans for this endowment," says South Dakota Mines President Jim Rankin.

Willard, who passed away in 2013, was a 1970 civil engineering graduate. He was past owner of Plant and Flanged Equipment Company in Minneapolis and an avid golfer. He often touted the experiences and mentoring he received at South Dakota Mines as instrumental in his successful business achievements.

Goodman was from Philip, and expressed how appreciative he was for the great education South Dakota Mines provided to him. One of Goodman's key reasons for donating to the civil engineering department is the support he received as a student from department head Bill Coyle. Coyle's tenure with the university spanned 40 years, both as a faculty member and department head. Many alumni remember Coyle for his interest and interactions with students that expanded beyond the classroom. His concern for students and their well-being made them seek him out for guidance on academics, career planning, personal challenges, and financial difficulties.

"When he would talk about his professor Bill Coyle, he would start by saying, 'I'm probably going to start to cry when I tell you this.' He was very open about how South Dakota Mines changed his life — and thanks to the Goodmans, this gift is going to allow the university to become even better at changing the lives of the students for many more generations," says Brad Johnson, vice president for development of the South Dakota Mines Foundation.

"Bill Coyle's reputation has been the long-term, standing foundation of the department. His enduring legacy proves that a teacher and a mentor can have a true impact on a person's life," said Scott Kenner (CE 77), the current civil engineering department head. "The Goodmans' gift will continue that legacy and tradition of supporting the next generation of SD Mines graduates."

HIGH IMPACT HARDROCKERS

Dr. Darrell J. Drickey (Phys 56)

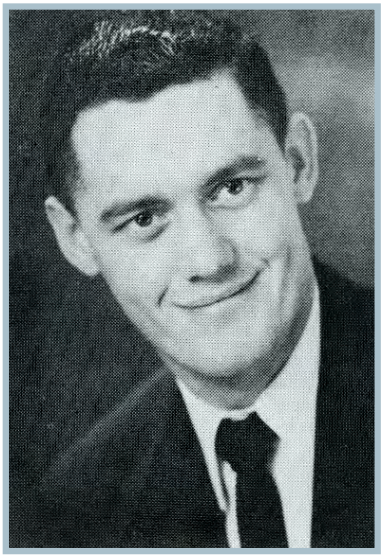
This is the first in an ongoing series of articles describing Mines alumni or associates who have made significant impacts on history.

The front page of the July 2, 1970, edition of the *New York Times* (NYT) carried an article titled "US and Soviet Set Joint Atom Studies." This article describes the first joint high energy physics studies formally undertaken between the USA and the USSR. It explained that the first joint study would be conducted at what was then the most powerful "atom smasher" in the world at Serpukhov, USSR. It would be followed by further joint studies at what was scheduled in the next year to become the world's most powerful accelerator at Fermilab, at Batavia, Illinois. It goes on to state:

"Yesterday, Dr. Darrell J. Drickey of the University of California, Los Angeles, leader of the American group, explained that the projected experiment at Serpukhov which is 60 miles south of Moscow could be performed only with a machine as powerful as the Soviet's."

This collaboration was to occupy Drickey for much of the next two years. The work is credited by many for starting a thaw in scientific relations between the world's two superpowers. The NYT article doesn't mention that he got his start as a physicist at South Dakota School of Mines & Technology, graduating in 1956.

Drickey had a strong bias for action—he got things done. The Serpukhov experience was an excellent example of this. He and some fellow scientists had envisioned an important measurement in high energy physics. It required particles accelerated beyond the limits of then existing US and western European facilities. It was ideal for the forthcoming US Fermilab. However, this facility was not yet operational and the schedule for its commissioning was not firm. The established Russian facility was of sufficient energy to accomplish the preliminary portions of the experiment. Drickey, using contacts that he had developed during several assignments in European facilities, was able to interest Russian colleagues in the prospective experiments, particularly the extension into the much higher energy of Fermilab. The result of much initiative and planning was described in the NYT article.



He and his family were to move to Russia to initiate the Serpukhov phase of the collaboration. He was a significant contributor in high energy physics in the dozen years 1963 through 1974 conducting research and building equipment at Stanford University, Brookhaven Laboratories, University of Paris (Sud), Institute for High Energy Physics at Serpukhov, University of California at Los Angeles, and Fermilab. He participated in the startups of both the Stanford Linear Accelerator and Fermilab. He was regarded by many of his contemporaries as one of the most accomplished experimental physicists of his generation, particularly as the leader of projects and teams. His promise for significant future accomplishment was cut short in late 1974 by cancer.

> Dr. Darrell J. Drickey of the University of California, Los Angeles, leader of the American group, explained that the projected experiment at Serpukhov which is 60 miles south of Moscow could be performed only with a machine as powerful as the Soviet's.

For more information about Darrell J. Drickey, PhD, especially his South Dakota roots and his accomplishments, see www.sdsmt.edu/research.

MED@ MINES

South Dakota School of Mines & Technology prepares many of the healthcare professionals of tomorrow. Here are just a few of our recent grads who are now pursuing healthcare-related careers.

Taylor Clemmons

Taylor Clemmons, a 2017 applied biological science graduate, is currently in the US Navy Health Professionals Program pursuing a degree in osteopathic medicine. The prestigious program pays 100 percent of her tuition and includes a commission as a Naval officer. Upon completion of the program, Clemmons will serve active duty one year for every year of participation in the program. She attends Idaho College of Osteopathic Medicine in Meridian, Idaho.

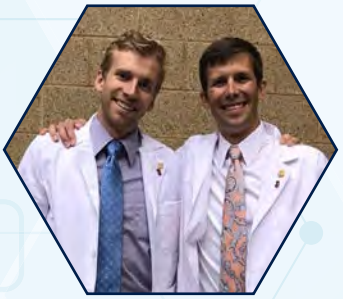
Allie Boggs Wright

Allie Boggs Wright majored in pre-professional health sciences for three years before being accepted early into chiropractic school. She is currently studying to become a chiropractor at Life University in Atlanta, Georgia. Boggs Wright says Mines was a great fit because it allowed her to play volleyball while also getting her degree. On the advice of her advisor, she was able to gain early acceptance to Life University by taking as many science classes as possible while at Mines.

Lydia Ford

Lydia Ford graduated from South Dakota Mines in May of 2019 with a degree in interdisciplinary sciences with an emphasis on pre-professional health sciences. She's currently getting her Master of healthcare administration at the University of North Texas Science Center in Fort Worth.

Ford says the rigorous coursework at Mines along with the high expectations of her professors did a great job of preparing her for the challenges of graduate school.



Peter and Levi Franz

Brothers Levi and Peter Franz are both graduates of South Dakota Mines and both went on to medical school at the University of South Dakota Sanford School of Medicine in Vermillion. Peter graduated from Mines in 2012 with a degree in industrial engineering. He is currently a third-year medical student at USD. He says Mines prepared him well for medical school "as it taught the basic foundations of critical thinking and hard work. In addition, Industrial Engineering is well suited for the field of medicine as there is weight given to process driven thinking and many opportunities for quality improvement.

Levi graduated from Mines with a degree in applied biological sciences in 2014. He is also a third-year medical student at USD. In addition to his degree studies, Levi also worked as a tech in the emergency department at Rapid City Regional Hospital to gain experience in the healthcare field. He found this incredibly helpful. Levi found that Mines taught him to work hard, which has helped him in his medical education. But he also learned while attending Mines to be kind to himself regarding his grades. "There's so much more to life than grades and your profession," he says.

Maggie Rizor

Maggie Rizor graduated from South Dakota Mines in May 2019 with a degree in industrial engineering and engineering management. She is currently a first-year dental student at the University of Iowa College of Dentistry. Rizor says her education at Mines "specifically in an engineering discipline, has prepared me in a number of ways for a career in dentistry." She says the focus on ergonomics, statistics, safety and hygiene, and process optimization, to name just a few, will benefit her greatly in dentistry school. "My education has also taught me to use logical reasoning to solve difficult problems." To top it all off, Rizor says her Mines education has inspired her to become a lifelong learner, which is critical in a healthcare field that is constantly evolving.

Tiny Fibers Reap HUGE REWARDS

The technology at the heart of Nanopareil revolves around nanofibers a thousand times smaller than a human hair. This astonishingly small-scale innovation could have a massive impact on the manufacturing cost for medicines and vaccines.

"The pharmaceutical industry really needs this technology," says Todd Menkhaus, PhD, a professor of biological and chemical engineering at South Dakota School of Mines & Technology and one of the researchers to develop the Nanopareil technology. "We developed this technology specifically to lower the costs of purifying lifesaving vaccines and medications so that they would be more accessible and more economical around the globe."

Nanopareil LLC got its start on the SD Mines campus in 2008 when Menkhaus and Hao Fong, PhD, a professor in chemistry, biology, and health sciences, began collaborating on research into nanofibers and separations.

They quickly found some pretty exciting results. By spraying or "electro spinning" polymer nanofibers into multiple layers, Fong and Menkhaus created sheets of a filter or sponge-like material. In its initial state, the material feels almost spongy to the touch. After final preparation, however, the sheet material feels and looks much like simple white paper.

Fong and Menkhaus discovered that when the material is used as a filter, it works as a sponge and collects or traps the targeted materials while allowing the inactive ingredients to flow through. Used in a pharmaceutical setting, where purification of drugs is critical, the spongy material can trap the "targeted, high-value product" and separate out the unwanted impurities or by-products, creating safe medications, says Craig Arnold, president and CEO of Nanopareil.

From their early data, Menkhaus and Fong realized the potential of their research and through a series of grants from the National Science Foundation, including the Small Business Innovation Research Phases I/II/IIB Grants, and investments from Black Hills Angel Fund and individuals and angel funds from around the state, were able to establish Nanopareil, LLC. The company has also gained support from the investment fund South Dakota Equity Partners.

In 2014, the company won the South Dakota Governor's Giant Vision Business Plan Competition, and in 2017 Nanopareil was named the Buzz of BIO at the BIO International Convention and took first place in Technologies of Tomorrow category.

The company's first home base was in a small lab on the campus of SD Mines. Recently, it moved into the Ascent Innovation building, located on campus. Ascent, Rapid City's business incubation center, is enabling the company to grow in research capabilities while also providing an ideal location for hosting potential customers and partners who have come from around the world to meet with Nanopareil staff and evaluate its new purification technologies. Nanopareil now has a second lab in Sioux Falls.

Menkhaus says interest in the technology has been most significant from pharmaceutical companies. Currently, the purification process for therapeutic drugs is expensive, time-consuming, and requires large infrastructure. With more companies losing exclusive patents on brand name medicines, the door has opened for other companies to make cheaper generic brands, and companies are seeking ways to cut costs while maintaining safe, effective medications. Nanopareil's technology will make this possible.

> We developed this technology specifically to lower the costs of purifying life-saving vaccines and medications.

Using Nanopareil's nanoscale purification devices is 100 to 1,000 times faster than the current processes. A purification cycle that currently takes 100 hours now could be reduced to less than one hour.

The technology also allows for much smaller, much cheaper and portable purification equipment, says Menkhaus. Nanopareil can reduce purification costs for pharmaceutical companies by more than 80 percent.

"Generics or "Biosimilars" are making it important for them to be more cost competitive," Menkhaus says. "This is a better way of purifying therapeutic drugs." And as the pharmaceutical industry moves toward personalized and gene-based medicines, companies will need cheaper, more efficient alternatives as medication batches become smaller.

In the area of vaccines, Menkhaus says the technology could reduce costs from $20 a dose to less than 20 cents a dose. "We want to focus on doing good while doing well," says Menkhaus, who points out that the technology could help bring economical vaccines to the developing world.

While pharmaceuticals are the main focus of the technology, Arnold and Menkhaus expect it will also find customers in other industries over time, including water purification, renewable energy, and biomedical devices.

Having made first sales, the company is making inroads in commercializing the technology. "When it comes to commercialization of bioprocessing technology, it takes significant time and resources to gain acceptance by the marketplace," Arnold says.

The company is actively engaged with multiple "market-leading" companies already servicing the pharmaceutical industry. "Our goal is to introduce our technology to market in the fastest and most effective way. We believe that we could achieve our market adoption goal faster with the right partner," Arnold says.

The company continues to develop and grow in its new lab at Ascent. SD Mines students are hired to work in the lab, giving Nanopareil a workforce and students a hard-to-beat experience with a cutting-edge startup. It's a win-win situation for the company and the students, and another example of how trailblazing technology often gets its start at SD Mines.

"We feel fortunate that we've been able to locally source our employees," says Arnold. "And we're excited to witness how this SD Mines-developed technology will make a positive impact in the world."

SCHEDULE OF EVENTS

Monday, July 6

On Monday, a bicycle trip along the Mickelson Trail in the Hill City area will be held. This will be an informal event which you can join at any time during the day, and take as long as you want. Bring your own bikes, or you can rent bikes at any of the local bike shops. A map will be available online from our website which will point out suggested routes. All will be "easy" or "moderate" in difficulty. A few suggested hiking trails will also be included.

Tuesday, July 7

Outdoor activities will feature biking and hiking in the Sylvan Lake area. You may enjoy biking on the nearby stretch of the Mickelson Trail, or the many hiking trails in the Black Elk Peak and Sylvan Lake area. This will also be an informal event that you can join at any time, for as long as you want. Details will be available on the Alumni Association / Reunion 2020 website.

Wednesday, July 8

Additional outdoor activities are scheduled for Wednesday in the Sheridan Lake and Needles area. Suggested routes will be available on our website for those wanting to hike, bike, or rock climb in the central Black Hills.

Registration will be open The Pearson Alumni Center at 1 p.m. Be sure to stop by the registration area to pick up your Reunion 2020 Program, souveniers, and your tickets for reunion events.

Thursday, July 9

Registration will be open at The Pearson Alumni Center, 8 a.m. to 4 p.m. President Jim Rankin will officially welcome all reunion attendees at Surbeck Center at 9:30 a.m. Tunnel activities will commence at 10:30 a.m. after the official welcome. All are welcome to attend a forum at the King Center where you will learn about new economic development activities that are under way in the region that the Mines is involved in. You will be pleased to hear about all of the opportunities available for our students. The all class social will be held at the Alumni Center. It will be organized by decade as in the past. At the conclusion of the social, opportunities will be available for additional entertainment and socializing downtown at Summer Nights.

Friday, July 10

Registration will be open 8 a.m. to 4 p.m at Surbeck Center. The Hardrocker Golf Classic will again be held at the Golf Club at Red Rock. Those wishing to participate should sign up during your online registration. Proceeds from this event will benefit the Hardrock Club.

The Alumni Center will be hosting an open house on Friday morning. Stop by for a tour of the facility. The family picnic will again be held on the campus quad. After the family picnic, all campus departments will be hosting open houses. You are invited to stop by the academic departments, athletic department and the music department for tours and short presentations. Many professional societies, fraternities, and sororities will be having special events for their members on Friday evening. If your organization is planning an event, they will be contacting you separately. A new event this year is a pub crawl and Black Hills brewery tour. The pub crawl will visit many popular establishments in Rapid City. Sign up for the bus tour when filling out your online registration form. The bus tour will make stops at many of the fine Black Hills brewing and wine making companies from Hill City to Deadwood and will be returning to campus around midnight.

Saturday, July 11

The day begins early with a pancake breakfast at Founders Park near M Hill. After breakfast, the group will climb M Hill. The decade lunches will be held after the hill climb at various restaurants in Rapid City. The locations of the lunches will be on the reunion website and in the reunion program.

The banquet and dance will again be held at the Ramkota. Several campus organizations have requested special seating arrangements for their alumni members. We have reserved all available banquet facilities at the Ramkota, and we will do our best to seat members of the organizations together. If you would like to be seated with a particular group, be sure to make the selection when registering online. At the conclusion of the banquet, the individual areas will be opened up to allow for mingling and socializing.

Sunday, July 12

We will conclude our reunion activities on Sunday morning at the Newman Center. The Newman Center is located just east of the Pearson Alumni Center. On Sunday morning, a Catholic mass will be held at 7 a.m. A non-denominational alumni worship service will be held at 9 a.m. Whether you attend the religious services or not, all reunion attendees are invited to stop by the Newman Center for a "farewell" coffee on Sunday morning.

If you have any questions, feel free to contact us at: serausch@aol.com or lgrausch@aol.com, or Sarah.VonEye@sdsmt.edu.

Scott Rausch (EE 75) & **Linda [Ganske] Rausch (ChE 75)**

Reunion 2020 Co-Chairs

COME HOME HARDROCKERS

We would like to welcome you all to the 2020 five-year all-school reunion. In planning for this event, we have retained many favorite activities from years past, and added a few new events which we hope you will enjoy. Our goal for reunion week is to entice you to spend your summer vacation with your School of Mines friends in Rapid City! We are including three days of informal, family-oriented outdoor events in addition to the traditional reunion events we have enjoyed in the past.

The biggest change from prior reunions is a substantially reduced registration fee of $25 per person. The generosity of several donors has made this possible. We know that many alumni have come home during past reunion weeks to visit family and friends, but some were reluctant to register for the reunion because of the fee. It is our hope that you will perceive the value of all of the included events for the modest cost and join us!

New events include hiking, biking, and rock climbing for families to enjoy on Monday, Tuesday, and Wednesday of the reunion week.

A pub crawl and Black Hills brewery bus tour will be new on the schedule for Friday evening.

Look for traditional reunion event favorites such as the golf tournament, tunnel activities, family picnic on the quad, M Hill climb, decade class lunches, and the banquet.

The chemical engineering and electrical engineering departments will be hosting special events to celebrate their 100th anniversaries on campus. The university will be hosting an economic development panel on Thursday to showcase recent business development activities in the region.

Our reunion hotel is the Ramkota, located just north of I-90 on LaCrosse Street. They are offering special rates for reunion attendees. Their contact information is on their web site. Be sure to mention that you are with our reunion to get the special rate, and make your reservation early.

Check the Alumni Association Reunion 2020 website for the latest information about the reunion activities. We will be providing additional details there for your vacation planning purposes as the reunion approaches.

Where the GRASS IS GREENER

Two Mines Alumni Journey from NASA to Biomedical Entrepreneurship in Ireland

Successful entrepreneurs share a key trait: they excel at managing risk. In 2017, **Amanda (CEE 12)** and **Travis (ME 13) Davis** faced the challenge of a giant leap into entrepreneurship head on. The couple left successful jobs at NASA and moved to Dublin, Ireland, to launch two medical device companies. Amanda is leading Diaspense™, which specializes in patient centric diabetic products. Travis is the chief technical officer for Starling Surgical. The startup is developing a new wound closure device that could fit well into the $7 billion global market for this procedure.

The couple didn't make the decision to leave secure jobs lightly. "We're engineers, so we overthink many of our decisions," jokes Travis. In fact, the couple found their engineering background at South Dakota Mines key to their continued success as entrepreneurs. "It's a balancing act between careful planning, research, and bold leaps," says Amanda.

In the medical device field, there are countless unknowns. "Do you understand the needs of the market? Do you need patents? Do you need FDA approval? When should you hire someone who knows the process to help?" says Amanda.

"It's not for the faint of heart. The research and the regulatory process can be a real bear, but if you take it step-by-step and follow a plan, you can achieve success" says Travis.

> "YOU'RE AN ENGINEER. STOP THINKING THAT SOMEONE ELSE WILL FIND A SOLUTION."

The Quest for Pain

The first step in developing a new medical device is knowing the market. As a type 1 diabetic, Amanda's own experience as a patient gave her personal knowledge of the "pain points" in the marketplace.

"It was early morning and my blood sugars were low—I was shaking and struggling to set up my blood glucose meter," remembers Amanda. "My struggling woke my husband and he hurried to help. I had a brand-new vial of test strips and my husband, fully awake, still had a tough time hurriedly retrieving a single test strip for my meter. Finally, after dumping the entire container of test strips on the counter, we were able to check my blood glucose. Not surprisingly, I had very low blood sugar. Travis sprinted to the kitchen to get a juice box to bring my blood sugar back into range, then asked, 'Isn't there an easier way to get those out?'"

This is how Amanda's company, Diaspense, was born. The couple's invention, a cap on the bottle of test strips that dispenses one strip at a time, is now available for sale, and it's receiving rave reviews from users. The lesson here, says Amanda, is "stop thinking that someone else will find a solution." She knew the need for a new product and she had the engineering expertise and the entrepreneurial drive to create a patient-centered solution. Her product is a textbook example of the best way to get a foothold in the medical device field.

"Find a need that needs to be filled," says Travis. This phase of medical device business development generally requires careful observation and a lot of research. "It's an additional skill above our engineering degrees. To be successful, you spend a lot of time observing patients."

Capitalizing Opportunity

Travis is the CTO of Starling Surgical. The company is tackling the challenge of wound closure with a product called "QuickStitch." This is no small market. There are 250 million surgeries each year — 450 every second. The idea behind the technology came from Travis's partner, Starling Surgical CEO Cyrus Doctor, a trauma and orthopedic surgeon who saw a need for better ways to close a wound after performing thousands of surgeries.

During an operation, such as a hip replacement, closing the laceration quickly and then limiting infection risk during healing can dramatically improve patient survival rates. There are two primary options on the marketplace—sutures, which are slow to administer but have a lower infection rate, and staples, which are fast but have a higher infection rate. QuickStitch provides superior sutures at stapler speed. The device allows surgeons to quickly close a wound with optimal post-operative healing.

The product is making a big splash. The pre-clinical results of the patent pending device have received rave reviews from industry leaders. Starling Surgical has also secured about $1 million in funding from Enterprise Ireland and EIT health. QuickStitch is in the FDA approval process with plans to spin out of Trinity College Dublin (where Travis is based) in late 2020. Starling Surgical is maintaining the momentum needed to carry their product to market as it continues to seek investors to help make the leap into manufacturing.

Growing Greener Grass

Ireland is well known for its mind-blowing level of green. Parts of the country receive annual rainfall best measured in feet, not

inches. The lush landscape underpins Ireland's traditional economic mainstays agriculture and tourism. About twenty years ago, medical technology industry leaders in Dublin and the surrounding cities made a move beyond medical device manufacturing and into research and development. They cultivated a cooperative ecosystem that allowed various players to work together for the benefit of everyone. Today, Ireland's biomedical sector is recognized as a global hub that touts centers for major industry leaders such as Johnson & Johnson, Medtronic, Pfizer, and Boston Scientific.

"It's grown into the main driver of the area's economy," says Travis. "They started by building an environment that allowed small companies to thrive and that attracted larger firms." Travis and Amanda see potential in this model for the Black Hills. "If we looked at all our strengths in South Dakota we could do this as well, as long as we can make sure everyone complements each other's efforts," adds Amanda.

"The human capital is here thanks to South Dakota Mines and area universities," says Travis. The couple sees promise in the building of the new Ascent Innovation campus in Rapid City. They also give praise to programs on the South Dakota Mines campus like the Entrepreneurs in Residence, CEO Business Competition, and the Braun Inventors Award. "These weren't at Mines when I was a student eight years ago. I encourage current students to take advantage of these opportunities," says Travis.

Bend, Don't Break in the Wind

(This update came to this article just before publication.) Travis and Amanda are expecting their first child in March, fittingly on St. Patrick's Day. Like any good entrepreneurs, they are flexible in molding their plans to conform with their life goals.

The couple has moved back to the United States be closer to family. Amanda is continuing work with her company Diaspense, and they are working together on DavisD4, which helps its clients build prototypes, develop websites, and create marketing plans.

Travis writes "Starling Surgical is transitioning to a point that I had completed a large part of the exploratory research and design. We have grown the team and I have stepped back from full time to free up more of our budget for manufacturing and hiring. I still have periodic calls with the team to work with them on the overall vision and continued fundraising efforts. It is great to see the company growing and we have a long way to go, but it is exciting to see how far we have already come."

Travis accepted a position with Blue Origin as a test engineer II in Huntsville, Alabama, at the Marshall Space Flight Center Test Area. He is on the team that test fires the BE-3 and BE-4 rocket engines for Blue Origin.

Diaspense™

IN MEMORIAM

The names below include those who have passed (based on our database records) in the last 10 years, but whose names have not appeared in a previous Hardrock magazine. Please contact us if you know of any errors in this list. Going forward, it will be helpful if you share information about the passing of alumni you may know. The names below were received by February 7, 2020, and are listed alphabetically by year of graduation.

Romauld Bachmayer (ChE 40) 7/9/19
Bob Steinbach (MetE 43) 7/18/19
Geraldean Fluke (Phys 48) 10/19/19
Lewis O'Neal (GeolE 48) 2019
Ronald Pulfrey (CE 48) 2019
James Robertson (ME 49) 11/21/19
George Carleton (ChE 50) 8/22/19
Ronald Kiehn (EE 50) 1/29/20
Robert Prunty (ME 50) 3/3/19
Taylor Smith (CE 50) 11/19/18
Hezzy Brown (GenE 51) 11/24/16
John Deney (GeolE 51) 5/19/18
Russ Hendrick (ME 51) 12/23/19
E. H. "Pete" Pederson (ChE 51) 10/4/18
Robert Kenner (GeolE 52) 10/5/19
Roy Harrison (ME 53) 7/13/19
Richard Wall (EE 54) 6/28/19
Jack Roadifer (GeolE 55) 10/14/18
K. Fred Brodsky (EE 56) 5/3/17
Allen Brugman (GeolE 56) 10/15/19
Vernon Buchele (CE 56) 4/12/19
John Regnier (Chem 56) 10/12/19
Harry Baltzer (CE 57) 11/11/19
Nancy Ward Dunham (EE 57) 12/4/19
Clyde Jundt (CE 57) 1/8/20
Jim Lanphere (GenE 57) 12/8/19
Jim Adams (ChE 58) 8/31/19
James Joyce (EE 58) 9/11/19
David Sturgeon (GeolE 58) 11/3/19
Richard Todd (ME 58) 8/28/19
Richard Becker (EE 59) 6/17/19
James Christensen (MetE 59) 1/23/19
Duane Gustad (MetE 59) 6/28/19
Jim Hayes (GenE 59) 11/29/19
Don Niebrugge (CE 59) 6/13/19
Jack Smart (EE 59) 9/20/19
Joseph Spencer (ME 59) 5/14/19
Ronald Dodson (CE 60) 11/17/19
Dennis Dutcher (ChE 60) 10/30/19
Darrell Henderson (ME 60) 12/5/19
James Washenberger (Math 60) 9/4/19
Daniel Baldauf (CE 61) 10/9/19
David Cowling (ME 61) 4/12/19
Donald Steffe (EE 61) 8/4/19
Donald Thommen (EE 61) 10/16/19
Gilbert Anderson (EE 62) 7/26/19
Frank Hoxsie (EE 62) 5/22/19
Wallace "Buck" Nowell (ME 67) 9/19/19
Karl Bartel (EE 68) 11/23/19
Bjørg Corneliussen (EE 70) 10/24/19
Owen Cowing (ME 70) 1/17/20
Tonya [Lund] Rist (Chem 70) 10/27/19
Ted Deilke (ChE 72) 11/20/19
William Frels (MS Phys 72) 8/21/19
Raymond Bernatchez (GeolE 73) 7/31/19
Mike Meszaros (ME 78) 11/11/19
Daniel Stout (EE 79) 6/13/19
Kevin Lammle (MinE 80) 1/24/20
Phil Viet (ME 83) 11/12/19
Todd Heathershaw (EE 86) 8/4/19
Karel Silovsky (ME 86) 7/17/16
Michael Havird (ME 89) 7/7/19
Brent Garrison (ME 94) 9/3/19
Rod Hauptmeier (EE 03) 11/23/19
Bobby Davis (Geol 04) 2/5/15
Michael DeFea (GeolE 04) 11/16/19
Brian Glover (EE 04) 10/30/19
Houston Wagner (Geol 16) 11/11/19
Torger Henckel (MinE 19) 9/21/19

Former Faculty/Staff:
John Arneson (Psyc Professor) 9/17/19
Frank Bosworth (CE Faculty) 2/2/20
C.W. Chiang (ME faculty) 1/31/20

CLASS notes

1940s

Bachy Bachmayer (ChE 40) died on July 9, 2019, at the age of 102. Until then, he was our oldest known living School of Mines alumni. Bachy is shown starting over with only one birthday candle for his 101st birthday on October 26, 2017. According to our database records, we cannot confirm that we currently have any centenarian alumni.

1950s

Richard Schafer (CE 51) Success Dam in the Central Valley of Tulare County, California, has been renamed the Richard L. Schafer Dam. Richard has devoted decades of hard work in collaboration with the US Army Corps of Engineers toward the improvement and enlargement of the dam to benefit farmers and citizens of the area with storage, flood control, irrigation, recreation, and electrical power generation. The Dam is a federal project and required legislation introduced in the US House of Representatives by Rep. Kevin McCarthy to change its name. This bipartisan bill unanimously passed in the House and the Senate and was signed into law by President Trump on August 9, 2019. The renaming ceremony, hosted by the Corps of Engineers, was on October 1, where Sacramento District Commander Colonel James Handura said, "It is not often that we get the chance to rename a dam, and it is a special privilege to honor a man like Richard L. Schafer who has done so much for his community and the nation." Schafer is a WWII veteran and has not yet officially retired. He turned 94 on October 8 and has always been known as a friend of the farmer. This attribute may be linked to his boyhood years growing up in Cresbard, SD.

William Cohan (MinE 55) "I finally retired at the end of September after 64 years in mining, of which the last 39 were as a consultant. My wife of 60+ wonderful years passed away in June of last year. But I have four wonderful daughters who look after me. In my career I have worked on projects in most of the western United States, Australia, Canada, the Yukon, Ghana, Mexico, South Africa, Kazakhstan, and Pakistan. I have served on several state boards in Colorado, including the Colorado Mined Land Reclamation Board (3 terms) and the Mineral, Energy and Geology Advisory Board to the Governor of Colorado. All in all, my career has been very interesting and most of the time rewarding. An interesting side note, in 2006 I had my right knee replaced by **Terry Heil's (ME 55)** son! It is a small world!"

Pete Vossos (Chem 56) "I am still alive and kicking although the pace is certainly slower. My wife and I are lucky in that all of our kids and grandkids live close. What that means is that we often babysit and even more often have to decide which baseball, soccer game or school event to attend. Weekends used to be for chores, even Sundays, but not anymore. I talked to **Bob Annett (ME 56)** recently

and we are both hoping to attend the reunion this coming summer and look forward to seeing many old friends!"

Ron Sanders (CE 57) "Since retiring much of my time has been taken by teaching two Bible classes. I also have had two books published, *God in IMax* and *Revelation.*"

Bruce Johnsen (CE 59) "We visited Rapid on a whirlwind trip. Went to Rockham for opening day and saw only one pheasant—water everywhere, like none of us have ever seen before. The crops were still in the muddy fields. As the priest at Rockham said Sunday, 'We prayed desperately for rain last year and got too much this year.' Meanwhile, back in California, fire season is upon us and we desperately need rain. The power outages are still north of us, but it could happen any day. Other than that, I am still consulting with family businesses and partnerships at a reduced rate and trying to get out and have more fun in between."

Jan Matousek (MetE 59) and **Anne-Marie Suriano (PhD MES 16)** represented SDSM&T in Vancouver in August at Copper 2019 as part of the Conference of Metallurgists of The Metallurgical Society of CIM.

1960s

Per Kragseth (CE 62) "From the start of the early 50s, about 800 Norwegian students came to South Dakota School of Mines & Technology in Rapid City to get a higher technical education. Most of these students came from Bergen Technical School (BTS) but also from other Norwegian schools. This is such an important side of the higher Norwegian education system that some of us have written the book: *Drømmen om Rapid* (The Dream of Rapid) about this. It is written in Norwegian and can be ordered directly from the publisher: www.bodoniforlag.no. Tentative plans are to get this translated to English."

Herb Reichert (Math 66) "My wife Sally and I celebrated our 50th wedding anniversary on July 26, 2019. Our celebration started on July 21, 2019, with a church service made special by the singing of some of our favorite hymns, arranged in advance by our oldest grandson (who also played his trumpet to accompany some of the hymns) and his parents. We had flowers on the altar and served cake to our church family after the service. Most important was the fact that our entire family was there for worship. In the afternoon, our entire family drove to Cragun's Resort near Brainerd, Minnesota, for a family 'get together.' We spent four nights and five days in a cabin large enough for our entire family (19 of us). We had perfect weather for the entire time and had great family time together; many memories were created for everyone!"

Gary Young (CE 66) [on right] and a group of Delta Sigs gathered for lunch in Denver. From left: **Marv Truhe (ME 67), Peter Haugen (MetE 69), Randy Parcel (MinE 67), Russ Buyse (EE 63),** and **Dan Young (CE 70).**

Paul Axtell (ChE 68) "I enjoyed the annual pheasant hunt near Pierre with **Ron Jeitz (CE 69)**. My new book on meetings will be out on February 1, 2020."

Delmar Rumph (GeolE 68) "What a glorious sunset tonight, following a beautiful Indian Summer day here in Colorado! Jan and I got to walk nine holes and shared the golf course with several big mule deer bucks, a lone skulking coyote, and Canada geese in a vee overhead. Retirement just doesn't get any better than this, all of which got me to thinking about how lucky we are. This Veterans Day is a great time to give thanks and honor all you fellow Hardrockers for your military service to our country."

Dan Carda (ChE 68) is back in Rapid City working on a new injection mold design for surgical training devices.

Gene McPherson (EE 68) "Attending my 50-year reunion in 2018 was an adult-life goal. I SO enjoyed being there! I think that the most important thing that we now have in common, we who were there, is that we all have survived life for 50 adult years and can gather to tell about it. The only problem was that so many of our classmates were not there. I now spend winters at the home of my new wife, Barbara, in Punta Gorda, Florida, just north of Ft. Myers. Last year, we went on a three-month round-the-world journey to West Africa, East Africa, Cape Town, South Africa, Seychelles, Maldives, Sri Lanka, Thailand, Malaysia, Singapore, Manila, Palau, Guam, and Hawaii."

Charley Chambers (ME 69) is enjoying retirement and traveling. "In October, we spent three weeks in Italy. The highlight was when lightning hit the villa we were staying in (we were out), but there was major damage to the villa."

Gary Vaplon (MetE 69) "Time flies when you are having fun! Hard to believe it has been 50 years since leaving Mines for a busy work career that spanned 32 years with four major corporations, life in six different states and four years in Malaysia. My wife, Sharon, and I retired from Cabot Corporation in 2001 where I was director of global operations for 45 Industrial chemical plants in thirty-three countries. Our daughter and son are both engineers, have very successful careers, and lead busy family lives in San Diego. Retirement in Payson, Arizona, for the past 17 years has been rewarding in many aspects and has allowed us to enjoy living in the mountains only 90 minutes from Phoenix. Sharon still enjoys overseas trips but I have almost hung up my spurs for those long encounters. We both golf and enjoy the outdoors with elk and other wildlife passing through our front yard frequently. Our dog Annie keeps us safe. An engineering degree from Mines provided a lot of opportunities in mining, minerals, and specialty chemicals as I gained valuable work experience in these fields and the challenge of working with a multitude of people from all walks of life. I always felt that my education at Mines was competitive with all the graduates from many of the top engineering schools that I encountered."

1970s

Bjarne Rolland (EE 70) "Some of us from class of 1970 from Bergen, Norway, are planning to attend (hopefully) the 50-year graduate reunion in May."

Fred Rist (ME 70) "My wife, Pastor **Tanya [Lund] Rist (Chem 70),** died on October 27. We were looking forward to celebrating our 50th wedding anniversary and attending our 50th class reunion next spring. Tanya died from dementia with Lewy bodies. Her health declined over the last two-and-a-half years, and since early this year, her decline was quite rapid. Her funeral was on November 1, All Saints Day. **Tom Hayes (Chem 70),** a classmate of ours, attended the funeral. We also had contact with other classmates: **Craig (Chem 70)** and Mary Lou, **Scott and Dianne Hinsch (Chem 70).**

Allan (ChE 71) and Carolyn **Clark** "We moved closer to our grandchildren and now live full time in Florida. We took a two-week cruise to New Zealand and Australia to celebrate our 45th wedding anniversary in November."

Bruce DeMarcus (MinE 73) "I am completely retired after shutting down my consulting services company and living a good life on top of Strawberry Hill outside Deadwood/Lead. Recently had an intruder (a black bear) eating at my bird feeder on my upper deck. Lots of friends and colleagues go south for the winter, but we thrive in this environment."

Vickie DeNeui (Math 73) "I am still contracting parttime supporting SAP projects, but also had a lot of fun traveling with **Mary Jane Green (CE 78)** to Asia for about five weeks in October and November. The photo is from the Great Wall in Beijing."

Jim Klein (CE 73) is still retired and living in paradise (New Braunfels, Texas). "I have

been shelling pecans and have a guest bedroom."

Alan (EE 74) and Liz **Bergeron** "We had an amazing adventure to Morocco. We learned a lot, ate extremely well, and saw a wide variety of sights. Morocco was fascinating with a diverse and mystical history. We explored tiny alleyways in ancient cities, stopping in lively markets and colorful bazaars. It was thrilling (for Liz, not so much for Alan!) to ride camels in the Sahara and camp under the stars. In the lovely coastal town of Essaouira, we wandered beaches, enjoyed delicious fresh fish with local fishermen, and met artisans and residents. The final stop was Casablanca where we visited the spectacular Hassan II Mosque (the largest in Africa) and ate at a reconstructed Rick's Café."

Marc Loken (MS Math 77), Debbie and **Ralph (CE 75) Wagner** celebrated a Mines Muster at the Basilica of St. Mary in Minneapolis. Mines Musters started when Ralph was Alumni Association president (2008-10).

Front: **Susan Kuhns (GeolE 75)** and **Kathy Miller (Chem 74).** Back: **Linda Rausch (ChE 75) Anita Freeman (EE 76)**, and **Carmen Adams (ChE 75)** enjoy time together in Rapid City on M Day.

Mike (MetE 77) and Shelley **Heil** "We retired in Bucks County, Pennsylvania, in 2018 to be closer to two grandchildren. We make frequent trips to central Indiana to visit our other five grandchildren. We absolutely love all seven of them and their unique personalities. We try to get to the Dakotas as often as we can to visit family. We're planning on attending the 2020 SDSM&T reunion and spend most of July in the Dakotas. Retirement is good. Medicare is around the corner, there is always a project, and settling into the community, church, and of course, local coffee shops. P.S. We love visitors! Come, stay, and explore the area."

Janita Smith (Chem 77) lives in Northern Illinois. "My main concerns at this age are my seven children, their spouses, 14 grandchildren with a 15th on the way, plus an Andalusian horse farm! My husband has not yet retired, but we travel quite a bit, and try to spend four to six weeks in the winter somewhere warm - lately Grand Bahama Island!"

Mary Jane Green (CE 78) and **Vickie [Pollock] DeNeui (Math 73)** went on a 38-day Asian adventure starting in Beijing with a week of mainland tours. "We boarded ship in Shanghai for a 27-day cruise around Japan, Taiwan, Philippines, Hong Kong, Vietnam, Cambodia, and Thailand. We spent two days in Singapore and arrived back in the US two days before Thanksgiving. We are looking forward to Reunion 2020."

Dave Gibbons (MinE 78) "Toni and I continue to get mail in Denver, however seems like we are always on the go, either back in South Dakota visiting family and friends or in Alabama, where our youngest son lives. We have the 2020 reunion on our calendar and hope to attend."

Ernest Anoma (MinE 78) "Greetings from Fulshear, Texas. I had a nice visit with President **Jim Rankin (EE 78)** and Interim Provost **Lance Roberts (CE 97)** in July. It was a great homecoming for me to see the campus transformation after 41 years of absence. Thanks for enabling my contact with **Jim Guthrie (MinE 79)**, my buddy at Tech, and with classmate **Mike Koch (MinE 80).** Thank you to classmate President Rankin for allowing me to park in the parking space reserved for the president.

1980s

Sharon (Wagner) Jones (Chem 81) "My sister, **Lisa (Wagner) Durgin (ChE 93),** and I have been getting some publicity for winning the Sheridan, Wyoming, startup challenge with our new MuscleShok™ (muscle and pain relief) products. It's been a fun experience and we credit our strong STEM foundation from SDSM&T as fundamental to our success in this new business venture."

Rick (MetE 81) and Wanda **Howie** and **Bonnie [Isaak] McCourtie (ChE 80)** met twice in 2019 for weddings. Rick and Wanda's daughter Victoria was married in Sioux Falls on May 26. Bonnie's son Matthew was married in Wilmington, North Carolina, on June 29. "Since we live on opposite sides of the country, we don't get together very often but this year we had lots to celebrate!"

Harry (CE81) and Vicky **Rossander** retired from their work places last year. "We built a concrete berm home on a small acreage in southwest Iowa and moved in to the new house in May. I'm still trying to figure out what retirement looks and feels like, but so far it is pretty nice. I'm very much looking forward to the reunion next summer in Rapid City."

Al Goldschmidt (EE 82) "Pam and I did quite a bit of world traveling again this year and also relocated from the West Coast to the East Coast. We are very happy and relieved to be out of California with all the problems it is experiencing these days with the fires and water shortages."

Steve Rice (ChE 82) "Greetings from Mitchell, SD, home of the world's only Corn Palace. I am still hanging out in Mitchell after 38 years. I guess I never created a reason to leave. I have been married for 33+ years and have three grown children, all college graduates, two gainfully employed and the third in medical school hoping to someday be employed. I also have one granddaughter who is the center of the universe. For the past 10 years I have been working for Innovative Systems in telecommunications software development. We have at least 28 School of Mines graduates working here so Tech happenings are always being discussed. I was a nine-year Mitchell School Board member and I am completing my eighth year on the City Council. This is not a political note but a note to encourage community involvement. The engineering problem-solving viewpoint is unique. This thinking has a place in business and there is a need in community governments and leadership. There is a reason there is a push for STEM students in the education system as the need for data-driven problem solving is increasing in our ever-changing world. I work with an engineer whose wife continually reminds him that, 'normal people don't think that way,' he nods his head and says he is grateful for being an engineer and not being normal. I have the 2020 school reunion on my calendar for this summer."

Ronald (MS Geol 84) and Diana **Rueb** enjoy traveling Europe while living in Stuttgart, Germany, where they both work for the U.S. Department of Defense.

Jerry Beckman (EE 84) "I'm on the move, yet again. My position as a data center equipment designer came to an end in late September with Molex in Little Rock, Arkansas, but I was fortunate to quickly find a new position as a medical electronics designer with Sanmina in Huntsville, Alabama, which is my wife's home state. This is the third time in my career working in the state of Alabama, so between this and my wife's help, I'm getting to know the state quite well. Lastly, my wife reminded me to say 'Roll Tide!'"

Mike Mutchler (MinE 85) "I am the CEO for Amarillo Gold, a TSXV company developing two gold projects in Brazil."

Lynne [Wictor] (ChE 87) and Mike **Bukovic** visited the Black Hills and the School of Mines' campus in September. "We thoroughly enjoyed connecting with friends and alumni both on and off campus! We toured the new Pearson Alumni and Conference Center and encourage visiting alumni and their families to stop by to see the new building. We are always impressed by the new developments and opportunities for students and positive changes at Mines!"

WAPA (Western Area Power Administration) has over 1,000 wholesale customers (municipal, rural electrics, and federal and state institutions, including SDSM&T) in eleven western states. **Kevin Schultz (EE 90), Roger Hanson (EE 72), Michael Scheibe (EE 88),** and **Lori [Tschetter] Messegee (EE 88)** are employed at WAPA In Huron. **Levi Butts (CEng 19)** and **Chris Bultsma (EE 09)** also work for WAPA.

Nancy Nixon (CSc 89) "I love coming back to South Dakota and spending time with my five grandkids and mom. Since retiring from Wayne Fueling Systems several years ago, I am able to spend much of my summer and fall with them. The photo was at the Shrine Circus in Deadwood. I also enjoy traveling with my husband, Mark, on his work trips. Favorite this year was Emerson Exchange in Nashville. My oldest son, Tate Wells, runs the ranch in Piedmont and works at Adams. Charles Fort (a baby when I graduated Tech) works at RecStation in Spearfish and runs pontoon rentals. Josh Nixon graduated from Texas Tech (ChE) and is working for Invista (Koch) in Victoria, Texas (following dad's footsteps). Youngest son, Jordan Nixon, works at EEA is Austin, Texas, designing HVAC systems, got his associates in engineering and is continuing his ME. Can't wait for our new house in the country at San Gabriel, Texas, to be completed."

Jackie Sargent (EE 89), Austin (TX) Energy GM/CEO, and **Jackie Flowers (CE 92)**, Tacoma (WA) Public Utilities Director/CEO, toured the only offshore wind farm project in the western hemisphere (off the coast of Rhode Island's Block Island).

Dale Hrachovec (EE 89) "It has been an inexcusably long time since I last contacted anyone from the college. Hello to old classmates I have lost touch with. My kids and current business climate have taught me to make texting my primary form of communication these days, and I use no social media except LinkedIn (rarely). I am now working in developing next generation medical devices. Significant change in work life from designing and starting up power plants all over the world for the prior 20 years. Cheers."

1990s

Rich (ChE 91) and Kate **Hardegger** returned to the Twin Cities after five years in Calgary. "I was the office manager for Barr Engineering's Calgary office from 2013 to 2018 and focused on diversifying the client base and project work during the downturn in the oil market. Kate filled several contracts in health research with the University of Calgary while we were there. Calgary's proximity to the beautiful Canadian Rockies is missed, but we are happy to be closer to our sons again. Jon and Matt are also engineers in the Twin Cities."

Jackie Flowers (CE 92), Tacoma (WA) Public Utilities Director/CEO, and **Jackie Sargent (EE 89),** Austin (TX) Energy GM/CEO, met up for a night tour of Washington, DC, during a power conference. Jackie and Jackie treat their LPPC executive colleagues to a Jackie[2] duet of Ramblin' Wreck whenever they have meetings. LLPC (Large Public Power Council) is comprised of 27 of the largest consumer-owned utilities in the United States.

Chris (ME93) and Ann **Kruschke** "Our eldest son, Titus, is a freshman at the University of Cincinnati majoring in chemical engineering. It isn't Tech, but it is engineering! Titus is also

in the UC marching band. Maddie is in the color guard for Beavercreek High School marching band. Evelyn just picked up drums so she will follow in her brother's footsteps in three years. I was promoted last June to the position of senior facility engineer at the Air Force Research Lab at Wright-Patterson AFB. Good job as I get to interface with and help the rest of the lab's facility engineering offices throughout the country."

Kenneth Hargens (IS 96) "Since my retirement from the Veterans Administration I am kept busy by my building projects at my place northwest of Hill City on Mystic Road. I often write historical pieces for the *Custer Chronicle* and local magazines centered on geology and mining. I give talks on the pioneer history of the original folks who populated Custer State Park before the state appropriated the lands. Whenever possible, I explore and prospect. As I received another degree from South Dakota State University Class of 2006 (BSN), I have established an annual scholarship at the SDSU West River Campus. I have two grandchildren 10 and 12. They are interested in their school sports, science, and robotics."

Paula Jensen (IE 98) is the senior fleet coordinator at Black Hills Energy in Rapid City.

Scott Young (CE 99) "My wife and I are no longer in Sweden. I am still with VOLVO construction equipment but now based out of our Shippensburg, Pennsylvania, office and we live in Maryland. "

Roger Kurtenbach (Chem 99) started a business seven years ago called Sticks and Stones, LLC. "I custom make walking sticks for tourism related businesses and have sold nearly 5,000 sticks to customers in states all over the US."

2000s

Brandon Cruse (IE 05) was the referee for the 2020 Rose Bowl football game between the Wisconsin Badgers and the Oregon Ducks. Brandon is shown meeting with the team captains and Rose Bowl dignitaries at the coin toss prior to kickoff.

Joy [McClure] Mueller, MD (MetE 07) has joined the Regional Health Medical Clinic as a family physician in Sturgis. Her in-clinic family practice includes pediatrics, adolescents, adults, women's health, and geriatrics. She also serves as an inpatient and emergency care physician. Dr. Mueller is excited to live in the Black Hills with her husband and son to enjoy a wide variety of outdoor activities.

Trevor and **Jennifer [Davis] (CE 08) Walz** welcomed a baby girl, Serenity, to their family on March 21, 2019. "She is living up to her name. Trinity is loving being a big sister, but has to be reminded that Serenity needs her own space sometimes."

Chris Bultsma (EE 09) married

Helen Hoekman in Watertown on October 5. Hardrockers in attendance included **Adam Schulz (CEng 09), Nathan Fischer (EE 09), Justin (CEng 09)** and **Renae (IS 09) Schmidt.** "I am still working for WAPA in the Operations Office."

Jordan (EE 09), Abby (8

months), and Kelly **Reuer** enjoy living in Colorado Springs, Colorado. Jordan is a systems engineer with Northrop Grumman. "The engineering landscape has certainly changed a lot in the 10+ years."

2010s

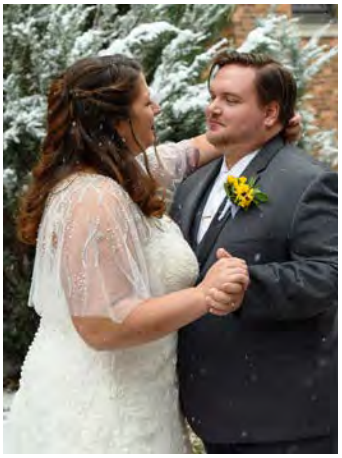
Josh (ME 11) and Kathryn [Claxton] **Green** (on the right) were married in Macon, Georgia, on November 23. Attending the wedding were **Adam Schulz (CEng 09), Crystal Kuchta (MinE 13)**, and **Jim Green (ME 74)**.

Alpha Omega Epsilon sisters **Katherine Toscana (ChE 11), Codie [Hughes] Burleson (ChE 12), Caitlin [Rohde] McNeilly (GeoE 12), Grace [Carrier] Moehring (ChE 14), Leah Davis (ChE 15)**, and **Katy Ramsbacher (IE 13)** gathered in Houston in August for a baby shower for Caitlin. Baby boy Hayes McNeilly was born on September 28.

Loryn [Schuetzle] (IE 11) and Kyle Lichty (ChE 11) have welcomed a new son to their family. Franklin Leon Lichty was born on July 4, 2019. Frank joins brother Wade (4) in their family of future Hardrockers. Kyle and Loryn both work and reside in Yankton, SD.

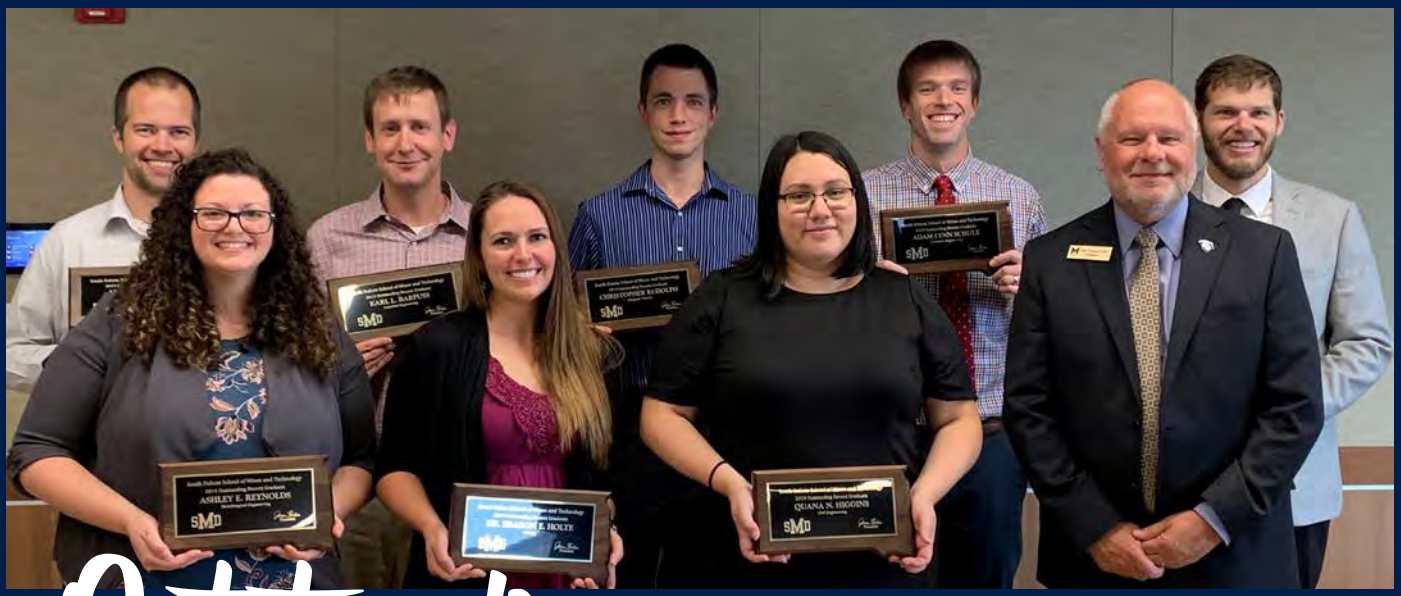
Dallas Harder (ChE 15) "I got married in September of this year to Emily Wehde (she went to Augustana University). We live in our hometown of Sioux Falls. I work for POET as a process engineer, and she is an admissions counselor for University of Northwestern – St. Paul."

Gina Rossi (CEE 16) and Michael Tinio were married on April 27, 2019, at Cure of Ars Catholic Church in Leawood, Kansas.



Luke Malsom (ME 17) & Shalyn [Salonek] Malsom were married on a surprisingly snowy afternoon on October 12, 2019 at St. Marys Catholic Church in Aberdeen, South Dakota. Luke works at Mettler Sichmeller Engineering as a mechanical engineer, and Shay works in the Aberdeen Public School System. The couple resides in Aberdeen. Members of the wedding party include, **Patrick Dawn (Best man, Chem 17), Mitchell Pence (ME 17), Justen Gelling (ME 17), Peter Moon (ME 17),** and **Shannon Spronk (ME 17).**

Marco Pascolo (EE 18) [sporting the 'helluva engineer' cap], **Rohit Dulal (ME 16),** and Philip Piestch (exchange student at Mines from Germany) enjoy time together at Lake Como, Italy. They all met at Mines, loved their time there, created lifelong friendships, and plan to meet other Hardrocker friends as they travel the world. Marco lives and works in Milan, Italy, and Rohit works remotely in Tampa for Mastel Precision in Rapid City.



Outstanding Recent Grads

Front:
Ashley Reynolds (MetE 09)
Sharon Holte (Geol 09)
Quana Higgins (CE 09)
President Jim Rankin (EE 78)

Back:
Andy Downs (EE 08)
Karl Barfuss (IE 08)
Chris Rudolph (CSc 08)
Adam Schulz (CEng 09)
John Nielson (MinE 08)

SD Mines In-State Tuition Awards =

$4000 / yr. in savings.

Hardrocker Heritage Award

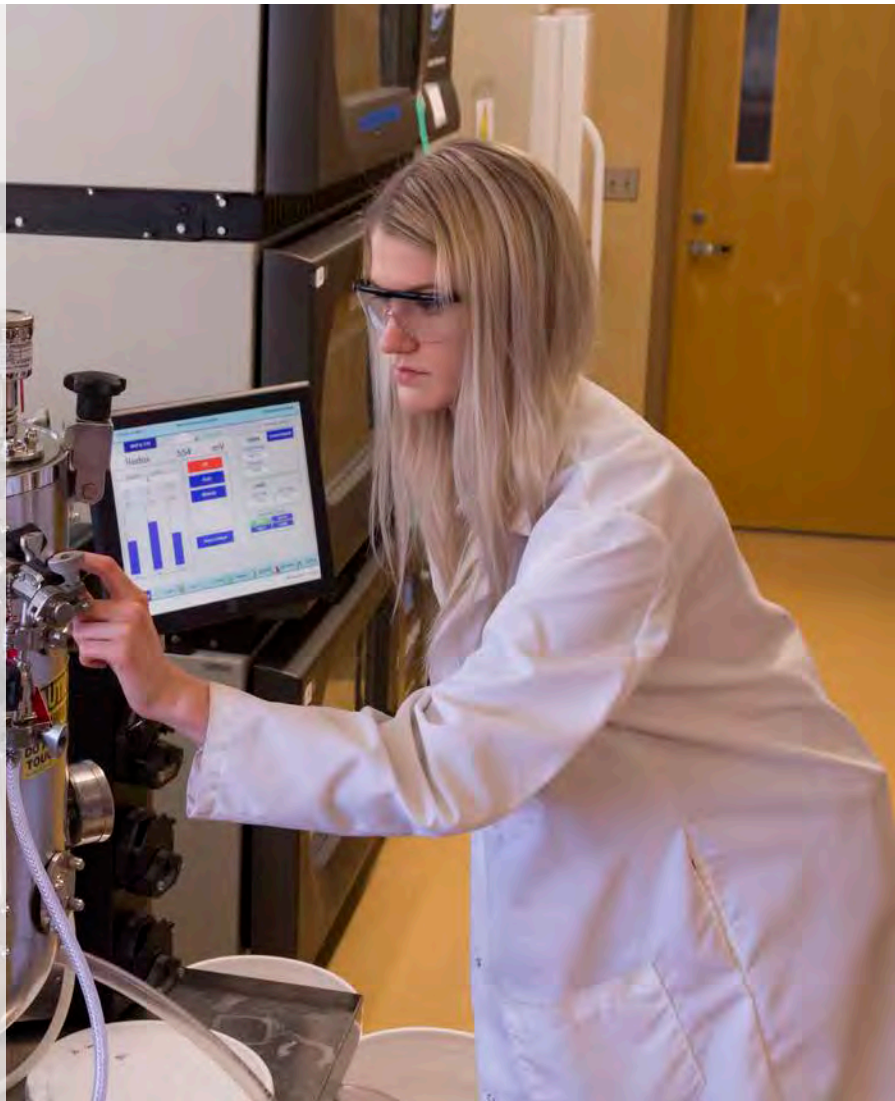
For qualifying students with at least one parent or legal guardian who graduated from SD Mines!

South Dakota Advantage

New freshmen and new transfers from North Dakota, Iowa, Nebraska, Wyoming, Montana, and Colorado pay in-state tuition.

Minnesota Reciprocity

Minnesota students receive in-state rates.



ALUMNI Gatherings

Sterling Greni, Jr (ME 08) and Sarah Swimm were married May 26, 2019 in Vail, CO. Front Row: **Shawn Klabunde (EE 90), Sterline Greni (ChE 81), Adam Thompson (GeolE 07), Mark Olsen (ChE 88),** Sarah and **Sterling Greni, Jr. (ME 08), Rita Krebs (Geol 98), Dave Hartmann (CE 94), Vivian Greni (ME 85),** and **Nick (CEng 99)** and **Aliana (CEng 40) Phillips, Dan Thuringer (EE 96), Kim (IS 99)** and **Mike (EE 03) Pridgeon, Tyson Kubas (IE 07),** Derek Sherman, Jason Jackson**, Rod Pappel (ME 77),** and **Brogan Pappel (ME 14).**

Brenna [Mollet] Radtke (Math 17) and **Jake Radtke (IE 17)** were married on December 28, 2019. Back row: **Chaz (CE 17), Hannah [Wegehaupt] Kieffer (CSc 18), Daniel Biorn (IE 16), Tad Radtke (CE 18), Dayne Jacobs (MetE 87), Chris (ME 90) and Audra [Schneider] (ME 91) Mollet, Phil Schneider (ME 85), Rachel (CSc 13), Scott (EE 86), and Rose [Schneider] (CSc 86) Pekarek, Marv Schneider (ME 85), Jaysen Schock (ME 90), Justin Schroeder-Schock (ME 16), Ben Wolf (CE 14), Chris Romanjenko (CE 18), Colby Harris (ME 18), Zeke Brallier (ME 19), Dallas Harder (ChE 15)** Front Row**: Cody Cronin (EE 18), Mark Undseth (IE 16), Kinslee Hage (CE 19), Jamie Reisenburg (IS 18), Jake (IE 17) and Brenna [Mollet] (Math 17) Radtke, Katie [Reed] Wolf (CE 17), Anna Larson (CE 18), Gina [Rossi] Tinio (CE 16), Elizabeth Larsen (CE 17), Libby Friesen (CE 17), and Matteo Knox (ChE 17).**

Kansas City, MO, August 8, 2019 - **Tyler Adams (CEE 14),** Rose Kelzenberg (EE Student), Michael Mansfield (CEE Student)**, Megan Harbour (CEng 07), Gena Engel (ChE 06), Gina [Rossi] Tinio (CEE 16),** Mindy [Castle] Mansfield (CE Student)**, Andrew Tobin (EE Student) I**saac Egermier (Csc Student), Josh Duklet (CSc Student)**, Justin Tomac (IE 93), Josef Ceritelli (CSc 18), Lance Baum (CEng 16), Mackenzie Lee (CE 18), Jordan Landen (ME 17), Guy Clay (ChemE 19), Erik Bjornbebo (CEng 11) John Tines (ME 08), Shane Lee (MinE 10), Justin Wenner (ME 06),** Michael Rogers (EE Student)**, Joshua Sass (ME 05), Walter Coombe (ME 09), Derek Stotz (CSc 14), Aaron Vogel (ME 18), Douglas Colbert (ME 12), Eric Young (MetE 10).**

Stavanger, Norway, September, 9 2019 - Front row: **Deborah Sandven (ChE 81), President Jim Rankin (EE 78),** and **Karsten Haga (EE 94).** Middle row: **Terje Høyland (EE 90), Geir Fjeldberg (EE 88), Perry Kopperstad (MetE 90),** and **Olav Elstad (CSc 87). Back row: Sven Tore Raugstad (MS T MGT 03), Ivar Fett (CE 72), Bjørn Finnby (EE 78), Reidar Hellesø (EE 78), Anne Lise Fjældberg (EE 90),** and **Per Jesper Lassa (EE 79).**

Bergen, Norway, September 12, 2019 - Front row: **Gunnar Bognø (ME 71), Tor Tylden (EE 72), Øvind Søvik (CE 70), Bjørn Ask (EE 70) and Lars Seeberg (EE 70).** Back row: **Øistein Fotland (CE 76), Godtfred Nymark (EE 69), Robert Fredriksen (ME 70),** Rune Vie Hafstad (exchange student)**, Olav Mæhle (ME 70), President Jim Rankin (EE 78), Hans Nilsen (EE 70), and Magne Hessen (ChE 69).**

A new record of 12 Hardrockers (all Triangles) made it this year to northeast Manitoba for the weeklong August Dogskin fishing event. Along with the Hardrockers, there are a few fishing friends mixed in. Standing: Dr Jim Kulbom, Rick Sederholm, **Dave Krull (Ex 70), Joe Vig (CE 71), Les Thiel (ME 67), Randy Shaw (EE 70), Mike Bates**-partially hidden **(EE 70), Bob White (CE 72), Wally Sieck (ME 70),** Pat Rodman, Paul Salverson, and Dr. Pete Rodman. Kneeling: Gary Power, **Lee Zacharias (ME 73),** Norm DeWit, Nathan DeWit, **Pete Birrenkott (ME 71), Dean Rafferty (ME 70), Bruce Harding (ChE 74),** and **Jim Brown (CE 70).**

San Antonio alumni held a muster on M Day, September 28, 2019. **Steve Vought (ME 10),** Louise and **Loren (ME 61) Peterson, Jason Luze (IS 10),** Shannon White (Lesleys daughter), **Lesley Pedde (CE 84) and Sam Begeman (ME 64).**

The Salt Lake chapter of the SD Mines Alumni Association held its luncheon at the Legends Grill on November 8, 2019. Fourteen people, including nine alumni, attended. The next luncheon is scheduled for February 1, 2020 at the Legends. Front Row: **Terry (ME 76) and** Kaye **Meidinger,** Carron Kopren, **Bill Benda (EE 57), Mary and Oliver (EE 64) Petik. Back Row: Chris Peters (MinE 12), Caleb Bestgen (MinE 08), Doug Kopren (EE 82),** Laurie and **Dan (EE 81) Brett, Kathleen Tew (MinE/GeoE 16),** Sue and **Bill Nissen (MetE 57).**

Walnut Creek, October 15, 2019 - Seated: **D**r. Wendy Rankin, Joanne McDowell, **Elizabeth Sailer (IS 93),** Donna Baird, and Anna Synhorst. Standing: **President Jim Rankin (EE 78), Anita Freeman (EE 76), Rob VonDerAhe (ME 76), William McDowell (EE 65), Charles Marks (CE 66), Gordon Lakso (MetE 64), Steve Aakhus (CE 78), Roger Baird (EE 53), Irshad Rana (MetE 70),** and **John Synhorst (EE 68).**

San Jose - October 16, 2019 Seated: **Dominic Kotab (ChE 94), Erin Slezak (EnvE 12), Elizabeth Sailer (IS 93), Caitlin Taggart (CSc 12), Greg Warder (ME 92), and Larry Truhe (ME 67).** Standing: **Brian Pelton (MetE 89), Doreen Shrivastava (CSc 86), Todd Stewart (ME 80), Michael Slezak (CSc 12), President Jim Rankin (EE 78), Bob Miller (EE 84),** and **Sandy Pelton (ChE 78).**

Find more on our Facebook Page **facebook.com/SDMinesAlumniAssociation/**

Anaheim, California, November 8, 2019 - Seated: **Andi Babbs (IE 15), John McCallum (EE 72), Bob OBrien (ME 72),** and Sarada Iyer. Standing: Mike Keegan, **John (Chem 62)** and Blanca Sibert, **Chuck Olson (Chem 67), Joree Sandin (ME 18), Reiji Cass (MS CSc 88), Shane Lee (MinE 10), Renita Mollman (CE 88), Srinivasa Iyer (PhD GeolE 74),** Christine Smith, **President Jim Rankin (EE 78), Henry Smith (ME 73), Kumari Iyer-Bharil (CE 85),** Rhonda and **Glenn (ChE 79) Schuelke (ChE 79),** Indhumathi and **Narayanan (EE 89) Iyer, Suvir Bharil (ME 12),** and Rajneesh Bharil.

The Hardrock is going Digital

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BY THE NUMBERS:

BLACK HILLS TECH SECTOR EMPLOYMENT

6,504
people are employed in the tech sector and manufacturing industries in the Black Hills

$60K
average salary

Sanford Underground Research Facility (SURF)

200
CURRENT EMPLOYEES

$952,000,000
Dune & LBNF economic output by 2026

1,859
Jobs created at the peak of DUNE & LBNF

$222M
Sanford Lab has spent more than $222 million in South Dakota to date

Startups and Other Companies Associated with Ascent Innovation and South Dakota Mines

SOUTH DAKOTA
SCHOOL OF MINES
& TECHNOLOGY

501 E. Saint Joseph St.
Rapid City, SD 57701

2020/2021
Career Fair dates

SAVE THE DATE

The Career Fair at South Dakota Mines, held twice each year, is open all Mines students and alumni. Those who are who are looking for a job or those looking to hire brilliant and hard-working engineers and scientists are welcome!

September 22, 2020
February 2, 2021